Test Construction
YOU LOOK WORRIED...

I AM WORRIED! WE'RE HAVING A TEST IN SCHOOL TOMORROW, AND THERE'S NO WAY I CAN PASS IT... ABSOLUTELY NO WAY!

HAVE YOU TRIED STUDYING?

WE'RE HAVING A TEST IN SCHOOL TOMORROW, AND THERE'S NO WAY I CAN PASS IT...ABSOLUTELY NO WAY!
PEANUTS

How did you do on your test?

Don't ask me... it was a disaster...

Couldn't you even pass a true or false test? What happened?

I falsed when I should have trued!
Well, I hope you learned a lesson.

You failed that true or false test because you didn't study.

No, I think I merely miscalculated...

If I had started with a false instead of a true, then the three trues would have been false, and the false that followed the true would have...

Oh, good grief!
Guidelines in Making MCQs

Objectives

1. Describe a multiple choice question.
2. Discuss the basic structure of the MCQ.
3. Identify common errors in constructing multiple choice questions.
4. Discuss the guidelines in crafting the stem and the alternatives of a MCQ
Why MCQ

- Directly assess a student’s ability to discriminate and make correct choices
- Comprehend concepts, principles and generalizations
- Make judgments about and choices among various courses of action
- Infer and reason, compute, interpret new data or information
- Apply information and knowledge in structural situations
Basic Structure of the MCQ

Which of the following is a common injury event in pediatric trauma? STEM

A. Blunt
B. Crushing
C. Penetrating
D. Burn

RESPONSES OPTIONS OR ALTERNATIVES
Basic Structure of the MCQ

- Asks the question
- Sets the problem
- Should clearly define the examinees’ tasks
- Should include specifications necessary to perform task
- Should include all words that would have to be repeated in the alternative
Basic Structure of the MCQ

- **Correct answer (key)**
- **Distracters**
  - logical misconceptions of the correct answer
  - common errors of students
- **Should always be arranged in a meaningful way (logically, numerically, alphabetically, etc)**
Basic Structure of the MCQ

- Be brief
- Follow the stem grammatically
- Homogeneous
- Should be at least 4
Rules to Guide in Construction of Multiple Choice Items
Design each item to measure an important learning outcome. Problem situation around which an item is to be built should be:

Avoid testing for unimportant details, unrelated bits of information and materials irrelevant to the desired outcome.
CRAFTING THE STEM
Crafting the Stem

POOR

Ritgen maneuver

a. Assist delivery of the fetal head
b. Prevent perineal laceration
c. Prevent infection
d. Increase collateral circulation

• **PROBLEM:** No central theme or idea; after reading the stem, a student should understand the main intent of the item – what type of response you expect.
Guidelines in Constructing MCQs

• Do:
  – Present a single clearly formulated problem in the stem of the item
    • Task set forth in the stem should be so clear that a student can understand it without reading the alternatives
    • Goal check on clarity and completeness of MC stem; cover alternatives and determine whether it could be answered without the choices
## Crafting the Stem

<table>
<thead>
<tr>
<th>POOR</th>
<th>BETTER</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ritgen maneuver</strong></td>
<td><strong>What is the role of the Ritgen maneuver during delivery?</strong></td>
</tr>
<tr>
<td>a. Assist delivery of the fetal head</td>
<td>a. Assist delivery of the fetal head</td>
</tr>
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</tr>
<tr>
<td>c. Prevent infection</td>
<td>c. Prevent infection</td>
</tr>
<tr>
<td>d. Increase collateral circulation</td>
<td>d. Increase collateral circulation</td>
</tr>
</tbody>
</table>
## Constructing the Stem

<table>
<thead>
<tr>
<th>Left Column</th>
<th>Right Column</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>POOR</strong></td>
<td><strong>POOR</strong></td>
</tr>
</tbody>
</table>

### Constructing the Stem

**Which of the following IS NOT done in neonatal resuscitation?**

- a. prevent loss of heat
- b. clear airway
- c. intubate if necessary
- d. give oxygen for pale extremities

**In patients with right sided colon carcinoma which of the following symptoms is LEAST LIKELY PRESENT:**

- a. anorexia
- b. right lower quadrant pain
- c. weight loss
- d. intestinal obstruction
- e. anemia
Constructing the Stem

POOR

Infertility work up includes the following EXCEPT:

a. Documentation of ovulation
b. Semen analysis
c. Hysterosalpingogram
d. Hysteroscopy

PROBLEM: Presenting the stem in the negative form; it tends to confuse students especially the younger or less careful ones. Even well-prepared students overlook the NOT in an examination question.
Guidelines in Constructing MCQs

- *Negatives items*
  - *easier to construct*
  - *have lower levels of difficulty*
  - *tend to measure unimportant learning outcomes*
  - *being able to identify answers that do not apply provide NO ASSURANCE that the student possesses the desired knowledge*
Guidelines in Constructing MCQs

• **Positive test items**
  
  – *measure more important learning outcomes than negatively stated item*
  
  – *best method or most relevant argument typically has more educational significance than the poorest or least relevant argument.*
Which of the following IS NOT done in neonatal resuscitation?

a. Prevent loss of heat
b. Clear airway
c. Intubate if necessary
d. Give oxygen for pale extremities

Which of the following measures are done during neonatal resuscitation?

a. Control of temperature
b. Maintenance of clear airway
c. Intubation if necessary
d. Administration of oxygen if the extremities are pale
Guidelines in Constructing MCQs

**REMEMBER:** Write the stem positively. If negatively phrased items are used, use the negative word only in the stem or only in an option (not both) and either underline the negative word or place it in **CAPITAL LETTERS**
Integral to organ transplantation is the anastomosis of donor and recipient organ vessels. The pioneering person in the field of vascular anastomosis is:

a. Joseph Murray
b. Alexis Carrel
c. John Hunter
d. William Halsted
e. Theodor Billroth

**PROBLEM:**

- “Window dressing” use of words that tend to “dress up” a stem to make it sound as though it is testing something of practical importance.

  - makes an item appear to measure applications
  - makes an item more difficult, less discriminating, less reliable, less valid.
Integral to organ transplantation is the anastomosis of donor and recipient organ vessels. The pioneering person in the field of vascular anastomosis is:

a. Joseph Murray  
b. Alexis Carrel  
c. John Hunter  
d. William Halsted  
e. Theodor Billroth
Guidelines in Constructing MCQs

REMEMBER:
- State the stem in simple clear language
- Every word used in an item should have a purpose.
1. A 29-year-old G2P1 (1001), 29 wks AOG complains of foul smelling, grayish discharge. Gram stain revealed inflammatory cells with epithelial cells stippled with bacteria. What is the most likely diagnosis?
   a. Trichomoniasis
   b. Vaginosis, bacterial
   c. Chlamydia infection
   d. Gonorrhea

2. The treatment of choice for the above is:
   a. Metronidazole
   b. Clotrimoxazole
   c. Azithromycin
   d. clarithromycin
Guidelines in Constructing MCQs

PROBLEM:

Linking – the answer to one or more items depends on obtaining the correct answer to a previous item. It results in double penalizing a student for an incorrect answer.
BETTER

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What is the treatment of choice for Chlamydia?
   a. Metronidazole
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   d. clarithromycin
Guidelines in Constructing MCQs

• Make certain each item is independent of the other items in the test

  – Information in one item should not help student answer another item in the test – careful review of items before the test is assembled

  – Avoid chains of interlocking items where the correct answer to an item depends upon knowing the correct answer to the item preceding it.
The increase in length per unit of length of a metal rod for each degree rise in temperature is known as:

a. coefficient of linear expansion of the metal
b. elasticity of the metal
c. specific heat of the metal
d. surface tension of the metal

**PROBLEM:**

- Definition is in the stem – it increases the likelihood that students will get the answer correct by only superficial knowledge of the term you wish to assess.

- Students can obtain the correct answer by knowing only that the words in the definition look like a word in the alternatives.
The increase in length per unit of length of a metal rod for each degree rise in temperature is known as:

- a. coefficient of linear expansion of the metal
- b. elasticity of the metal
- c. specific heat of the metal
- d. surface tension of the metal

What is the coefficient of linear expansion of a metal rod?

- a. the increase in length of the rod when its temperature is raised 1°C
- b. the increase in length when the temperature is raised 1°C divided by the total length of the rod at the original temperature
- c. the ratio of its length at 1 00° to its length at °C
- d. the rise in temperature which is necessary to cause the length of the rod to expand 1 per cent
Guidelines in Constructing MCQs

**REMEMBER:**

*To assess whether students have in-depth knowledge of a term, put the term in the stem and write various definitions in the alternatives.*
Crafting Alternatives or Foils
Guidelines in Constructing MCQs

• Functional and Plausible Alternatives – means that each alternative attracts at least one of the students who do not have the degree of knowledge that you expect of all students
- use three to five functional alternatives.
- remove deadwood or filler alternatives or non-functional alternatives
- base distracters on errors students commonly make
### Crafting Alternatives or Foils

#### POOR

A 48-year-old G8P8 (8008) with introital mass. IE showed the cervix prolapsing out of the introitus, anterior and posterior vaginal walls are lax, small corpus. What is your diagnosis?

- a. 1\(^{st}\) degree uterine prolapse
- b. 2\(^{nd}\) degree uterine prolapse
- c. 3\(^{rd}\) degree uterine prolapse
- d. None of the above

#### PROBLEM: Use of “none of the above”

- Results in less reliable, more difficult items
- Should not be used with the best-answer variety
- Best used in computational problems
A 48-year-old G8P8 (8008) with introital mass. IE showed the cervix prolapsing out of the introitus, anterior and posterior vaginal walls are lax, small corpus. What is your diagnosis?

a. 1\textsuperscript{st} degree uterine prolapse
b. 2\textsuperscript{nd} degree uterine prolapse
c. 3\textsuperscript{rd} degree uterine prolapse
d. None of the above

A 48-year-old G8P8 (8008) presents with an introital mass. IE shows the cervix prolapsing out of the introitus, with lax anterior and posterior vaginal walls, and a small corpus. What degree of uterine prolapse does the patient have?

a. 1\textsuperscript{st}
b. 2\textsuperscript{nd}
c. 3\textsuperscript{rd}
d. 4\textsuperscript{th}
A patient is delivered at our institution. She is HIV +. She intends to breastfeed her baby. You tell her that:

a. Breast feeding is contraindicated for HIV patients
b. Breast feeding is allowed by WHO if she has no other means to feed her baby
c. HIV transmission per liter of breast milk is similar to that of heterosexual transmission
d. All of the above

**PROBLEM: Use of “all of the above”**

- **Students who know that one option is correct may simply choose it and inadvertently go on to the next item without reviewing the remaining options**
A patient is delivered at our institution. She is HIV +. She intends to breastfeed her baby. You tell her that:

a. Breast feeding is contraindicated for HIV patients
b. Breast feeding is allowed by WHO if she has no other means to feed her baby
c. HIV transmission per liter of breast milk is similar to that of heterosexual transmission
d. All of the above

What would you advice an HIV + patient who has just delivered and intends to breastfeed her baby?

___a. It is contraindicated for HIV patients
___b. It is allowed by WHO if she has no other means to feed her baby
___c. HIV transmission per liter of breast milk is similar to that of heterosexual transmission
___d. She can breast feed as long as she practice sterile techniques
Crafting Alternatives or Foils

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<td>The most common complication of untreated HIRSCHSPRUNGS disease is:</td>
</tr>
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<td>a. toxic megacolon</td>
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<td>b. HIRSCHSPRUNGS enterocolitis</td>
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<td>c. perforation</td>
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<tr>
<td>d. impacted feces</td>
</tr>
<tr>
<td>e. peritonitis</td>
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**PROBLEM:** “Verbal clues in the alternative”. It leads the less knowledgeable but verbally able student to the correct answer.
## Crafting Alternatives or Foils

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Guidelines in Constructing MCQs

“Verbal clues in the alternative”. It includes:

1. Similarity of wording in both stem and the correct answer
2. Use of overlapping alternatives
3. Silly or absurd distracters
4. Clang (sound-alike words)
Guidelines in Constructing MCQs

“Verbal clues in the alternative”. It includes:

5. Including absolute terms in distracters that eliminates them as possible answers (always, never, only)

6. Including 2 responses that are all-inclusive

7. Including 2 responses that have same meaning
The cervical findings of a term primigravid in labor shows the following: 8-9 cm cervical dilatation, ruptured BOW through which were felt the malar prominences and a mouth with the chin near the sacrum. What is the presentation?

a. Face – mento-anterior
b. Face – mento posterior
c. Brow
d. Vertex

A positive Widal’s test supports a diagnosis of:

a. tuberculosis
b. typhoid fever
c. Koch’s
d. malaria
Guidelines in Constructing MCQs

**PROBLEM:**

*Use of opposite and synonymous distracters*

**Effect:** A test wise student will know that one of the opposite alternatives is the right answer while in synonymous distracters, if one is wrong the synonym is also wrong and the student is left only with two options to choose from.
The cervical findings of a term primigravid in labor shows the following: 8-9 cm cervical dilatation, ruptured BOW through which were felt the malar prominences and a mouth with the chin near the sacrum. What is the presentation?

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a. Face – mento posterior  
b. Brow  
c. Vertex  
d. Chin
Crafting Alternatives or Foils

**POOR**

A positive Widal’s test supports a diagnosis of:

- a. tuberculosis
- b. typhoid fever
- c. Koch’s
- d. malaria

**BETTER:**

A positive Widal’s test supports a diagnosis of:

- a. tuberculosis
- b. typhoid fever
- c. shigellosis
- d. malaria
Who among the following is at risk for ovarian CA?

a. 34-year-old with 5 years of OCP use
b. 24-year-old primigravida at 16
c. 33-year-old G8P9 (8008)
d. 23-year-old nulligravid whose mother died of ovarian CA and whose sister has recently been diagnosed with ovarian CA

**PROBLEM:**

*Making the correct answer longer than the incorrect one.*

*Item writer is particularly careful to express the correct answer with qualifications.*
## Crafting Alternatives or Foils

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Guidelines in Constructing MCQs

REMEMBER:

Vary the relative length of the correct answer to eliminate length as a clue
Crafting Alternatives or Foils

**POOR**

What is the official state bird of Philadelphia?

a. mountain laurel
b. Philadelphia
c. ruffed grouse
d. Susquehanna River

**PROBLEM:**

Lack of homogeneity of alternatives so that distracters do not function well
## Crafting Alternatives or Foils

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<td>a. goldfinch</td>
</tr>
<tr>
<td>b. Philadelphia</td>
<td>b. robin</td>
</tr>
<tr>
<td>c. ruffed grouse</td>
<td>c. ruffed grouse</td>
</tr>
<tr>
<td>d. Susquehanna River</td>
<td>d. wild turkey</td>
</tr>
</tbody>
</table>
Guidelines in Constructing MCQs

**REMEMBER:**

– Alternatives should be a member of the same things and each alternative should be appropriate to the item.

– The more alike the distractors, the more difficult the item
Crafting Alternatives or Foils

**POOR**

The leading cause of death from gynecologic malignancies is:

- a. Vulvar carcinoma
- b. Cervical carcinoma
- c. Corpus carcinoma
- d. Ovarian carcinoma

**Problem:** Repetition of words in the alternatives
The leading cause of death from gynecologic malignancies is:

a. Vulvar carcinoma  
b. Cervical carcinoma  
c. Corpus carcinoma  
d. Ovarian carcinoma

The leading cause of death from gynecologic malignancies is carcinoma of the:

a. Vulva  
b. Cervix  
c. Corpus  
d. Ovary
Guidelines in Making Alternatives or Foils

- *Put as much of the wording as possible in the stem of the item*
- *Avoid repeating same material*
- *Moving common content to stem helps clarify problem and reduce reading time*
Crafting Alternatives or Foils

POOR

A 90° angle is called a:

a. acute angles
b. obtuse angles
c. right angle

PROBLEM:

*Items contain grammatical clues to the correct answer which makes it easier and less reliable*
Crafting Alternatives or Foils

POOR

A 90° angle is called a:

a. acute angles
b. obtuse angles
c. right angle

BETTER

What are 90° angles called?

a. acute angles
b. obtuse angles
c. right angles
### Suggestions for improving the alternatives of multiple choice items

<table>
<thead>
<tr>
<th>TO DO</th>
<th>TO AVOID</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. In general strive for creating 3-5 functional alternatives</td>
<td>1. Avoid “none of the above” and “all of the above”</td>
</tr>
<tr>
<td>2. All alternatives should be homogeneous and of the same or varying length</td>
<td>2. Avoid using verbal clues</td>
</tr>
<tr>
<td>3. Put repeated words and phrases in the stem</td>
<td>3. Make distracters plausible and attractive to the uninformed.</td>
</tr>
</tbody>
</table>
Suggestions for improving the alternatives of multiple choice items

<table>
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<tbody>
<tr>
<td>4. Arrange alternatives in meaningful order</td>
<td>4. Avoid making it harder to eliminate a distractor than to choose the keyed answer.</td>
</tr>
<tr>
<td>5. All distracters should be grammatically correct with respect to the stem</td>
<td>5. Avoid use of synonymous and opposite distracters</td>
</tr>
</tbody>
</table>
THANK YOU
THANK YOU
Guidelines in Constructing MCQs

**PROBLEM: Use of “none of the above”**

- *In correct answer form, measures only ability to detect wrong answers and does not guarantee that the student knows what is correct*

- *Best used in computational problems*
Guidelines in Constructing MCQs

**PROBLEM: Use of “none of the above”**

- Doing so may frustrate examinees who may perceive these response alternatives as filler used by a lazy item writer.

- Use may draw students into test-taking strategies more than directly testing their knowledge.
Guidelines in Constructing MCQs

Remember that distractors must be plausible. Avoid using “none of the above” as a filler to increase the number of distractors. As an option “none of the above” is probably more confusing to younger students than the older ones. Use it with extreme caution.
Guidelines in Constructing MCQs

**PROBLEM: Use of “all of the above”**

– *Students who know that one option is correct may simply choose it and inadvertently go on to the next item without reviewing the remaining options*
Guidelines in Constructing MCQs

PROBLEM: Use of “all of the above”

- Students who know that two out of four options are correct can choose “all of the above” without having knowledge of the correctness of their option.
Guidelines in Constructing MCQs

REMEMBER:

Avoid using “all of the above”.
Rewrite items with multiple answers as two or more items and avoid these problems. Alternately, rewrite the item as a multiple true-false items.
Guidelines in Constructing MCQs

REMEMBER:

– *Don’t clue the correct answer or permit distractors to be eliminated on superficial bases*

– *Examples of inappropriate grammatical clues include lack of subject-verb agreement, inappropriate indefinite article and singular/plural confusion.*
Guidelines in Constructing MCQs

1. Design each item to measure an important learning outcome.
2. In general, there should be only one correct answer.
3. Be sure that competent authorities can agree that the answer keyed as correct is in fact correct.
4. Check over the entire text to ensure that the correct alternatives do not follow an easily learned pattern.
## Crafting the Stem of the Item

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>1. If possible write as a direct question.</td>
<td>1. Avoid superfluous, non-functioning words, phrases</td>
</tr>
<tr>
<td>2. If an incomplete sentence is used, be sure:</td>
<td>2. Avoid negatively worded items.</td>
</tr>
<tr>
<td>a. It implies a direct question</td>
<td></td>
</tr>
<tr>
<td>b. Alternatives come at the end</td>
<td></td>
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<tr>
<td></td>
<td>3. Avoid phrasing the item so that the personal opinion of the examinee is an option</td>
</tr>
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</table>
Crafting the Stem of the Item

<table>
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<td>3. Control the wording so that vocabulary and sentence structure are at a low and non-technical level</td>
<td>4. Avoid textbook wording</td>
</tr>
<tr>
<td>4. In items testing definition, place the word or term in the stem</td>
<td>5. Avoid cluing and linking items</td>
</tr>
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</table>
Item Writing Procedures

1. Use course objectives to choose content for testing
2. Select essential content for the item – item idea
3. Write the stem of the item
4. Write the correct (key) answer for the item
5. Write 3-4 plausible wrong answers (foils) for the item
6. Have the item reviewed by content and technical specialist

- **IS THE ITEM OKAY**
  - **YES**
    - Go on to the next item
  - **NO**
    - Rewrite the item using the reviewer’s comments
Crafting the Stem

Classical CS is:

a. More prone to uterine rupture
b. Leads to adhesions
c. Leads to monumento
d. Difficulty delivering the head

• **PROBLEM:** No central theme or idea; after reading the stem, a student should understand the main intent of the item – what type of response you expect.
The diagnosis of inguinal hernia can best be arrived at by:

a. an accurate history and meticulous physical examination
b. needle aspiration
c. transillumination
d. abdominal X-ray
e. silk-glove sign

PROBLEM:

Making the correct answer longer than the incorrect one. Item writer is particularly careful to express the correct answer with qualifications.
Crafting Alternatives or Foils

POOR
The diagnosis of inguinal hernia can best be arrived at by:

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BETTER
The diagnosis of inguinal hernia can best be arrived at by:

a. history and physical examination
b. needle aspiration
c. transillumination
d. abdominal X-ray
e. silk-glove sign
Which of the following is the most common injury event in pediatric trauma?

a. Blunt injuries
b. Crushing injuries
c. Penetrating injuries
d. Burn injuries

Problem: Repetition of words in the alternatives
Crafting Alternatives or Foils

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<td>d. Burn injuries</td>
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