Integration of Curricular Elements to Demonstrate Outcomes of Critical Thinking in Allied Dental Education

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PURPOSE STATEMENT

• The purpose of this section program is to share one definition of critical thinking and to explore formative and summative techniques that support educators in assessing critical thinking skills sets.

• Additionally, presenters will provide examples of best practices and offer suggestions to utilize and implement these various assessment techniques.
Objectives: After the Section Program, the dental hygiene faculty member will be able to:

Discuss the significance of assessment in dental and allied dental education.

Discuss the various categories of assessment available to educators and specific types of assessments within each category.

Discuss the significance of assessing critical thinking skills in dental and allied dental curricula.

Analyze and refine current assessment techniques used to evaluate critical thinking within a particular assignment or clinical course.

Review current best practices in critical thinking assessment.
ASSESSMENT
Key Questions:

What should be learned? What to learn?

ASSessment

Intended Learning Outcomes

How to gauge learning? How to show learning?
• 'Students can, with difficulty, escape from the effects of poor teaching, …..

• They cannot (by definition if they want to graduate) escape the effects of poor assessment'
  • (Boud, 1995).
...institutional assessment efforts should not be concerned about valuing what can be measured but, instead, about measuring that which is valued.
Assessment Definitions

- “Sustainable assessment” which Boud defines as
  - ...assessment that meets the needs of the present and prepares students to meet their own future learning needs...

- There is an equal level of importance to assessment:
  - as a tool for developing lifelong learning
  - alongside its function of measuring performance
Take Home Message 1:

- Without school-wide/program-wide consensus on what assessment means
  - *And what it will look like in your program*

- The development of consistent linkages across the curriculum may become problematic

**Take home message 1:**

- *Gain consensus on meaningful assessment definitions and in competencies, assignments, clinical or lab experiences which represent alignment with those definitions*
FORMATIVE VS. SUMMATIVE ASSESSMENT
Assessment Purposes

There are two key purposes:

- to certify/communicate
  (often to an external audience)
  - current standards
  - to aid decisions (promotion, etc.)

- to aid learning & improvement

Summative

Formative
Formative assessment

• Ongoing observations and methods of evaluation designed to measure student comprehension of a concept or task in order to identify areas that require enhanced or adapted instruction.

• These adaptations can include
  • reviewing material, alternative approaches to instruction, and additional practice.

• Feedback is used to help students achieve learning goals and takes the form of specific suggestions and discussion of errors rather than merely providing the correct answer.
  • Examples of formative assessments include journals, learning logs, the minute paper, concept maps, directed summarization, anecdotal records, diagnostic tests, and quizzes, questioning techniques

Summative assessment

• Evaluation administered at the conclusion of a unit of instruction to comprehensively assess student learning and the effectiveness of an instructional method or program.
  • LEARNNC, University of North Carolina

Examples:
examinations, competencies
Embedded Assessment Practices

Guidelines in creating and using embedded assessment:

- Faculty should:
  - Understand the curriculum as a plan for learning
  - Provide sequential and cumulative learning throughout the course
  - Encourage transferable learning across the curriculum
  - Design the curriculum as a matrix by integrating the development of specific skill sets
  - Implement student-centered teaching strategies to encourage engagement with the material and active rather than passive learning
  - Develop qualitative performance-based course-embedded strategies to assess and increase student learning
  - Clearly define learning as the ability to apply prior learning to a new situation or context.

- Term used when programs collect data on student learning for program or institutional level assessment.

- May involve the creation of new projects/assignments/exams that inform instructors about individual student performance
Examples of Course Embedded Assignments

- Questions on examinations
- Pre-post tests
- Rubrics
- Samples of student work/projects or papers
- Elements of a portfolio
- Competencies
- Field assignment or other internship
- Service Learning arrangements

Data collected is only as good as the assignment
Critical Thinking

• CODA supports the implementation of critical thinking as an essential component in both dental and allied dental curricula.
Dental CODA Standards

“Old” CODA Standards:

- Information Management and Critical Thinking
  - 2-23: Graduates must be competent in the use of critical thinking and problem solving related to the comprehensive care of patients

Under Consideration:

Competencies for the New General Dentist: The statements below define the entry-level competencies for the beginning general dentist:

- **1. Critical Thinking- Graduates must be competent to:**
  - 1.1 Evaluate and integrate emerging trends in health care as appropriate.
  - 1.2 Utilize critical thinking and problem-solving skills.
  - 1.3 Evaluate and integrate best research outcomes with clinical expertise and patient values for evidence-based practice.
Critical Thinking Competencies
Under Consideration

Comp1.2
• Utilize critical thinking and problem solving skills
  • Application of the scientific method in clinical problem-solving
  • Evidence-based delivery of oral healthcare
  • Critical thinking and problem-solving skills
  • Cultural competence
  • Communication skills, oral and written
  • Reading comprehension
  • Ethics
  • Computer literacy
  • Epidemiological methods
Dental Hygiene CODA Standards

• 2-25  Graduates must be competent in problem-solving strategies related to comprehensive patient care and management of patients

• **Intent**: Critical thinking and decision making skills are necessary to provide effective and efficient dental hygiene services
  
  ◦ Examples of evidence to demonstrate compliance may include:
    • Evaluation mechanisms to monitor knowledge and performance
    • Outcomes assessment mechanisms
DEFINING AND IDENTIFYING CRITICAL THINKING
But really… what IS it??

- **Definition:** the mental process of actively and skillfully *conceptualizing, applying, analyzing, synthesizing, and evaluating* information to reach an answer or conclusion

...The conclusion that is offered is that critical thinking extends beyond the traditional cognitive and psychomotor skills taught in dental schools and thus requires a new, additional educational approach called tentatively the "third pedagogy."

Critical thinking means being able to give reasons for what one says and does...

These reasons should be ..., extending to almost all of one’s activities and to the evaluation of novel practices....

...as a member of a community of reflective practitioners...

Attributes of a Critical Thinker:

- asks pertinent questions
- assesses statements and arguments
- **is able to admit a lack of understanding or information**
- has a sense of curiosity
- is interested in finding new solutions
- is able to clearly define a set of criteria for analyzing ideas
- **is willing to examine beliefs, assumptions, and opinions and weigh them against facts**
- listens carefully to others and is able to give feedback
- sees that critical thinking is a lifelong process of self-assessment
- suspends judgment until all facts have been gathered and considered
- looks for evidence to support assumption and beliefs
- **is able to adjust opinions when new facts are found**
- looks for proof
- examines problems closely
- is able to reject information that is incorrect or irrelevant
Resolution 5H-2010 ADEA Competencies for Entry to the Allied Dental Professions

• Critical Thinking:
  • The disciplined process of actively conceptualizing, analyzing and applying information as a guide to action;
  • ability to demonstrate clinical reasoning diagnostic thinking or clinical judgment
Group Activity: Even rows turn to odd rows, and in groups of 6, discuss the following questions:

• What is critical thinking?
• Does your institution have a uniform definition used across the curriculum?
• Do your faculty/students know it?
• Are there mechanisms in place whereby faculty are held responsible for incorporating AND measuring it?
• Have critical thinking components been “teased out” of existing assignments/projects/clinical or laboratory experiences?
Summary of Group Activity

• If you don’t know what you’re measuring, you’re likely to miss it even if it’s right before you

• If you don’t know what you’re measuring, you’ll miss opportunities to develop critical thinking skill sets in students

• Take home message 2:
  • Gain consensus in a working definition of critical thinking and discuss how assignments may be modified to gain outcomes of critical thinking skill sets
[Definition:] The ability of students to engage in a process of disciplined thinking that informs beliefs and actions. A student who demonstrates critical thinking applies the process of disciplined thinking by remaining open-minded, reconsidering previous beliefs and actions, and adjusting his or her thinking, beliefs and actions based on new information.

[Outcomes:] The process of critical thinking begins with the ability of students to remember and understand, but it is truly realized when the student demonstrates the ability to:

- apply, analyze, evaluate, and create knowledge, procedures, processes, or products to discern bias, challenge assumptions, identify consequences, arrive at reasoned conclusions, generate and explore new questions, solve challenging and complex problems, and make informed decisions.
The importance of …
Purpose of Goals & Objectives

- Provides direction
- Aids communication
- Provides student motivation
- Facilitates and simplifies evaluation
- Aids instructional design to demonstrate the best possible end product
Instruction is effective to the degree that it succeeds in changing students in desired directions and NOT in undesired directions. “

"If you're not sure where you're going, you're liable to end up someplace else—and not even know it."

CON: Objectives fail to measure the unexpected

- Focus on pre-selected goals/objectives lead educators AND students to overlook learning that is occurring as a result of interactions with others that are not listed as an objective
Do behavioral objectives work?

Do they measure the learning?

• Not all objectives are written clearly
  • Vagueness
    • Usually comes from ambiguous verbs that do not describe observable behaviors
    • Specific behaviors must be selected that correspond to the teacher’s goals for the session
  • Critical Thinking descriptors should be “teased out” purposefully
Mager Model: Component Parts of an Objective- ABCD’s

- **Audience:**
  - Who are you teaching?

- **Behavioral verb**
  - What do you want them to do?

- **Condition/Criterion**
  - How will they be ready to do it?

- **Degree**
  - How much to they have to do to demonstrate it to your satisfaction?
    - Degree is an addition to the initial Meager model but is commonly used today
Benjamin Bloom

Image Source: http://redie.uabc.mx/contenido/vol6no2/art-104-spa/bloom.png
Where it all begins: The Domains

- Domain 1:
- Bloom’s Cognitive Domain
Anderson & Krathwohl’s Cognitive Domain 2001
Psychomotor Domain

- Adapting
- Practicing
- Imitating
- Observing
Domain 3: Affective

Krathwohl's Taxonomy of Affective Domain

What’s the point?

• Memorizing, while a necessary element for critical thinking, is a lower level mental activity

• Making judgments, which requires analysis, synthesis and evaluation, is a higher level mental activity
  • Critical Thinking requires higher levels of mental activity
  • Critical Thinking is not just a Cognitive (Mental) Process
Measuring critical thinking...

- Should include activities that will be assessed which can promote its development
- Plan for measurement by writing explicit goals and objectives for each lesson, assignment, project, clinical competency
- Make the expectations VISIBLE and CONSISTENT across the entire curriculum

Take Home Message 3:
In creating assignments, lesson plans or clinical experiences, use all domains in the higher levels to achieve critical thinking development
How can *Critical Thinking* be made Observable?

PROTO-PROFESSOR ZOG: PIONEER IN FIRE RESEARCH
FORMATIVE ASSESSMENT: QUESTIONING TECHNIQUES FOR DEVELOPMENT OF CRITICAL THINKING SKILL SETS
What we usually do…

• Our students learn from being told and shown by expert faculty members how to use the best science and how to think about the role of science in practice
• This assumes that critical thinking is basically a cognitive skill
  • Free from application

• This philosophy is built on the “transfer of information” metaphor

• It also assumes that in the “skill learning” portion of dental/allied dental education, critical thinking is also being “taught” in the same fashion
  • Role modeling
Traditionally the curriculum consists of:

- Information transfer & associated exercises
- Practice of skills
- Neither didactic nor structured practice are sufficient to develop effective habits of critical thinking
- Learning happens best when it is organized around purposeful intended use of knowledge, skills and values in practice
- Reflection on these practices should be required and purposeful
“Novices do not understand the relationship between scientific concepts and their clinical applications the same way researchers or clinical experts do…

even when they can perform relevant tasks under controlled circumstances”

[i.e., competencies]

“Knowing the rules of science and …having the skill to apply them in controlled circumstances may not be a strong indicator of critical thinking performance…

...(Students) have the [critical thinking] tools but are not yet skilled in using them…”

• Consequently, evaluation of critical thinking must extend beyond traditional approaches in didactic and skill acquisition
  • More than Cognitive/Psychomotor Domains
  • Must also include reflection activities
    • Often found in Affective Domains

• “Applied critical thinking”
  • Present information that will bring all students to a uniform level of knowledge
  • Must consider the range of factors that account for students’ habits of reflection on practice
  • and emphasize reflection as a component that will improve the consistency of using CT in dental practice

Chambers JDE 2009
Consistent reflection is key in developing critical thinking skills
Reflection as a means to enhance critical thinking

• Reflection allows one to make judgments in complex and ambiguous situations
• Is the “integration of all learning in practice”
  • Suggests that without reflection, students are merely participating without meaningful learning occurring
    • Must have meaningful learning for long term behavior changes to take place

Dentistry requires 2 reflective processes

- **Reflection-on-action** = thinking about a situation after it has happened
  - Reevaluating the experience
  - Deciding what to do differently
  - Planning for trying out a new approach next time
- Drives improvement
- Is a mindful, purpose-driven and honest openness to what one is doing
- Should have an element of accountability
  - Who’s going to see what a student reflects on?
  - Who’s going to help with “stinking thinking” issues or offer positive reinforcement?

- **Reflection-in-action**: Reshapes what is being done while it is happening
  - Requires the creation of new ways of thinking and acting about the problems of dental practice
  - Educators need to be cognizant that reflective practice is a result of a cycle of action and reflection
  - Student need to be encouraged and have time to reflect on clinical experience purposefully in the curriculum and while on the clinic floor
  - All clinical faculty must participate
You can’t *(in the long run)* behave differently than how you feel about a situation

- Reflective experiences must also assess the individual’s *feelings* in order for comprehensive critical thinking to occur

- Exploring emotions linked to an experience is of great importance in moving towards new learning and permanent changes in behaviors
  - In this study, 120 reflective papers were written
    - 93 times students referred to connections they were making between the clinical experience and some aspect of their didactic coursework

Boyd JDE 2002
Sample reflection questions:

• Instructions: Think back to clinic today and replay the experience.
  • Describe the process from meeting the patient, recording assessment data, interacting with the patient in conversations, as you provided treatment, and after the patient left.

• What went well and what would you have done differently?

• What feelings did you experience during this process?

• In reflecting on what you learned today, what are some concrete examples of processes or procedures you will use with a patient with similar conditions next time?
Summary on reflection as a means to critical thinking

- Reflection is underutilized in dental educational circles
- Reflection can lead to deeper learning
- Reflection is a component part of the critical thinking process
- Dental & allied dental students benefit from a reflective process
- Changes in the curriculum and in application in clinic should be considered as a means to enhance the transition of critical thinking skills from the classroom to the clinical environment
CONSIDER ASKING.....
Remembering

Understanding

Applying

Synthesis

Analyzing

Creating

Evaluation

Comprehension

Application

Knowledge

How well have you managed this patient?
What have you learnt?

In this patient, what is the diagnosis?
...treatment plan? ...likely outcome?

What do these findings mean?

What are the causes? ...effects?
What do you understand by ...?

What is the name of ...? Where...

Summary

• Lower-level questions help students to…
  • reconnect with previously learned content,
  • help stimulate their making connections by thinking through what they may already know, and
  • check for understanding of relevant facts before exploring new concepts

• Higher-order questions ask students to…
  • *do* something with what they know,
  • apply their knowledge to new situations,
  • use their knowledge in analyzing information or events,
  • put together ideas to form new concepts or ideas, and
  • evaluate situations or scenarios based upon a set of criteria or expectations.
Take Home Message 3: For your own purposes, you may assess questions related to each domain

- Affective Domain
- Psychomotor Domain

Cognitive Domains
Scaffolding:
Another way to use Questioning
Cognitive Apprenticeship Model

- Situated cognition is a theory of instruction that suggests learning is naturally tied to authentic activity, context, and culture
  - (Brown, Collins, & Duguid, 1989).
  - It is more difficult to learn from un-natural activities.

- Cognitive apprenticeship is a model of learning based on the situated cognition theory.
  - It provides practical steps for applying situated cognition theory.
Scaffolding

• Traditional classroom uses IRE model of instruction
  • Initiation
  • Student Response
  • Evaluation

Teaching is a “prescript” for transmission of knowledge

• Scaffolding
  • Emphasizes social nature of learning and teaching
  • Considers the dynamic interaction and changing roles of teacher and student
  • General aim is to build support for students interactively
  • It was developed in conjunction with Constructivist view

• Scaffolding is a type of instructional assistance that enables the student to solve a problem, carry out a task, or achieve a goal that they cannot accomplish alone.
  - Wood, Bruner, and Ross (1976)

• Scaffolding involves a gradual release of responsibility by the teacher and increasing responsibility of the students through collaborative construction of curriculum on a moment-to-moment basis.
  - Gallimore and Tharp (1990)
  - Stone (1998)
• In the joint involvement of a scaffolded learning process, the teacher or the typical more capable other draws on various means of assistance in a meaningful dialogue
• Faculty provide purposeful:
  • modeling,
  • feedback (allows performance to be compared to a standard, allowing self-correction),
  • contingency management,
  • instruction requiring specific action,
  • questioning,
  • cognitive structuring,
  • task structuring
  • Tharp 1993
4 Stages of Scaffolding

• **Orientation**
  • Exposed to new information
  • Related to prior knowledge
  • Demonstration/role modeling

• **Coaching**
  • Teacher and student “think conjointly”
  • Scaffolding questions as needed for learner to absorb new information and transform into knowledge
  • Student performs on request, teacher provides encouragement, correction as needed

• **Tuning**
  • Refines knowledge
  • Application to “authentic” situations
  • Teacher prompts the next step
  • Continued practice
    • Supervision “fades”

• **Autonomy**
  • Behavior “routine-ized”
  • Learner knows how and when to use knowledge
  • Does it effectively without external prompting
  • Does it whether supervised or not

Goal of Scaffolding: Fading Away
What are we ACTUALLY doing?

- **Behar-Horenstein et al.** in a dental school environment and **Taylor et al.** in medical education found that instructors in their respective settings were aware of teaching best practices
  - such as guiding learners with open-ended questions to stimulate critical thinking,

- But *rarely used these* techniques when working with students.

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Taylor CA, Dunn TG, Lipsky MS. Extent to which guided discovery teaching strategies were used by 20 preceptors in family medicine. *Acad Med* 1993;68(5):385-7.
Further…

• Faculty development workshops don’t necessarily lead to instructional changes

• However, development opportunities that are based on sound pedagogy & encourage reasoning, reflection and discussion can result in a higher chance of application post-seminar

Take Home Message 4: Developing **strategic questions** may help to develop critical thinking skills

- Reflect on concept of scaffolding and embedded questions
- Imagine a scenario in which you would like to employ these strategies
- Write out strategic questions for your scenario considering:
  - Working definitions of assessment/critical thinking
  - 4 stages of scaffolding
  - Importance of purposeful reflection in development of critical thinking skills
MEASURING CRITICAL THINKING

The Art and Craft of Assessment

Or what I had to do to “prove it”
Description of a grade:

An inadequate report of an inaccurate judgment by a biased and variable judge of the extent to which a student has attained an undefined level of mastery of an unknown proportion of an indefinite material.
Why rubrics?

- Serve as guidelines for rating student performance.
- The guidelines specify what a performance is like at various levels (superior, excellent, good, poor) and, usually, on various attributes.
- The key elements of a rubric are the descriptors for what a performance is like within the full range of possible performance levels.
- Keep assessment practices visible.

Resource: Assessment Website Miami University Available at http://www.miami.edu
Benefits:

• The rubric provides those doing the assessment with exactly the characteristics for each level of performance on which they should base their judgment.

• The rubric provides those who have been assessed with clear information about how well they performed.

• The rubric also provides those who have been assessed with a clear indication of what they need to accomplish in the future to better their performance.
Take Home Message 4:

• In order to measure critical thinking consistently, one has to define the quality continuum which describes the levels of student performance.

• All criteria must be VISIBLE.

• Criteria that is linked to heirarchies of Domains may make documentation of critical thinking more practical.
OTHER BEST PRACTICES
Steps in Performing Critical Thinking in Clinic

The purpose of this article is to present a model now being used to measure dental student critical thinking abilities in patient assessment and treatment planning.

The schematic diagrams an agreed upon set of minimally essential steps in the critical thinking process applied to patient assessment and treatment planning.

Preceptor vs. Checker Approach

• the “One-minute preceptor approach”
  • communication framework that helps the medical student learn problem-solving skills while presenting cases to the medical preceptor.
  • introduced by Neher et al. in 1992

• ICARE System
  • Revised by Sakaguchi (Oregon Health and Science University)
  • Facilitates a professional exchange of information between the clinical instructor and the dental student while educating the student and providing the best possible care for the patient

Sakaguchi RL. Facilitating Preceptor and Student Communication in a Dental School Teaching Clinic
Questions?

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Critical Thinking Assessment in a Dental Hygiene Program

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