

IOWA

Use of EBD in delivering education

The Iowa experience

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Speaker

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 - Past President, University of Iowa Faculty Senate
- **Conflicts of Interest**
 - No conflicts of interest with respect to this presentation

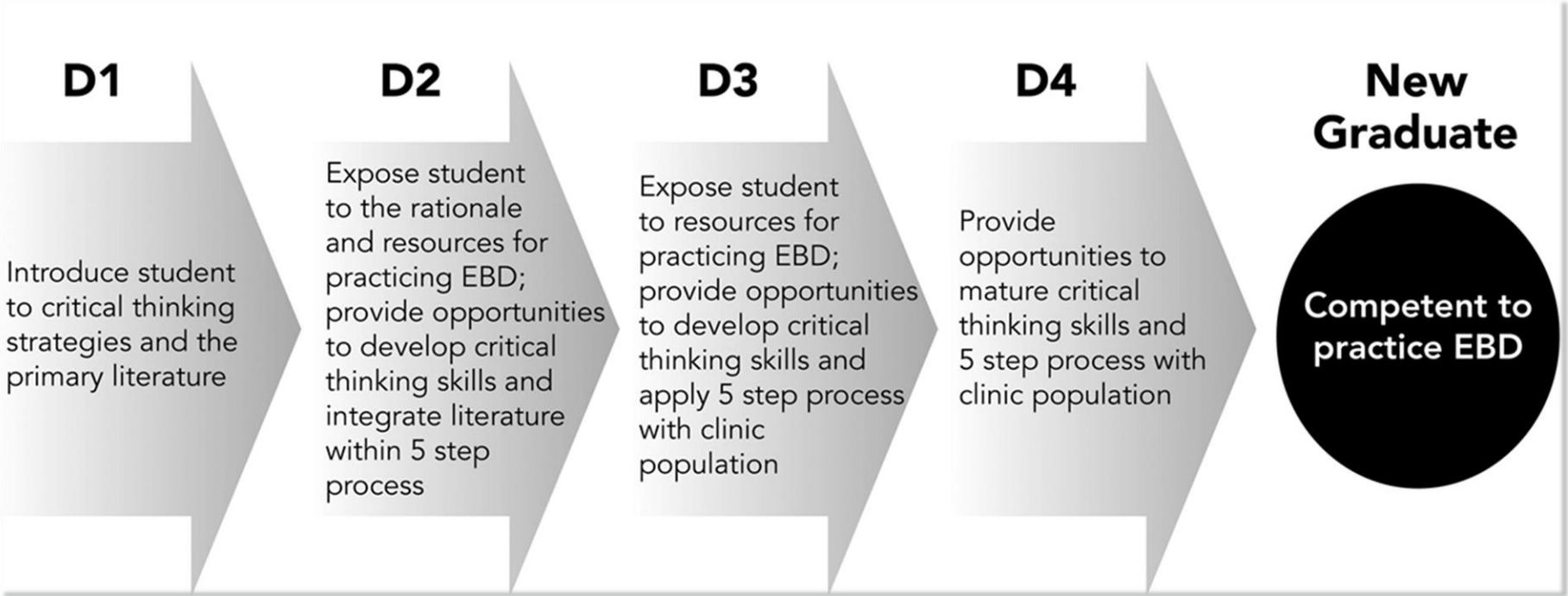
Objectives

- Iowa EBD experience
 - Educational program
- EBD: Novice to expert performance
 - Competency assessment

Iowa's EBD experience

Educational program

Iowa EBD curricular objectives



Approach to curricular design

- Identify primary **student outcome**
- Identify curricular **educational content** necessary to support achievement of desired outcome
- Identify **educational activities** for students to practice and/or model outcome
- Development of **assessment principles** and establish protocols and tools
- **Document** student mastery and/or integration of curricular content

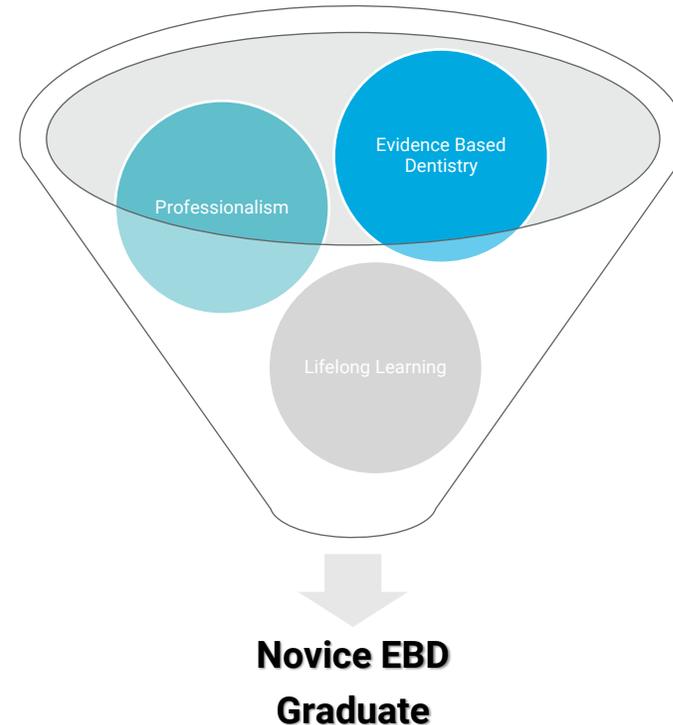
Approach to curricular design

Primary Student outcome

Graduate: Entry level competence to integrate science, experience and patient preferences in comprehensive care

Structure – Flow Chart

- Type of Learning
 - Knowledge
 - Behavior
- Educational Content
 - Evidence Based Dentistry
 - Professionalism
 - Lifelong Learning



Iowa EBD: layering type of learning and educational content

Type of Learning	EBD Educational Content
Knowledge (facts, concepts)	
	Ask: PICO question Study designs 5-Step Process Specialty concepts
Behavior (actions)	
Application	Acquire Critical appraisal 5 step process: artificial situation
Practice	Acquire Critical appraisal 5 step process: applied to patient situation Clinic experiences
Assimilation	Treatment planning Technology decisions Clinic experiences

Educational strategies - *Historical*

- Problem-based learning
 - Active learning
- Independent (online) learning
 - Active learning
- Lecture
- Small/Medium size group learning

Course activities - *Historical*

- Problem-based learning used to teach reading the literature, critical thinking, & application to patient care (*mid '90s*)
 - D1 year
- Layered D2, D3, & D4 years (*~2012*)
 - Online D2 year long EBD content
 - Online D3 yearlong EBD content
 - Applied Clerkship EBD content
 - D4 Integrated EBD with treatment planning

Educational strategies - *Current*

- Lecture
- Small/Medium size group activities
- *Active Learning*
 - *Learn by doing*
 - *Practice each step*
 - *Individually*
 - *With peers*
 - *Self- and peer-evaluations*

Current activities - *Current*

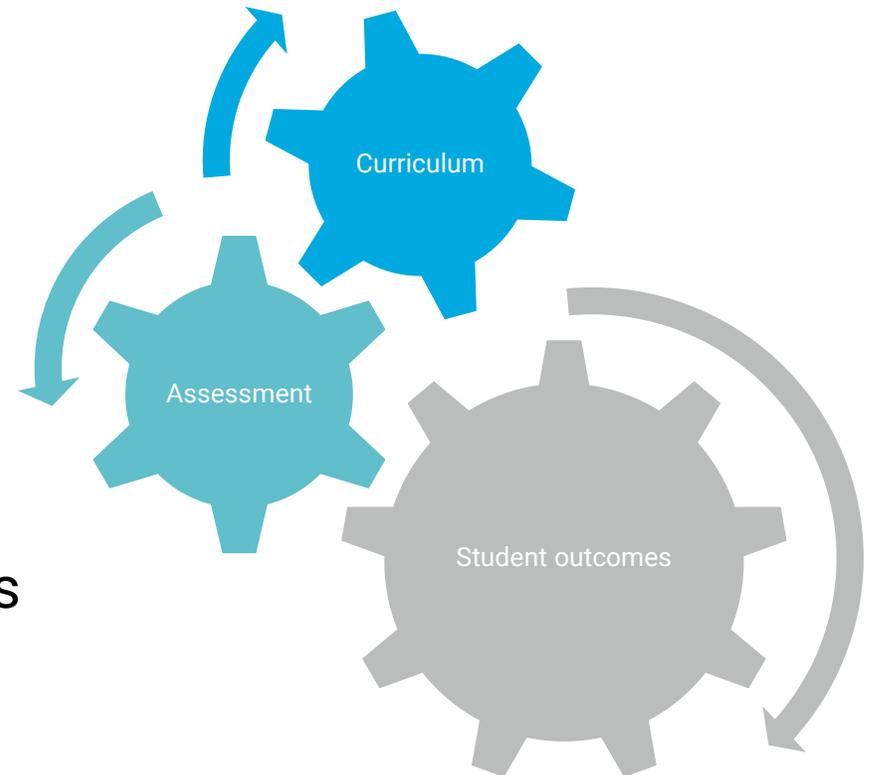
- D1: *Epidemiology coursework*
 - Critiquing the science
 - Study designs
 - Methodology
 - Statistical analyses
 - Lecture & Group activities
- D2: *EBD applied to treatment planning coursework*
 - 5-step process
 - Appraisal process
 - Resources

Current activities - *Current*

- D3: *5-Step process applied to live patient situation (Discipline clerkships)*
 - Integrated into patient case presentations
 - Multiple clerkships
- D4: *EBD integrated into patient care (Comprehensive care clinic)*
 - Foundation of treatment planning

Approach to assessment

- Assessment objective
 - Document mastery of desired outcomes
- Assessment design
 - Parallels curriculum
 - Learning guides
- Curriculum
 - Communicate desired outcomes
 - Impart behaviors to achieve desired outcomes
- Assessment protocols
 - Measure student performance



Example: Student outcomes

- EBD Knowledge
 - Design identification
 - Low stakes: *'completion'*
- EBD Behavior
 - 5 Step process application
 - High stakes: *'points'*
 - Effort vs. accuracy
 - Component identification
 - Commentary on component

Example: Design review assignment

- Learning guide

EVIDENCE BASED DENTISTRY SERIES

A. Module 1 – Elements of EBD #2

a. Design review

- i. *Objective: to review designs, including their advantages and disadvantages*
- ii. Center for Evidence Based Medicine (CEBM)
<http://www.cebm.net/study-designs/>
- iii. Activity – record your responses to the following and submit on ICON:
 1. Select a research manuscript, either new or previously read.
 - a. Identify the manuscript.
 2. Identify the research design for this manuscript.
 - a. What is the design?
 - b. How did you arrive at your answer?
 - c. Outline the advantages and limitations of this design.
 3. Identify 2 other designs that could have been used to address the research question.
 - a. List the two designs.
 - b. Outline the advantages and limitations of the proposed designs.

Example: Design review assessment protocol

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 3. Identify 2 other designs that could have been used to address the research question.
 - a. List the two designs.
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Assessment

- Confirm site read
- Activity completed

Example: Design review evaluation

2.

a. The design is a single-blinded, control clinical trial.

b. I used the design tree to come to my conclusion. Firstly, the manuscript quantified the relationship between using a manual vs. an electric toothbrush, classifying it an analytic study. Secondly, subjects were randomly assigned to either the Sonicare Elite toothbrush or the manual toothbrush (MTB), making it a random controlled trial (RCT).

c. The advantages of this study being an RCT include unbiased distribution of cofounders, blinding being more likely, and randomization facilitating statistical analysis. Some limitations include that these studies tend to be expensive and time consuming, volunteers and participants can present with biases, and they sometimes can raise ethical dilemmas.

2. a. Two other designs that could have been used to address this research question

Example: Design review evaluation

2.

a. The design is a single-blinded, control clinical trial.

b. I used the design tree to come to my conclusion.

Firstly, the manuscript quantified the relationship between using a manual vs. an electric toothbrush, classifying it an analytic study. Secondly, subjects were randomly assigned to either the Sonicare Elite toothbrush or the manual toothbrush (MTB), making it a random controlled trial (RCT).

c. The advantages of this study being an RCT include unbiased distribution of cofounders, blinding being more likely, and randomization facilitating statistical analysis. Some limitations include that these studies tend to be expensive and time consuming, volunteers and participants can present with biases, and they sometimes can raise ethical dilemmas.

3. a. Two other designs that could have been used to address this research question include a cross-sectional design or crossover design.

Example: Design review evaluation

a. The design is a single-blinded, control clinical trial.

b. I used the design tree to come to my conclusion. Firstly, the manuscript quantified the relationship between using a manual vs. an electric toothbrush, classifying it an analytic study. Secondly, subjects were randomly assigned to either the Sonicare Elite toothbrush or the manual toothbrush (MTB), making it a random controlled trial (RCT).

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Clerkship EBD Case Presentations

- Team-based presentations
- Patient-based presentations

Team-based presentation: Day 1



- 1 case presented by faculty
- Develop 1 PICO per group
 - 4 different PICOs
- Identify *best* resources to address PICO
 - 1 resource per team member
 - Consider quality, strength of evidence

Team-based presentation: Day 1



Team-based presentation: Day 2

- Group presentations (20 minutes)
 - Title slide
 - Ask: PICO
 - Acquire: 1/student
 - Appraise: 1/student
 - Apply: group consensus
 - Group Application
 - Group Treatment
 - Group Reflection
 - Group Summary



Esthetic Sequelae of Ceramic vs. Composite Veneers

Ask

- In patients with moderate to severe fluorosis, what is the benefit of using direct resin composite vs. porcelain veneers to improve esthetics?



Acquire

- **Pub Med**
 - Key words: Direct resin vs. veneers and treatment of fluorosis
- **ADA Systematic Reviews**
 - Key words: Veneers
- **Source citations**
 - *Primary articles*
 - Walls AG, Murray JJ, McCabe JF. "Composite laminate veneers: A clinical study." *Journal of Oral Rehabilitation*. 1988(15): 439-454.
 - Meijering A.C. et al (1997). "Patients' satisfaction with different types of veneer restorations". *Journal of Dentistry*. 25; pp 493-497.
 - S. Nalbantian, B. J. Millar. "The effect of veneers on cosmetic improvement". *British Dental Journal*. 207(2), article E3, 2009.
 - Gresnit, MM, Kalk W, Ozcan M. "Randomized clinical trial of indirect resin composite and ceramic veneers: up to 3-year follow-up". *Journal of Adhesive Dentistry*. 2013 Apr;15(2):181-90. doi: 10.3290/jjad.a28883.
 - *Systematic reviews*
 - Wakiaga JM, Brunton P, Silikas N, Glenny AM. "Direct versus indirect veneer restorations for intrinsic dental stains". *Cochrane Database Syst Rev*. 2004; (1):CD004347

Appraise

- Wakiaga JM, Brunton P, Silikas N, Glenny AM. "Direct versus indirect veneer restorations for intrinsic dental stains". *Cochrane Database Syst Rev*. 2004; (1):CD004347
 - UNC Systematic Review Critical Appraisal Worksheet
 - Strong evidence based on methods for systematic review
- Gresnit, MM, Kalk W, Ozcan M. "Randomized clinical trial of indirect resin composite and ceramic veneers: up to 3-year follow-up". *Journal of Adhesive Dentistry*. 2013 Apr;15(2):181-90. doi: 10.3290/jjad.a28883.
 - Center for Evidence Based Medicine-Oxford: RCT Critical Appraisal Sheet
 - Quality-Randomized Clinical Trial; modified split-mouth design
 - Strength-First trial of its kind to compare materials of different nature in same patient
- Meijering A.C. et al (1997). "Patients' satisfaction with different types of veneer restorations". *Journal of Dentistry*. 25; 493-497.
 - Dr. Marshall's Research Manuscript Evaluation
 - Quality- Compared direct resin, indirect resin, and porcelain veneers based on patient satisfaction (1 month, 1 year, 2 years)
 - However, lacks certain details in methodology as far as the clinical placement and the types of question in the questionnaire
 - Strength- Cohort study (relatively strong but not as good as RCT or systematic review)

Nicole's Key Results

- Walls AG, Murray JJ, McCabe JF. Composite laminate veneers: A clinical study. *Journal of Oral Rehabilitation*. 1999;26:459-464.
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Orhan's Key Results

- Meijering A.C. et al (1997). Patients' satisfaction with different types of veneer restorations. *Journal of Dentistry*. 25; 493-497.
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Matt's Key Results

- Wakiaga JM, Brunton P, Silikas N, Glenn AM. Direct versus indirect veneer restorations for intrinsic dental stains. *Cochrane Database Syst Rev*. 2004;(1):CD001881.
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Erin's Key Results

- S. Nalbandian and B. J. Millar, "The effect of veneers on cosmetic improvement," *British Dental Journal*. 1999;86:11-15.
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Meggin's Key Results

- Gresnit, MM, Kalk W, Ozcan M. "Randomized clinical trial of indirect resin composite and ceramic veneers: up to 3-year follow-up". *Journal of Adhesive Dentistry*. 2013 Apr;15(2):181-90. doi: 10.3290/jjad.a28883.
- Randomized clinical trial*
 - Objective: To evaluate clinical performance of laminate veneers made of particulate filled composite or ceramic in a split mouth design
 - Central incisors and symmetric other teeth received same type of restoration: 10 patients with 46 indirect laminate veneers
 - Randomization based on paired teeth and material chosen by coin flip
 - Veneers were re-evaluated every 6 months for chips, caries, debonding, fracture, and post-operative complaints
- Conclusion*
 - There were no statistically significant differences in survival rates between indirect resin composite and ceramic laminate veneers
 - However, the composite veneers demonstrated a higher frequency of surface quality change which may require more maintenance over time

Overall Results

- Difficult to separate longevity from esthetics when comparing outcomes
- Not enough data to support recommendation of one type of veneer over the other
- Long-term (~2 yrs) success of indirect composite veneers was poor
- At 2 year recall pts were more satisfied with porcelain veneers
- Indirect resin composite veneers require more maintenance than ceramic veneers

Application

- Treatment plan
 - Present both options and let patient decide since there's not one clear recommendation
 - Inform patient of pros/cons of options (cost, longevity, maintenance, etc.)
- Considerations
 - Study populations were generalized to our patient.
 - While it is feasible for a student clinician to provide the patient with anterior rehabilitation to treat moderate fluorosis, we would recommend that an experienced clinician perform the procedure since its success is highly technique sensitive.
- Benefits (improving patient's appearance/self esteem, decreasing caries risk, etc.) of treating moderate fluorosis can outweigh the risks (failure, cost, etc.)

Reflection

- What We Learned
 - Better research needs to be done in this area
 - There are a lot of options for esthetic restorations
 - Veneers seem to be best option for treatment of severe fluorosis
- What we'd do next time
 - Try to be more specific to treating fluorosis with anterior esthetic restorations in our search for sources

Summary

- Any last thoughts?
 - There are many options for treating fluorosis and not one clear solution.

Didactic Example: Individual Written Assignment

OPERATIVE - D3 EBD Exercise Format

A. 5 Step EBD Exercise Format

1. **Assess** the patient: describe your clerkship patient, including patient goals.

The patient was a 19 year old female who wanted to improve the esthetics of her teeth because of white spots on them. The white spots may be due to a moderate case of fluorosis or moderate amelogenesis imperfect. The patient also has several class III restorations on anterior teeth as well as white spot lesions on mandibular posterior teeth.

2. **Ask** a question: Using the PICO format, construct a question.

In Patients with esthetic concerns, how do porcelain veneer restorations compared to direct composite veneer restorations compare in longevity?

3. **Acquire** the best available evidence: Identify 1 original research manuscript and 1 other source that address your PICO question. The second source could be a critical summary, a clinical practice guideline, or another original research manuscript.

Kreulen CM, Creugers NHJ, Meijering AC. Meta-analysis of anterior restorations in clinical studies. Journal of Dentistry. 1998 (26): 345-353.

Gresnigt MMM, Kalk W, Ozcan M. Clinical longevity of ceramic laminate veneers bonded to teeth with and without existing composite restorations up to 40 months. Clin Oral Invest. 2013 (17): 823-832.

4. **Appraise** the evidence: Appraise each source using one the following formats:

<p>1. What question did the systematic review address?</p> <p><i>Kreulen CM, Creugers NHJ, Meijering AC. Meta-analysis of anterior restorations in clinical studies. Journal of Dentistry. 1998 (26): 345-353.</i></p> <p><i>This study aimed to compile results on the longevity of four types of veneer restorations in order to evaluate how the different veneering methods compared.</i></p>	
<p>The main question should be clear and focused. It should describe the population, intervention/exposure, and outcomes of interest.</p>	<p><i>I think the objective of the study was clear and focused but the population utilized was not very defined.</i></p>
<p>2. Is it likely that all relevant studies (published and unpublished) were identified?</p>	
<p>Look for a comprehensive search for studies in relevant bibliographic databases (e.g. MEDLINE, Cochrane,</p>	<p><i>Somewhat, the study utilized MEDLINE but no other resources for identifying articles. Thus, the search</i></p>

<p>EMBASE); a search of reference lists from relevant studies; contact with experts; search for unpublished studies. The search should not be limited to English language only. The search strategy should include both controlled vocabulary terms (e.g. MeSH) and text words.</p>	<p><i>strategy likely included many relevant studies but could have missed some because only one database was searched. Weaknesses of the search strategy also included that the search was limited to only studies published in English (which lead to 6 studies being excluded) and only used "dental in SB" and "veneer" as key words.</i></p>
<p>3. Were the criteria used to select articles for inclusion predetermined, clearly stated, and appropriate?</p>	
<p>The inclusion or exclusion of studies should be a clearly defined a priori. The eligibility criteria should specify the patients, interventions or exposures, outcomes of interest, and study designs.</p>	<p><i>Yes, the inclusion and exclusion criteria for the meta-analysis were clearly shown in tables and were well-defined. These criteria were defined "a priori." All of the criteria appeared to be appropriate.</i></p>
<p>4. Were the included studies sufficiently valid?</p>	
<p>Was the methodological quality of each study assessed using predetermined criteria appropriate to the type of study (e.g. randomization, allocation concealment, and follow-up for randomized controlled trials)</p>	<p><i>Yes, a very detailed method of scoring the quality of each study included in the meta-analysis was utilized and portrayed in a table.</i></p>
<p>5. Were studies selected and data extracted by 2 or more individuals?</p>	
<p>There should be at least 2 independent selectors/extractors and a tie-breaking procedure for disagreements.</p>	<p><i>Yes, three individuals selected and extracted the data from studies. However, they had very limited experience, as they were final-year undergraduate dental students. However, two of the articles authors were used to score the quality of the studies.</i></p>
<p>6. Were the results similar from study to study?</p>	
<p>Ideally, the results of the included studies should be similar (homogeneous). If heterogeneity exists, the authors may estimate whether the differences are significant (chi-square test). Possible reasons for the heterogeneity should be explored.</p>	<p><i>The authors analyzed the homogeneity between the studies extensively. The authors discussed reasons for the heterogeneity among the included studies and analyzed if the differences between studies were significant.</i></p>
<p>7. Conflict of interest</p>	
<p>Sources of support and other potential conflicts should be acknowledged and addressed.</p>	<p><i>The study acknowledges potential conflicts of interests in assuming that the three students who searched for studies were not connected to institutions or individuals that may influence the</i></p>

Didactic Example: Individual Written Assignment

	<i>inclusion and exclusion criteria.</i>
8. Clinical Importance	
<p>8a. What were the results of the review? <i>(Are the results of all included studies clearly displayed? Are the results similar from study to study? Is there a clinical bottom line? If the study results were combined, was it appropriate to do so?)</i></p> <p>8b. How precise are the results? <i>(What is the confidence interval? p-value?)</i></p> <p>8c. Did the interpretation of the review's results accurately reflect the results themselves? Are the results generalizable?</p>	<p><i>Results from the different studies included varied in how they assessed longevity of veneered restorations. The authors commented that the results from their meta-analysis were not very clinically applicable because the studies on veneered restorations need to assess longevity in a more homogenous manner. The authors were very careful to only combine results from different studies if appropriate (which is why very few studies were combined). The authors conclusions on porcelain veneered restorations (based on 9 studies) were much more reliable than their results for preformed acrylic, direct (based on 3 studies) as well as indirect and direct composite veneered restorations (based on 1 study of each). Thus, I think only the survival results about porcelain veneered restorations are generalizable. The conclusions of the meta-analysis reflected that the results were not very clinically applicable except for porcelain and possibly preformed acrylic restorations because the clinical trials of veneered restorations varied so much in study design and analysis. The one "clinical bottom line" of this meta-analysis was that porcelain veneered restorations show acceptable and better longevity than preformed acrylic veneered restorations. The results seemed to be precise because of the statistical analysis used to evaluate them.</i></p>

Gresnigt MMM, Kalk W, Ozcan M. Clinical longevity of ceramic laminate veneers bonded to teeth with and without existing composite restorations up to 40 months. Clin Oral Invest. 2013 (17): 823-832.

SCREENING	
<ul style="list-style-type: none"> Does the study question match your question? Was the study design appropriate? 	<p><i>The study design matched my research question somewhat in that it addresses the longevity of porcelain veneers but does not provide insight into my question about the longevity of composite veneers. The study is designed well in being a clinical trial to evaluate the survival of porcelain veneered restorations, so it is a high quality of evidence.</i></p>
VALIDITY	
<p>F: Patient Follow-Up</p> <ul style="list-style-type: none"> Were all patients who entered the trial properly accounted for at its conclusion? Losses to follow-up 	<p><i>There were no drop-outs in the study, so patient follow-up was not an issue in this study. However, the patients were observed for an average of only 21.6 months so it may be</i></p>

<ul style="list-style-type: none"> should be less than 20% and reasons for drop-out given. Was follow-up long enough? 	<p><i>argued that the results of this study only show information about short-term longevity of ceramic veneers.</i></p>
<p>R: Randomization</p> <ul style="list-style-type: none"> Were the recruited patients representative of the target population? Was the allocation (assignment) of patients to treatment randomized and concealed? 	<p><i>Randomization was not applicable in this study as the population utilized was small and patients either had or did not have the "assignments" of existing composite restorations before receiving ceramic veneers. Evaluators of the veneers were aware of the patients having prior restorations or not.</i></p>
<p>I: Intention to Treat Analysis</p> <ul style="list-style-type: none"> Were patients analyzed in the groups to which they were randomized? Were all randomized patient data analyzed? If not, was a sensitivity or "worst case scenario" analysis done? 	<p><i>All patient data was analyzed but patients were not randomized.</i></p>
<p>S: Similar Baseline Characteristics of Patients</p> <ul style="list-style-type: none"> Were groups similar at the start of the trial? 	<p><i>The inclusion criteria was broad and so patient characteristics likely varied considerably.</i></p>
<p>B: Blinding</p> <ul style="list-style-type: none"> Were patients, health workers, and study personnel "blind" to treatment? If blinding was impossible, were blinded raters and/or objective outcome measures used? 	<p><i>Evaluators of the veneers were blinded to the objective of the study.</i></p> <p><i>Objective outcome measures such as for failure of restorations were defined before the study was carried out.</i></p>
<p>E: Equal Treatment</p> <ul style="list-style-type: none"> Aside from the experimental intervention, were the groups treated equally? 	<p><i>Yes, the two groups were treated equally because the intervention was done on the patients prior to the study and veneer placement.</i></p>

Didactic Example: Individual Written Assignment

<p>Conflict of Interest</p> <ul style="list-style-type: none"> Are the sources of support and other potential conflicts of interest acknowledged and addressed? 	<p>Yes, directly in the article.</p>
<p>Summary of Article's Validity</p> <ul style="list-style-type: none"> Notable study strengths or weaknesses or concerns? How serious are the threats to validity and in what direction could they bias the study outcomes? 	<p>The study was detailed and consistent with its procedures for placing veneers and had excellent follow-up. However, the study only had 20 patients.</p> <p>I think the results from this study could be seen as tentatively valid because the study design was strong but the sample size was very limited. I would say the results of this study that existing composite restorations do no significantly effect the longevity of ceramic veneers would be very clinically applicable if supported by another study with a larger population. However, if limited to only seeing this study, I would view the results as clinically applicable.</p>

5. **Apply** the evidence (conceptually): How would you use this piece of evidence to address your 'clinical' situation given your experience and the patient's goals?

Porcelain veneered restorations (VRs) appear to be the most long lasting type of veneered restorations (versus preformed acrylic and indirect and direct composite veneered restorations). This is because porcelain VRs had a survival rate of 92% after three years from the compilation of several studies. Although the evidence is just from 2 clinical trials each, indirect VRs and direct VRs appear to have an adequate survival rate of approximately 80% each after 2 years and 2.5 years respectively. Preformed acrylic VRs only appear to have a survival rate of 74% from the compilation of three studies so appear to have the worst longevity of types of VRs. They also require tooth structure removal. Thus, I would not recommend preformed acrylic VRs to be used in any case because porcelain VRs could be used and last longer or composite VRs could be used without removing tooth structure and be less expensive.

In this clinical situation, I would utilize direct composite restorations because the patient is so young. Direct composite restorations appear to have an adequate survival rate and do not require tooth structure removal. Thus, if the direct composite restorations on this patient fail later in life, you place porcelain VRs and not have any issue about having enough tooth structure left to place porcelain VRs.

Because the patient has several existing class III composite restorations on her teeth, it would be good to know if they would effect the longevity of porcelain veneered restorations when deciding what type of veneers to use. Thus, from analysis of the second study I looked at, I would say that her previous restorations would not affect my decision on whether or not porcelain veneers would be a smart treatment for her. Also, I would know that replacing existing composite restorations before placing a porcelain-veneered restoration would not be indicated unless there were recurrent caries associated with them.

6. **Reflect:**

a. What did you learn from this exercise?

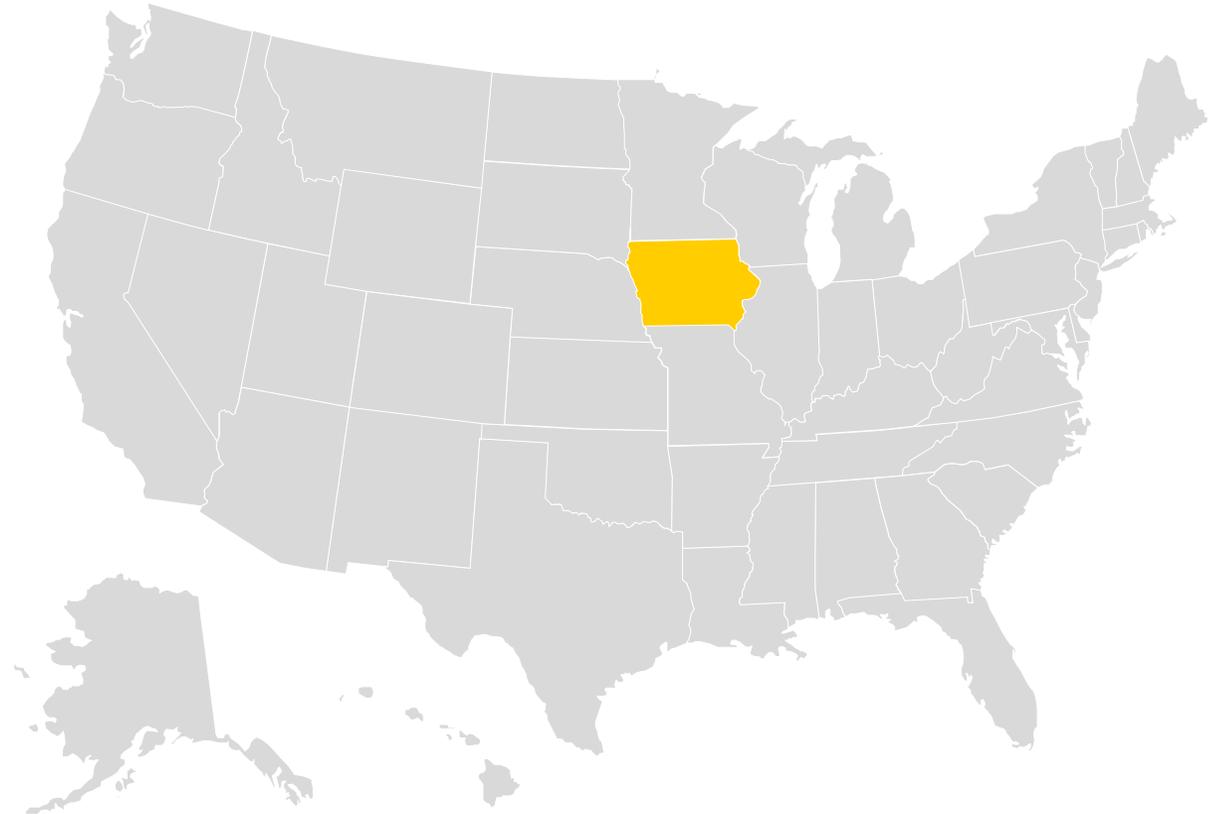
I learned how to incorporate scientific evidence with clinical and "common sense" evidence. This is because although porcelain VRs appear to have the best longevity, I think the clinician needs to use common sense to be conservative about tooth structure removal on such a young patient when other VRs types appear to be adequate alternatives. I also learned how difficult it is to look for studies that address your specific clinical questions. Each clinical situation is unique, so it takes skill in incorporating scientific evidence into your clinical situation in a practical and "common sense" manner.

b. How would you do this exercise differently next time?

I would spend less time searching for articles and more time using the first ones I saw. I think I would be less particular on the age of the article I chose. Also, I think I would use more than 1 database to search for articles after seeing how limited the results were from the meta-analysis I reviewed.

Iowa: summary

- EBD objective
- Approach to curricular design
 - Content
 - Activities
- Approach to assessment
- Examples



EBD: Novice to Expert Performance

Competency assessment

EBD competency

- Requires
 - Knowledge
 - Ability to use knowledge
- ‘lifelong practice – mastery of skills is a process – and not an event with a final endpoint’
- Consistent with multiple levels of skill acquisition
- Theme:
 - EBD outcome?
 - Skills required?
 - Application assessment?

Process to define EBD competency

- Bloom's taxonomy of knowledge and cognitive domains
- Each step of 5-step process
 - Bloom's knowledge dimension
 - Bloom's cognitive process dimension
 - Our educational objectives

	Bloom's Knowledge Dimension	Bloom's Cognitive Process Dimension	Educational Objectives
Step 1: Ask	<u>Factual</u> : PICO question format <u>Conceptual</u> : Relationship between population, probable treatment options/exposure and outcome	<u>Understand</u> : Interpreting, classifying, inferring, comparing	<ul style="list-style-type: none"> a. Construct question from patient/situation information and knowledge limitations that addresses problem b. Articulate PICO components
Step 2: Acquire	<u>Procedural</u> : Where and how to search for appropriate resources <u>Meta-cognitive</u> : Selection of resource targeting knowledge deficit within clinical context	<u>Apply</u> : Executing <u>Analyze</u> : Differentiating	<ul style="list-style-type: none"> a. Search scientific literature b. Identify primary and/or appropriate secondary resource c. Select resource whose objective/hypothesis matches PICO
Step 3: Appraise	<u>Factual</u> : Deconstruct research article, critical summary or practice guideline <u>Procedural</u> : Critique research article, critical summary, or practice guideline	<u>Analyze</u> : Differentiating, attributing <u>Evaluate</u> : Critiquing	<ul style="list-style-type: none"> a. Identify factual information (knowledge) b. Critique manuscript content with respect to scientific principles c. Critique manuscript content with respect to clinical situation d. Differentiate between clinical and statistical relevance in context of clinical situation
Step 4: Apply	<u>Meta-cognitive</u> : Integration of found knowledge with patient preferences and self-experience within environmental context	<u>Create</u> : Generating, planning, producing	<ul style="list-style-type: none"> a. Relate the evidence and assumptions to clinical situation (PICO) b. Identify relevance (i.e., consideration of quality and results) of scientific findings to clinical concern c. Balance patient preferences with relevant science d. Acknowledge clinician experience in context of relevant science e. Propose treatment plan integrating science, patient preferences and clinician experiences
Step 5: Post-Assess	Meta-cognitive: Linking of treatment outcome with patient expectations and self-awareness	Analyze: Differentiating Evaluate: Checking, critiquing	<ul style="list-style-type: none"> a. Evaluate current outcome stage (i.e., ongoing process); frame of reference is initial objective/need b. Acknowledge past and current confounders/modifiers c. Consider both patient's and clinician's perspectives

	Bloom's Knowledge Dimension	Bloom's Cognitive Process Dimension	Educational Objectives
Step 1: Ask	<u>Factual</u> : PICO question format <u>Conceptual</u> : Relationship between	<u>Understand</u> : Interpreting, classifying, inferring, comparing	a. Construct question from patient/situation information and knowledge limitations that addresses problem
	Bloom's Knowledge Dimension	Bloom's Cognitive Process Dimension	Educational Objectives
Step 2: Acquire	<u>Procedural</u> : Where and how to search for appropriate resources <u>Meta-cognitive</u> : Selection of resource targeting knowledge deficit within clinical context	<u>Apply</u> : Executing <u>Analyze</u> : Differentiating	a. Search scientific literature b. Identify primary and/or appropriate secondary resources c. Select resource whose objective/hypothesis matches PICO

Process to identify skill acquisition

- Dreyfus model of skill acquisition
 - Includes novice to expert skill levels
 - Identify behavioral expectations
 - Matching evaluation criteria
- Applied to each step of 5 step process
 - Competent skill level
 - Expectation for graduating dentist

Step 1: Ask

		Behavior Expectation	Outcome Evaluation Criteria
Dreyfus Model of Skill Acquisition*	Expert	Articulates sound PICO pieces targeting relevant clinical problem and knowledge limitation	<ol style="list-style-type: none">1. Each expected PICO piece is readily identifiable, focused and/or a searchable term and2. The PICO targets the clinical problem and/or knowledge limitation
	Proficient	Articulates sound PICO pieces related to clinical problem	<ol style="list-style-type: none">1. Each expected PICO piece is readily identifiable, focused and/or a searchable term and2. The PICO is related to the problem
	Competent	Proposes clear PICO pieces related to clinical situation and/or problem	<ol style="list-style-type: none">1. Each expected PICO piece is readily identifiable and2. PICO pieces are logical for the clinical situation or3. PICO pieces are related to the problem or knowledge deficit
	Advanced Beginner	Proposes clear PICO pieces related to clinical situation; does not address problem	<ol style="list-style-type: none">1. Each expected PICO piece is readily identifiable and2. PICO pieces are logical for the clinical situation and3. PICO pieces do not address the problem or knowledge deficit
	Novice	Suggests unclear PICO pieces that are not related to clinical situation; does not address problem	<ol style="list-style-type: none">1. Missing expected or vague PICO pieces or2. PICO pieces are not relevant to patient situation

Step 1: Ask

		Behavior Expectation	Outcome Evaluation Criteria
tion*	Expert	Articulates sound PICO pieces targeting relevant clinical problem and knowledge limitation	<ol style="list-style-type: none">1. Each expected PICO piece is readily identifiable, focused and/or a searchable term and2. The PICO targets the clinical problem and/or knowledge

Step 1: Ask

		Behavior Expectation	Outcome Evaluation Criteria
Dreyfus Model of Skill Acquisition*	Competent	Proposes clear PICO pieces related to clinical situation and/or problem	<ol style="list-style-type: none">1. Each expected PICO piece is readily identifiable and2. PICO pieces are logical for the clinical situation or3. PICO pieces are related to the problem or knowledge deficit
Dreyfus	Novice	Suggests unclear PICO pieces that are not related to clinical situation; does not address problem	<ol style="list-style-type: none">1. Missing expected or vague PICO pieces or2. PICO pieces are not relevant to patient situation

PICO: In children with primary teeth, does frequency of soda-pop intake increase caries compared to frequency of 100% juice intake?

Competent

1. Matches PICO pieces, logical for clinical situation and addresses problem.
2. Meets 'competent' criteria

Outcome Evaluation Criteria

1. Each expected PICO piece is readily identifiable, focused and/or a searchable term and
2. The PICO targets the clinical problem and/or knowledge

Outcome Evaluation Criteria

1. Each expected PICO piece is readily identifiable and
2. PICO pieces are logical for the clinical situation or
3. PICO pieces are related to the problem or knowledge deficit

1. Missing expected or vague PICO pieces or
2. PICO pieces are not relevant to patient situation

Step 2: Acquire

Dreyfus Model of Skill Acquisition*

		Behavior Expectation	Outcome Evaluation Criteria
	Expert	Selects research manuscript/secondary resource whose objective is best available match for PICO; design appropriate for type of question; design is highest available evidence for PICO	<ol style="list-style-type: none"> 1) Study objective targets PICO and 2) Design is the highest level of design for question and 3) Design is highest level available for PICO and 4) Study execution appears solid
	Proficient	Selects research manuscript/secondary resource whose objective matches PICO; design is acceptable for question; moderate level evidence for PICO	<ol style="list-style-type: none"> 1) Study objective matches PICO and 2) Design is a higher level of design for question and 3) Design is appropriate for PICO and 4) Study execution is without major limitations
	Competent	Selects research manuscript/secondary resource whose objective matches PICO; design is weak for type of question or lower level evidence for PICO	<ol style="list-style-type: none"> 1) Study objective matches PICO pieces and 2) Design is a lower level design for research question (assuming that a higher design is feasible) or 3) Design is weak for the PICO and 4) Study execution appears adequate
	Advanced Beginner	Selects research manuscript/secondary resource whose objective is relevant, but does not match PICO; design is weak for type of question; lower level evidence for PICO	<ol style="list-style-type: none"> 1) Study objective relates to clinical situation, but is not a good match for PICO (assuming that a good match should exist) or 2) Design is a lower level design for research question (assuming that higher design is feasible) or 3) Design is a lower level of evidence for PICO or 4) Study execution has limitations, but acceptable
	Novice	Selects manuscript/secondary source whose objective is not relevant to PICO or clinical situation - something interesting that they found	<ol style="list-style-type: none"> 1) Study objective is not relevant to PICO; a completely different question or 2) Study objective is not relevant for the clinical situation or 3) Study execution appears to have fatal flaws

Step 2: Acquire

		Behavior Expectation	Outcome Evaluation Criteria
n*	Expert	Selects research manuscript/secondary resource whose objective is best available match for PICO; design appropriate for type of question; design is highest available evidence for PICO	<ol style="list-style-type: none"> 1) Study objective targets PICO and 2) Design is the highest level of design for question and 3) Design is highest level available for PICO and

Step 2: Acquire

		Behavior Expectation	Outcome Evaluation Criteria
Dreyfus Model of Skill Acquisition*	Competent	Selects research manuscript/secondary resource whose objective matches PICO; design is weak for type of question or lower level evidence for PICO	<ol style="list-style-type: none"> 1) Study objective matches PICO pieces and 2) Design is a lower level design for research question (assuming that a higher design is feasible) or 3) Design is weak for the PICO and 4) Study execution appears adequate
	Dre	relevant to PICO or clinical situation - something interesting that they found	<ol style="list-style-type: none"> 1) question or 2) Study objective is not relevant for the clinical situation or 3) Study execution appears to have fatal flaws



Source: 100% fruit juice and dental health: a systematic review of the literature. Front Public Health. V.7;2019.

Novice

- 1. Missing Soda-pop – does not match PICO
- 2. Objective isn't relevant for clinical situation

Question	Outcome Evaluation Criteria
Study objective appropriate for type of question for PICO	1) Study objective targets PICO and 2) Design is the highest level of design for question and 3) Design is highest level available for PICO and

Outcome Evaluation Criteria
1) Study objective matches PICO pieces and 2) Design is a lower level design for research question (assuming that a higher design is feasible) or 3) Design is weak for the PICO and 4) Study execution appears adequate

Study objective not relevant for clinical situation or	question or
2) Study objective is not relevant for the clinical situation or	
3) Study execution appears to have fatal flaws	

Step 3: Appraise

		Behavior Expectation	Outcome Evaluation Criteria
Dreyfus Model of Skill Acquisition*	Expert	Extracts relevant details from resource; identifies clinical relevance; places in context with scientific principles/patient/clinical situation	<ol style="list-style-type: none"> 1) Extracted details are relevant to clinical situation/PICO and 2) Clinical relevance of study is mentioned and 3) Commentary (>80%) communicates thinking; places study in context of scientific principles OR clinical situation
	Proficient	Extracts relevant details from resource; integrates details in context of scientific principles/patient/clinical situation	<ol style="list-style-type: none"> 1) Extracted details are relevant to clinical situation/PICO and 2) Commentary (>60%) communicates thinking; integrates study details with quality/appropriateness of techniques with respect to scientific principles OR patient presentation OR clinical situation
	Competent	Extracts specific details from resource; elementary integration of details in context of scientific principles/patient/clinic situation	<ol style="list-style-type: none"> 1) Details are defined, specific with few yes/no responses and 2) Commentary (>60%) communicates thinking; provides elementary commentary on study quality/appropriateness of techniques with respect to scientific principles OR patient presentation OR clinical situation
	Advanced Beginner	Extracts specific details from resource with general unclear commentary	<ol style="list-style-type: none"> 1) Details are defined; specific to resource; few yes/no responses or 2) Commentary is present; primarily (>50%) factual, with few supporting details
	Novice	Extracts nonspecific details from resource with minimal commentary	<ol style="list-style-type: none"> 1) Details are vague and/or yes/no type of responses – perhaps not specific to resource or 2) Little if any commentary; if present, primarily (>80%) factual with minimal thinking communicated

Step 3: Appraise

		Behavior Expectation	Outcome Evaluation Criteria
*	Expert	Extracts relevant details from resource; identifies clinical relevance; places in context with scientific	1) Extracted details are relevant to clinical situation/PICO and 2) Clinical relevance of study is mentioned and 3) Commentary (>80%) communicates thinking; places study in

Step 3: Appraise

		Behavior Expectation	Outcome Evaluation Criteria
Dreyf	Competent	Extracts specific details from resource; elementary integration of details in context of scientific principles/patient/clinic situation	1) Details are defined, specific with few yes/no responses and 2) Commentary (>60%) communicates thinking; provides elementary commentary on study quality/appropriateness of techniques with respect to scientific principles OR patient presentation OR clinical situation supporting details
	Novice	Extracts nonspecific details from resource with minimal commentary	1) Details are vague and/or yes/no type of responses – perhaps not specific to resource or 2) Little if any commentary; if present, primarily (>80%) factual with minimal thinking communicated

1: What is the research question/hypothesis?

a) To compare the effectiveness of phosphoric acid pumice to conventional hydrochloric acid pumice compound in treating different severities of dental fluorosis with a clinical situation

b) [PICO question specific micro info ble PICO

Proficient:

1. Details are relevant to the clinical situation and the PICO.
2. Commentary communicated thinking; addressed the clinical situation, but not scientific principles.

Outcome Evaluation Criteria

- 1) Extracted details are relevant to clinical situation/PICO and
- 2) Clinical relevance of study is mentioned and
- 3) Commentary (>80%) communicates thinking; places study in

Outcome Evaluation Criteria

- 1) Details are defined, specific with few yes/no responses and commentary (>60%) communicates thinking; provides elementary commentary study quality/appropriateness of techniques with respect to scientific principles OR patient presentation OR clinical situation
ing details
are vague and/or yes/no type of responses – perhaps not to resource or
any commentary; if present, primarily (>80%) factual with minimal thinking communicated

Step 4: Apply

		Behavior Expectation	Outcome Evaluation Criteria
Dreyfus Model of Skill Acquisition*	Expert	Integrates relevant evidence with patient preferences/characteristics and clinical experience in the context of the environment to identify an appropriate treatment plan – suggestive of weighing pros/cons of various treatments	<ol style="list-style-type: none"> 1) Evidence of synthesis of science, patient preferences and clinical experiences in the context of the environment for proposed logical treatment and 2) Acknowledges alternative treatments with justification for selected treatment
	Proficient	Integrates relevant evidence with consideration of patient preferences and clinical experiences to develop appropriate treatment plan; acknowledgment of other treatment consideration	<ol style="list-style-type: none"> 1) Evidence of synthesis of science, patient preferences and clinical experiences for proposed treatment and 2) Acknowledges alternative treatments
	Competent	Proposes appropriate treatment consistent with evidence and consideration of patient preferences or clinician experience	<ol style="list-style-type: none"> 1) Integration of evidence in treatment plan and 2) Considers patient preference or 3) Considers clinician experience
	Advanced Beginner	Considers/proposes appropriate treatment consistent with evidence without consideration of patient preference or clinical experience	<ol style="list-style-type: none"> 1) Links science to patient care and 2) Does not consider patient preference or 3) Does not consider clinician experience
	Novice	Considers/proposes treatment that is inconsistent with evidence; mirrors evidence without consideration of patient preferences or clinical experience; or is illogical	<ol style="list-style-type: none"> 1) Does not link science to patient care or 2) Proposes treatment at odds with science (dependent upon quality of science) or 3) Does not mention patient preferences or 4) Does not consider clinical experience or 5) Suggests dubious or illogical treatment

Step 4: Apply

		Behavior Expectation	Outcome Evaluation Criteria
Dreyfus	Expert	Integrates relevant evidence with patient preferences/characteristics and clinical experience in the context of the environment to identify an appropriate treatment plan – suggestive of weighing pros/cons of various	1) Evidence of synthesis of science, patient preferences and clinical experiences in the context of the environment for proposed logical treatment and 2) Acknowledges alternative treatments with

Step 4: Apply

		Behavior Expectation	Outcome Evaluation Criteria
Dreyfus	Competent	Proposes appropriate treatment consistent with evidence and consideration of patient preferences or clinician experience	1) Integration of evidence in treatment plan and 2) Considers patient preference or 3) Considers clinician experience
	Novice	Considers/proposes treatment that is inconsistent with evidence; mirrors evidence without consideration of patient preferences or clinical experience; or is illogical	1) Does not link science to patient care or 2) Proposes treatment at odds with science (dependent upon quality of science) or 3) Does not mention patient preferences or 4) Does not consider clinical experience or

Example #1: This is a VERY exciting subject as most millennials' practices will have a large amount of baby boomers to treat. Placing implants will play a huge part of my future practice as this procedure will continue to decline in price and incline in availability and technology. I will need to know the risks and rewards for every procedure, especially one as invasive as this. I am very excited to apply this knowledge in to my practice.

Novice

- 1) *Science is mentioned with respect to clinical practice – not a specific patient (characteristic of student maturity)*
- 2) *Patient preferences not mentioned*
- 3) *Clinician preferences not mentioned.*

	Outcome Evaluation Criteria
ment to	1) Evidence of synthesis of science, patient preferences and clinical experiences in the context of the environment for proposed logical treatment and
ous	2) Acknowledges alternative treatments with justification for selected treatment
ration	1) Evidence of synthesis of science, patient
	Outcome Evaluation Criteria
of	1) Integration of evidence in treatment plan and
ician	2) Considers patient preference or
	3) Considers clinician experience
ces or	2) Does not mention patient preferences or (dependent upon quality of science) or
	3) Does not mention patient preferences or
	4) Does not consider clinical experience or
	5) Suggests dubious or illogical treatment

Example #2: *Patient asked if chewing gum could prevent cavities.* I would tell my patient that it would be beneficial to chew sugar-free (sorbitol or xylitol) gum to prevent cavities especially chewing gums containing xylitol. I would tell him the amount of protection is also based on their cavity risk and that someone with a higher cavity risk may be benefitted more than someone with a lower risk. I would also remind them that chewing gum is not going to replace regular hygiene habits, and that brushing and flossing regularly is the most effective way to prevent cavities. Educating patients is important and something students can do.

Proficient

1. *Science is integrated with patient concern and clinician behavior.*
2. *Proposed advice is logical*
3. *Different gums and preventive behaviors identified*

Outcome Evaluation Criteria
1) Evidence of synthesis of science, patient preferences and clinical experiences in the context of the environment for proposed logical treatment and
2) Acknowledges alternative treatments with justification for selected treatment

Outcome Evaluation Criteria
1) Integration of evidence in treatment plan and
2) Considers patient preference or
3) Considers clinician experience
4) Does not mention patient preferences or
5) Does not consider clinical experience or
6) Suggests dubious or illogical treatment

Summary

- Defined competency
- Created competency definition based on
 - Bloomberg's taxonomy of knowledge and cognitive domains
 - Dreyfus's model of skill acquisition
- Applied competency criteria to Ask, Acquire, Appraise, & Apply steps of EBD process

References

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Questions

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