



Multiple Choice Questions and Higher Order Learning



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Centre for Teaching, Learning, and Technology (CTLT)
UBC - Vancouver, 2020 and 2021

Land Acknowledgement native-land.ca

Native Land  

Territory Acknowledgement Teacher's Guide Join or Donate Blog About Language

Territories Languages Treaties

Search your address, or toggle switches above to add shapes. Click around! [Think critically about this map](#)

Territories

Languages

Treaties

You are on the land of:

- [səlilwətaʔ təməx* \(Tseil-Waututh\)](#)
- [S'ólh Téméxw \(Stó:lō\)](#)
- [St'umínus](#)
- [xʷməθkʷəy̓əm](#)
- [səlilwətaʔ təməx* \(Tseil-Waututh\)](#)

Qayqayt

S'ólh Téméxw (Stó:lō)

Katzie

sčawaθenat təməx* (Tsawwassen)

Export Map Colors Labels

mapbox

© Mapbox © OpenStreetMap



Fig 2.2: Indigenous wholistic framework.

Protocols

- Will go quickly
 - Slides available on UBC Wiki page for 2021 Summer Institute
- Judy or Carrie will be monitoring Chat
 - We aim to address the questions at designated pauses throughout the workshops
 - Remember, you can send chats directly to individuals (not the group)
- Feel free to MUTE when not speaking
- Video or No video: Your Choice



Learning Outcomes

At the end of this workshop, you will be able to:



- Define and give examples of higher order thinking/learning
- Explain the importance of aligning learning outcomes, instructional methods and assessment
- Write good learning outcomes that aid in assessment
- Identify and apply best practices in writing MCQs
- Assess the appropriateness of using a MCQ to assess a learning outcome
- Write MCQs that assess higher order thinking/learning



Agenda *90 min*

Higher Order Thinking and its relationship with Learning Outcomes and Assessment

Best Practices in writing MCQs

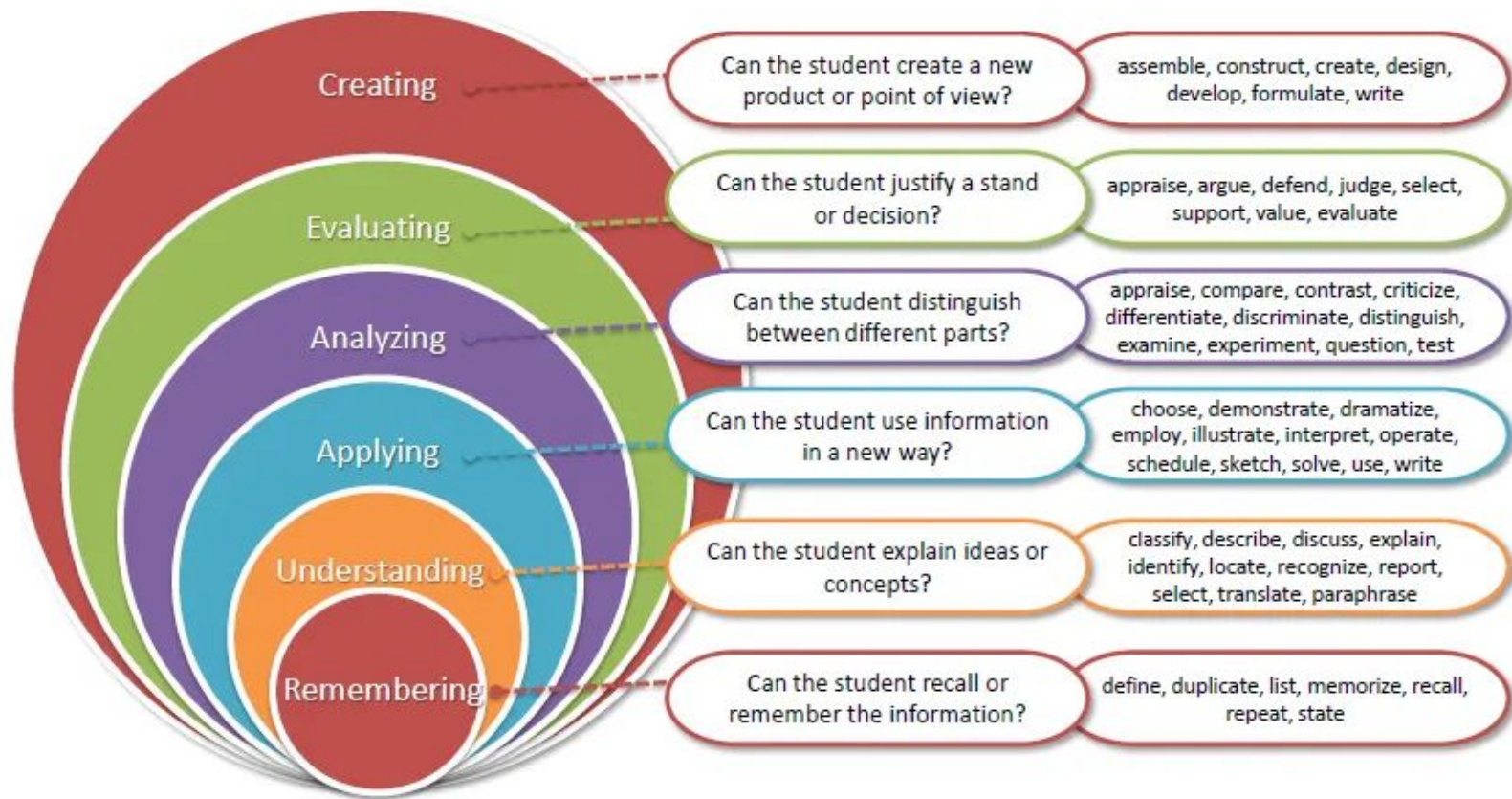
Tips for Developing HOL MCQs

Breakout - Take one or two of these strategies and apply it to one or two of the questions/content you brought

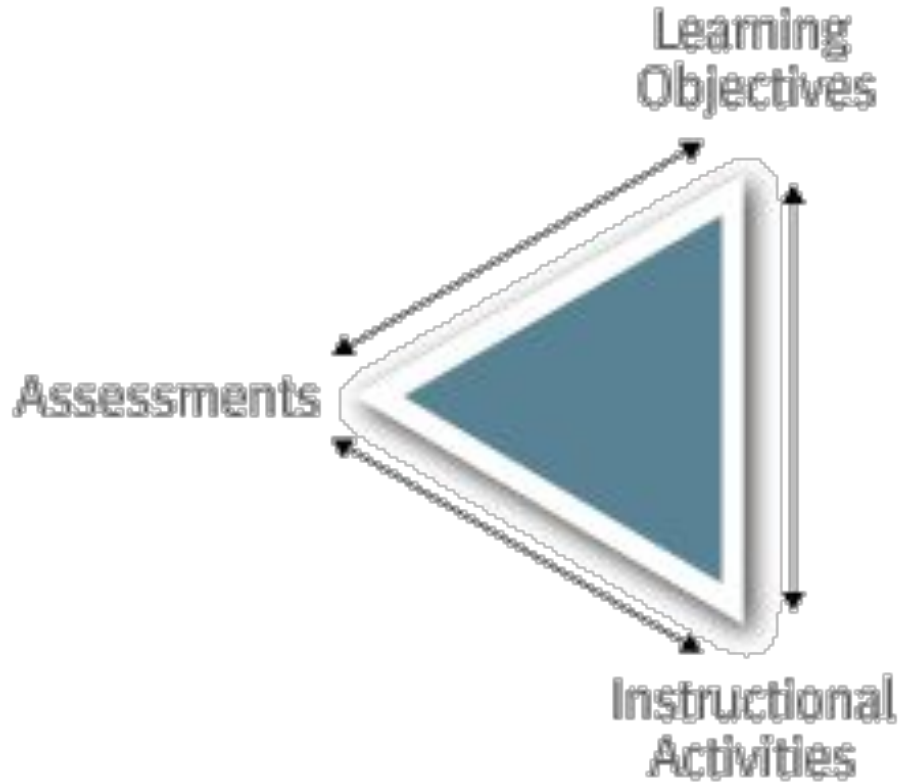
**NOTE: if you have to leave at the breakout, please let us know in advance so we don't assign you to a breakout room*

Share back

Bloom's Taxonomy (Revised)



CONSTRUCTIVE ALIGNMENT



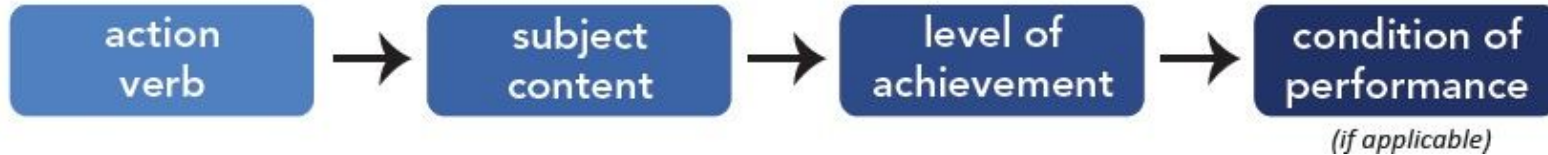
GOOD LEARNING OUTCOMES

.....Make Assessment Questions Easier

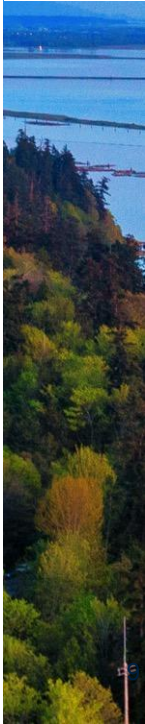
A *Learning Outcome (LO)* is a

- **measurable**, **observable**, and **specific** statement that clearly indicates what a student should know and **be able to do** as a **result** of learning.

Well-written LOs involve the following parts:



So, Step 1: Clarify your Learning Outcome!



Example

Learning Outcome:

Identify the artists responsible for major contemporary musical pieces.

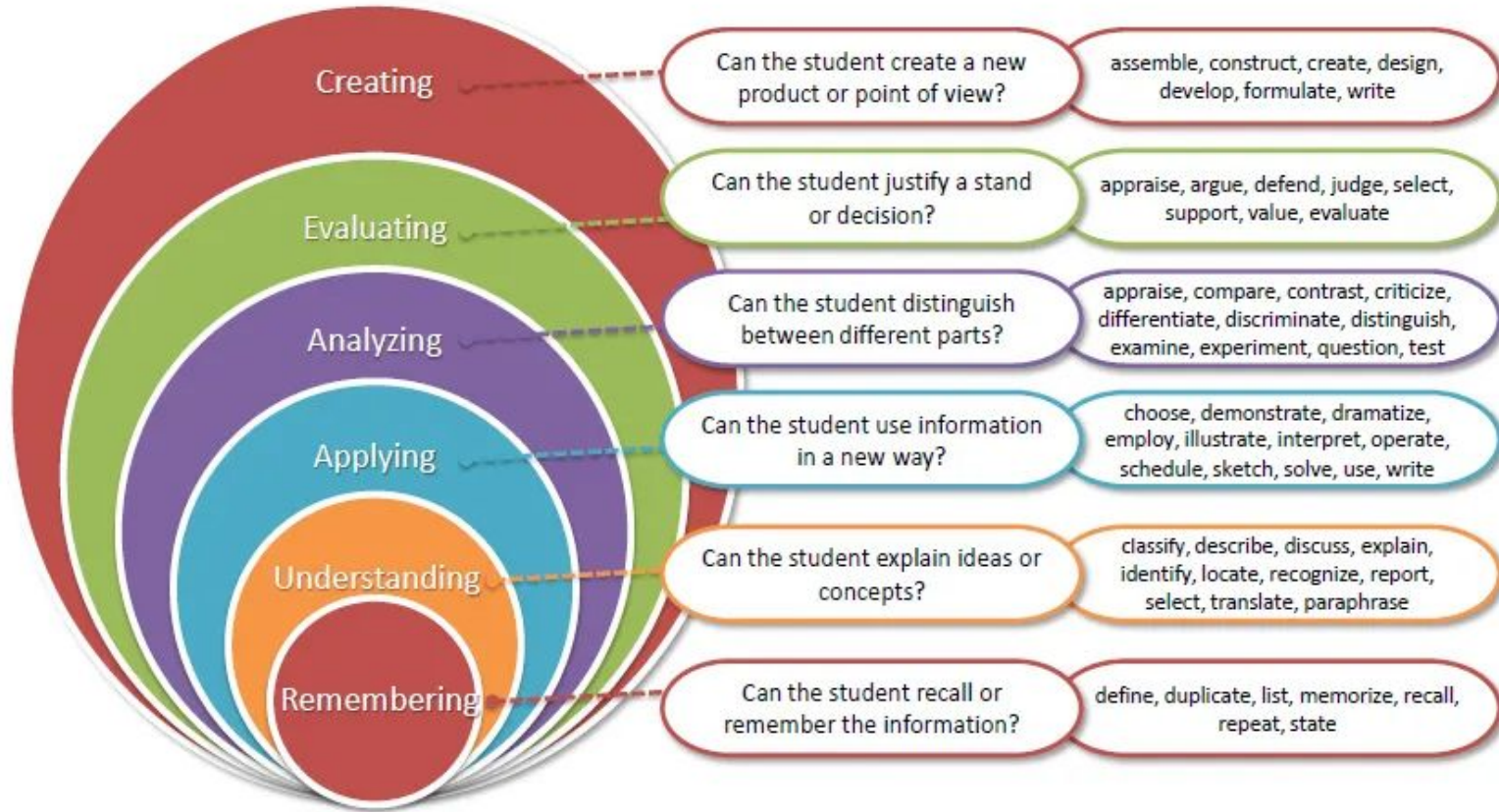
Possible Question:

What band first recorded the song “Let It Be”?

- a) The Rolling Stones
- b) The Beatles
- c) The Beach Boys
- d) The Who
- e) The Kinks



Are MCQs appropriate for every Learning Outcome?



Best Practices in Writing MCQs



What is the primary purpose of this workshop?

- a. Generate multiple choice question banks
- b. Mingle with other instructors
- c. Create good learning outcomes
- d. Expand your capacity to create good MCQs for higher order thinking outcomes

One-Best-Answer Question Format
Scope of Question



Which of the following shows an appropriately shaped question?

A.

Short Stem

A.

B.

C. Long Options

D.

E.

B.

Long Stem

A.

B.

C. Short Options

D.

E.

Length of Stem
Length of Options



Which option is most often the 'correct' answer on traditional, paper-based exams?



- A. A
- B. B
- C. C
- D. D
- E. E
- F. I don't know

Right Answer Frequencies
Testwise-ness & Guesswork

Which of the following statement(s) is/are **FALSE** about multiple choice questions:

- A. Consists of a stem, lead-in question, and options
- B. Can be used to assess higher order learning, such as application and synthesis
- C. Easy to construct for assessing recall of facts
- D. Tests literacy skills
- E. I don't know

True/False Question Format
Ambiguous Options



Which of the following statement(s) is/are **FALSE** about multiple choice questions:

- A. Consists of a stem, lead-in question, and options
- B. Can be used to assess higher order learning, such as application and synthesis
- C. Easy to construct for assessing recall of facts
- D. Tests literacy skills
- E. None of the above; they are all true**

True/False Question Format
Ambiguous Options



When writing your options (wrong answers/distractors), make sure that they are:

- A. Homogeneous in content (eg, all are diagnoses; all are next steps in patient care)
- B. Incorrect or inferior to the correct answer
- C. Plausible and attractive to the uninformed
- D. Similar to the correct answer in construction and length
- E. Grammatically consistent and logically compatible with the stem
- F. All of the above
- G. I don't know

Formulating the Options

All of the above/None of the above



Use plausible distractors (wrong-response options)

- (i) Only list plausible distractors, even if the number of options per question changes
- (ii) Write the options so they are homogeneous in content
- (iii) Use answers given in previous open-ended exams to provide realistic distractors

- A. (i) only
- B. (ii) only
- C. (i) and (ii)
- D. (ii) and (iii)
- E. (i) , (ii), and (iii)
- F. I don't know

Variation of
One-Best-Answer
Formulating Distractors
(common misconceptions)



In summary: University of Waterloo & Vanderbilt



Do's: Stem

- Informative and concise
- Ask students to pick 'best' answers

Do's: Alternatives

- Plausible alternatives (3 to 5)
- Meaningful and logical distribution
- Consistent grammar, length, and language
- Include: "I don't know." (for formative assessment)

Don'ts: Stem

- Negative wording
- Word association
- Trick question
- "Which of the following is correct?"

Don'ts: Alternatives

- "Always", "Never", "None", etc
- "All of the above", "None of the above"



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Tips for developing MCQs For Higher Order Thinking

Use Real World Scenarios

Original MCQ Question	MCQ
What symbol does a formula always start with in Excel?	If you want to total the first ten data cells in column B, which one of the following formulas should you use?
What is the first concern of an emergency worker?	You arrive at the scene of an accident where people are panicked and yelling. Three people appear to be injured. One person has scrapes and bruises, a second is lying on the ground moaning in pain and a third is quickly losing blood from a skull injury. Which person will you take care of first?
When writing a CSS style sheet, what property is used to position an element to the left or right?	How will the text and photo be aligned using the code below? CSS: <code>.photo {float: right;}</code> HTML: <code>My Cat </code>



Evaluation of a Solution to a Problem

A student was asked the following question: *"List and explain the stages of the creative process."* The student answered: *"It takes place in 5 stages, in the following order: orientation, when the problem must be identified and defined, preparation, when all the possible information about the problem is collected, incubation, when no solution seems in sight and the person is often busy with other tasks, illumination, when the person experiences a general idea of how to arrive at a solution to the problem, and finally verification, when the person determines whether the solution is the right one for the problem."*

How would you judge this answer?

- a) **EXCELLENT** (all stages correct in the right order with clear and correct explanations)
- b) **GOOD** (all stages correct in the right order, but the explanations are not as clear as they should be)
- c) **MEDIOCRE** (one or two stages are missing OR the stages are in the wrong order, OR the explanations are not clear OR the explanations are irrelevant)
- d) **UNACCEPTABLE** (more than two stages are missing AND the order is incorrect AND the explanations are not clear AND/OR they are irrelevant)



Premise-Consequence

If nominal gross national product (GNP) increases at a rate of 10% per year and the GNP deflator increases at 8% per year, then real GNP:

- a) Remains constant.
- b) Rises by 10%.
- c) Falls by 8%.
- d) Rises by 2%.



Analogy

E-mail is to an unmoderated listserv as office hours are to:

- a) Class lecture.
- b) Class discussion.
- c) Review sessions.
- d) Tutorials.



Switching between Principle and Example

Original MCQ	Higher Order MCQ
Which of the following is a symptom of the flu?	<p>A patient presents with the following symptoms: X, Y, Z</p> <p>What is the most likely diagnosis:</p> <ul style="list-style-type: none">a) The flub) A coldc) Seasonal Allergiesd) Covid-19 (<i>too soon?</i>)



Analysis of Visuals

Original	MCQ
What are the components of a computer's video system? (Select all that apply.)	Using the repair flowchart shown here, what should you check if the monitor stops working?
Which country has the largest population?	What does this graph predict about world population in the year 2020?
Select the best definition of <i>active listening</i> .	Which video best demonstrates <i>active listening</i> during a call with an irate customer?
Choose the best definition of rate card.	Using the rate card, what is the best time for a customer in the United States to make an international call to Brazil?



Two Tiered Questions

The following table describes **4 trials of an experiment** to determine if new fertilizer affects the number of tomatoes a plant can produce. Which trials should be compared?

Variable	trial 1	trial 2	trial 3	trial 4
fertilizer mix	old	new	old	new
sunlight (hours/day)	8	12	8	8
water (ml/day)	500	300	300	300
# tomatoes produced	80	140	100	100

Which of the following explanations most closely explains your choice?

- a) We should compare trials that show the new fertilizer yields more tomatoes than the old
- b) We should compare trials that show a difference in the number of tomatoes
- c) We should compare all trials because conclusions can only be drawn from experiments repeated
- d) We should only compare trials that isolate the variable tested
- e) We should only compare trials that support the hypothesis tested.



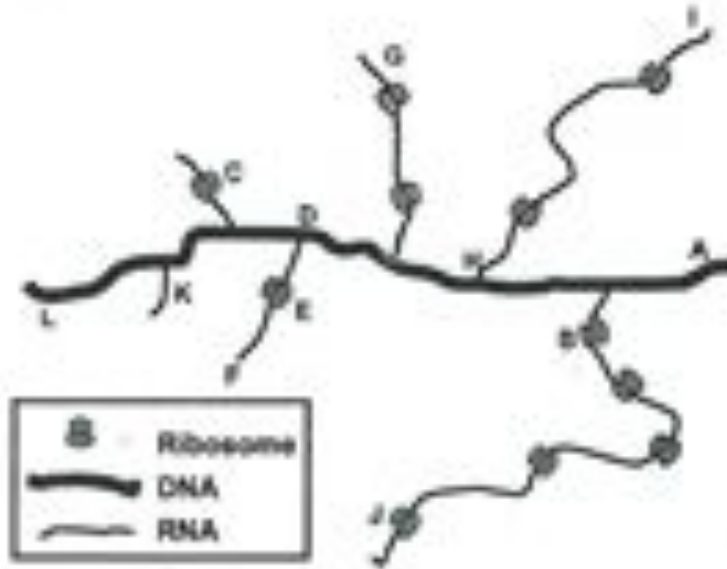
The Answer Plus The Reason Why

Original	MCQ
What are three signs of edema?	A patient entered the hospital with edema of both lower extremities. What action should the nurse take and why?
Select the most effective tone for writing technical documentation.	Select the paragraph and reasoning that best demonstrate how to start a technical document.
Name three qualities of effective entrepreneurs.	Review the financials of these three startup companies. Which one would you invest in and why?



Multiple True False

A cartoon of an electron micrograph is shown below. A piece of chromosomal DNA containing a single gene is illustrated as a thick line. Thin lines radiating from the DNA are mRNA molecules in the process of being transcribed. Ribosomes are attached to the mRNA. Newly synthesized peptides are not shown.



Refer to the drawing when answering the true (T)/false (F) questions below.



- f* The sequence of bases in the mRNA labeled K is complementary to the sequences of bases in the mRNA labeled F.
- t* The promoter for this gene is closer to L than to A.
- t* Ribosome J has made fewer peptide bonds than ribosome B.
- f* In the RNA transcript labeled H-I, the 5' end of the RNA is at H.
- t* The RNA polymerase located at position D (directly above E) is moving toward the right.
- f* The cell from which this chromosomal DNA was isolated is eukaryotic.
- t* The distance between ribosome E and end F is increasing.
- f* Ribosome C has just synthesized the carboxy terminus of the protein.



Multi-logical Questions

Tim's second grade teacher is concerned because of the following observations about Tim's behaviour in class:

- Withdraws from peers on the playground and during group work
- Often confuses syllables in words (ex: says magazine instead of magazine)
- Often confuses b and d, p and q, etc. when writing or recognizing letters
- Loses his place when reading

The teacher has arranged a meeting with Tim's mother to discuss these concerns. Which of the following statements is best for the teacher to say to Tim's mother?

- A. Tim needs extra practice reading and writing problematic letters and words at home at least 30 minutes per day.
- B. Please discuss the importance of schoolwork to Tim so that he will increase his efforts in classwork.
- C. These are possible symptoms of dyslexia so I would like to refer him to a specialist for diagnosis.
- D. Please adjust Tim's diet because he is most likely showing symptoms of ADHD due to food allergies.



Bury the Verb

Original	MCQ
Describe...	Select the best <i>description</i> .
Interpret.....	Which of the following is the most accurate <i>interpretation</i> ?
Evaluate....	Which of the following is a correctly constructed sentence?



K Type Questions

CD is a 40 yr old woman living alone and suffering trauma from previous sexual assaults. While intoxicated one evening, she shot her tenant, who she thought was an intruder. Which of the following cases could be viably be used in her defense?

- I. Steele v. The State of Virginia, 2011
- ii. Grosvenor v. British Columbia, 1974
- iii. Mervin v. Gordini, 2019

- a) I. only
- b) I. and iii only
- c) ii. and iii only
- d) All of i, ii, and iii
- e) None of these cases could viably be used.





Break Out - 15 min

Consider unmuting and sharing video in break out rooms.

Share your Questions or Content or Issue you brought.

Help each other write an MCQ for that Content.

Return to main room prepared to share an example or two.

Break out Room	Participants
1	
2	
3	
4	

Sharing



We would like to invite a couple of you to share your experience 'transforming' your question in your small group.

Questions?

Use annotation or type in Chat!



Additional Resources on MCQs



Vantage College, UBC, Revising MCQ for Multilingual Learners:

<https://vantagecollege.ubc.ca/PODcast>

University of Waterloo, Designing Multiple Choice Questions:

<https://uwaterloo.ca/centre-for-teaching-excellence/teaching-resources/teaching-tips/developing-assignments/assignment-design/designing-multiple-choice-questions>

McGill University, Designing Effective Multiple-Choice Questions:

https://www.mcgill.ca/skillsets/files/skillsets/mcq_handout3.pdf

Vanderbilt University, Writing Good Multiple Choice Test Questions:

<https://cft.vanderbilt.edu/guides-sub-pages/writing-good-multiple-choice-test-questions/>

Yale University, Designing Quality Multiple Choice Questions:

<https://poorvucenter.yale.edu/MultipleChoiceQuestions>

Additional Resources on MCQs and Higher Order Thinking



http://thelearningcoach.com/elearning_design/multiple-choice-questions/

<https://teaching.uwo.ca/pdf/programs/Writing-Higher-Order-MCQ-Fall-2018.pdf>

http://www.sfu.ca/sfublogs-archive/departments/fhs-teaching/527_multiple-choice-questions-that-assess-higher-order-cognition.html

<https://cft.vanderbilt.edu/guides-sub-pages/writing-good-multiple-choice-test-questions/>

Canvas How to MCQ:

https://community.canvaslms.com/docs/DOC-10460-canvas-instructor-guide-table-of-contents#jive_content_id_Quizzes



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