

TEST ITEM DEVELOPMENT GUIDE

NATIONAL BOARD DENTAL EXAMINATIONS

*A publication of the Joint Commission on National Dental Examinations
American Dental Association, 211 East Chicago Avenue
Chicago, Illinois 60611-2637*

TEST ITEM DEVELOPMENT GUIDE

NATIONAL BOARD DENTAL EXAMINATIONS

January 2011

The Test Item Development Guide is available on the ADA.org web site at
<http://www.ada.org/2287.aspx>

Contents

Introduction	3
Examination Specifications.....	3
Cognitive Level.....	3
Test Item Formats	4
Traditional Multiple Choice.....	4
Paired True-False	4
Cause-Effect	5
Exception.....	5
Matching	5
Ordering.....	6
Multiple Response	6
Item Sets - Testlets.....	7
Item Shells	10
Item Writing Guidelines	11
Writing Stems	11
Questions and Incomplete Statements.....	12
Keeping It Simple.....	12
Positive and Negative Stems	13
Making Stems Inclusive	14
Writing Alternatives (Answers and Distractors)	14
Correct Responses and Best Responses.....	14
Keeping Alternatives Similar	15
Avoiding Overlapping Alternatives	16
Making Alternatives Specific	17
Writing Plausible Distractors	17
General Guidelines.....	18
Using Absolute Terms.....	18
Repetition of Key Terms.....	18
Consistent Grammar.....	18
Consistent Construction	19
Stages of Item Development	19
References.....	21
Copyright Assignment	22
Item Submission Form.....	23

INTRODUCTION

This publication of the Joint Commission on National Dental Examinations provides item development guidelines to new and current item writers to augment the quality and quantity of new test items into our item bank. The use of the item development guidelines should increase the chances that items submitted to testing services will be accepted. This exercise affords an opportunity to participate in a professional activity associated with dentistry. To this end, the *Test Item Development Guide* is intended:

- To inform dental and academic communities of interest about the item development process for National Board Dental/Dental Hygiene Examinations
- To encourage participation in our item development and review activities.
- To broaden our base of item writers, item reviewers, and future test constructors.
- To replenish our item pool with current knowledge in a variety of item formats.

EXAMINATION SPECIFICATIONS

The *National Board Dental and Dental Hygiene Examination Specifications* describe the structure of the examination as well as the content. A practice analysis is conducted to glean information on the knowledge and skills essential to the practice of dentistry and dental hygiene from experts in the field. The examination specifications derive from the practice analysis and outline the knowledge required for professional practice. The examination specifications determine the structure of the examination, i.e., the percent of items in each discipline, test length, case-independent and case-dependent item formats, etc. Essentially, the examination specifications communicate what is considered important, and therefore, what to measure. With content comes process - the methods to measure content (item formats), and the methods to process knowledge (cognitive tasks).

COGNITIVE LEVEL

A cognitive level is assigned to each item to gauge the different thought processes required to respond and to determine the item's level of process difficulty. As such, the cognitive level reflects the manner in which knowledge is being assessed, rather than the technical difficulty of the content. The cognitive level is based on the task of the examinee. The items are classified according to the following three cognitive levels:

Level 1 - Understanding

Items elicit knowledge of specific facts, terminology, sequences, methodology, principles, theories, and structures in a different context. Identifiers: acquire, define, identify, recall, recognize

Level 2 - Application

Items elicit application of specific facts, terminology, sequences, methodology, principles, theories, and structures in a complex manner. Identifiers: apply, choose, classify, develop, relate, organize, differentiate

Level 3 - Reasoning

Items elicit understanding or the ability to identify and interpret specific data, terminology, sequences, methodology, principles, theories, and structures. Identifiers: analyze, synthesize, interpret, evaluate

In assigning a cognitive level to an item, the item writer has to consider the cognitive skills of an entry-level dentist or dental hygienist. Mislevy (1993) cautions that item writers, as experts, use different cognitive strategies in responding to a problem or circumstance than a novice. An expert works from an extensive knowledge base and processes information in a less complex manner. In turn, the novice uses more complex cognitive operations to address a problem. In item development, the item writer should be sensitive to the cognitive skills of the entry level professional.

TEST ITEM FORMATS

There are a variety of item formats used in both large- and small-scale assessment instruments. Whereas the test specifications outline what to measure, the type of item format, linked with cognitive level, informs us how to measure. In general, the array of item formats available is conducive for a wide spectrum of cognitive tasks, from information retrieval to critical thinking and problem-solving tasks. The skills of the item writer are essential in determining the potential range of cognitive abilities associated with a test item.

Traditional Multiple Choice

Multiple-choice questions or items are considered by experts the most versatile and useful of objective test questions. They are effective in measuring not only people's knowledge and understanding, but also the more complex cognitive processes of application, analysis, synthesis, and evaluation. In order to be effective, however, the items must be written well.

There are a few essential parts to the multiple-choice item. The *stem* is the introductory question or partial statement that the examinee must answer or complete. The stem is followed by three to five *alternatives*, marked by the letters A, B, C, D, and E. One of the alternatives, the *key*, is the correct, or best, *response* to the stem. The incorrect, or inferior, alternatives are known as *distractors*. In many cases, common misconceptions make excellent distractors. In general, the effective performance of a test item is directly related to the discriminating quality of the distractors.

Paired True-False

At times it is appropriate to write items that use paired true-false statements. The stem consists of two statements on the same topic. Note that the responses are set. This format can be used to compare and contrast treatment plans, methods, findings, drug use, and concepts.

The following is an example of a paired true-false item.

The patient's apprehension and stress can inhibit healing following periodontal surgery.

Restorative care following initial periodontal therapy is most likely to succeed if the dentist implements a behavioral change program with this patient.

- A. Both statements are true.
- B. Both statements are false.
- C. The first statement is true, the second is false.
- D. The first statement is false, the second is true.

Cause-Effect

The stem consists of a statement and a reason. These are written as a single sentence connected by “because.” This format provides an avenue for the analysis of relationships.

The following is an example of a cause-and-effect item.

Before undergoing periodontal surgery, a patient should be controlling accumulation of plaque because in the plaque-infected dentition after surgery, the incidence of disease recurrence will be greater.

- A. Both the statement and the reason are correct and related.
- B. Both the statement and the reason are correct but NOT related.
- C. The statement is correct but the reason is NOT.
- D. The statement is NOT correct, but the reason is correct.
- E. NEITHER the statement NOR the reason is correct.

Exception

A negative item is characterized by a word such as EXCEPT or NOT in the stem. These key words are capitalized to help examinees. These items are of the “Which of the following is INCORRECT?” format. In general, this item format should be used sparingly, and in cases where exceptions to general rules or principles exist.

The following is an example of a negative, or incorrect, item format.

Each of the following drugs is appropriate for the treatment of cardiac arrhythmia EXCEPT one. Which one is the EXCEPTION?

- A. Phenytoin
- B. Lidocaine
- C. Quinidine
- D. Propranolol
- E. Epinephrine

Matching

The matching item format is a variation of the multiple choice item. A list of words or statements and a number of responses are listed with the intent of matching the correct word or statement with the correct response. This item type lends itself to recognizing or understanding a series or list of symptoms linked with disease choices, terms with definitions, drugs with side effects, etc. The list of responses usually exceeds the number of statements to prevent guessing. As an item format, matching items are straightforward to write and to score and can assess a wide range of content.

The following is an example of a matching item format.

For each symptom listed below, select the correct disorder from the list provided.

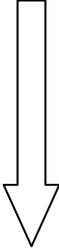
Symptom	Disorder
___ 1. White patches easily removed with light abrasion	A. Squamous cell carcinoma
___ 2. Buccal lesion with erythematous surface	B. Candidosis
___ 3. Dorsal tongue carcinoma	C. Syphilis
___ 4. Paterson-Kelly Syndrome	D. Iron deficiency
___ 5. Abdominal pain, diarrhea, weight loss, fever	E. Crohn's disease
___ 6. Multiple bluish-purple macules or plaques on lower extremities	F. Sjögren syndrome
___ 7. Hairy tongue	G. Kaposi sarcoma
	H. Paget's disease
	I. Hypothyroidism
	J. Septicemia

Ordering

The ordering format requires ranking or sequencing the steps, processes, or procedures presented in the test item.

The following is an example of a multiple response item format.

Order the citric cycle as it occurs. Match each letter with its proper sequence number

pyruvic acid from glycolysis to:		
1		A. Malic acid
2		B. Succinyl-CoA
3		C. Acetyl-CoA
4		D. Fumaric acid
5		E. Succinic acid
6		F. Isocitric acid
7		G. Oxaloacetic acid
8		H. α -Ketoglutaric acid
9	I. Citric acid	

Multiple Response

The multiple response format is appropriate for determining what characteristics are associated with a particular disease, drug, treatment plan, etc. (i.e. symptoms of a disease, side effects of a drug, steps of a treatment plan).

From the following list, select the three symptoms associated with candidosis.

- A. Small blisters
- B. Parasitic in nature
- C. Reduced prothrombin
- D. Fungal in nature
- E. Bruxism
- F. Malabsorption syndrome
- G. Bacterial in nature

Item Sets - Testlet

An item set consists of some form of stimulus material presented with a set of associated test items. Item sets are alternately known as testlets or case clusters. The stimulus material can be a patient problem, scenario or vignette, a photograph, radiograph, lab report, chart, or drawing. The associated set of test items can range in number from 2-10. Some examples of item sets are the case-based component B sections of the NBDE Part II and NBDHE, the community health area of the NBDHE component A, and the Reading Comprehension section of the Dental Admission Test.

SAMPLE TESTLET FOR NBDHE

A dental hygienist employed at a public health clinic in a rural county of the United States is assigned the project of developing a preventive dental health program for a subgroup of the population.

COMMUNITY PROFILE: The primary employers in this county have been coal mining companies. The unemployment rate in the county has increased by 32 percent since the closing of the coal mine companies.

The median age of the population is forty-six. In the county there are five general dentists, three dental hygienists, and one public health-centered dental clinic. The clinic employs a full-time dentist and dental hygienist. The public health clinic sees low-income children and senior citizens on a sliding fee schedule.

The dental hygienist employed by the public health clinic conducts the dental screenings for the kindergarten students each year. The mean deft scores for the kindergarten students, for the last three years, are: d = 1.02, e = 0.87, f = 4.22.

The community does not have water fluoridation because of multiple water sources. The state funds a 0.2%-sodium fluoride rinse program in grades K-5. The state mandates that a dentist or a dental hygienist perform deft/dmft/DMFT and GI indices on all students in grades 1, 2, 3, 5, 7, and 10. On a yearly basis, all pathology is brought to the parent's attention and referred to a dental professional.

1. Which population group is dentally underserved in this community?
 - A. Adult age
 - B. Geriatric age
 - C. Adolescent age
 - D. Early childhood age
 - E. Elementary school age

2. What can be stated about the deft scores of the kindergarten students?
 - A. Early exfoliation
 - B. High decay rate
 - C. Increased referrals
 - D. Late eruption pattern
 - E. Treatment needs are being met

3. Each of the following is perceived as a barrier to dental care for this community EXCEPT one. Which one is the EXCEPTION?
 - A. Geographic isolation
 - B. Lack of water fluoridation
 - C. Maldistribution of providers
 - D. Services are not affordable
 - E. Loss of income and insurance

4. What would be the next step for the dental hygienist to take in program planning after selecting the target population?
- A. Appraise the program.
 - B. Define goals for the program.
 - C. Compile data on the target group population.
 - D. Develop educational components.
 - E. Identify manpower resources in the community.

SAMPLE TESTLET FOR NBDE PART I

Age	65 YRS	SCENARIO
Sex	<input checked="" type="checkbox"/> Male <input type="checkbox"/> Female	<p>The patient presents for replacement of a filling in tooth 19. He reports that he lost the filling over a year ago, but he delayed seeking care because the tooth has not been sensitive. Upon examination, tooth 19 has a missing occlusal restoration and a fractured ML cusp.</p> <p>Extraoral examination revealed mild actinic damage of his lower lip vermilion border.</p>
Height	5' 9"	
Weight	240 LBS	
B/P	170/100	
Chief Complaint	"I lost the filling in my back tooth"	
Medical History	He last saw his physician 2 years ago. Father died of heart attack at age 52.	
Current Medications	diuretic for hypertension statin for high cholesteremia low dose aspirin	
Social History	married, grown children retired construction foreman has smoked a pipe daily for 25 years	

1. Which syndrome does the patient have?
 - A. Ehlers-Danlos
 - B. Metabolic
 - C. Marfan
 - D. Trisomy 21

2. This patient needs an immediate referral to his physician for
 - A. weight control.
 - B. smoking cessation.
 - C. stress management.
 - D. uncontrolled hypertension.
 - E. nutritional counseling.

3. The patient initially resists accepting the need for referral to his physician and requests that the dentist proceed to address his chief complaint. The ethical principle in conflict for the dentist is
 - A. nonmaleficence and autonomy.
 - B. justice and veracity.
 - C. beneficence and veracity.
 - D. autonomy and justice.
 - E. nonmaleficence and beneficence.

4. Each of the following represents a potential mechanism of action for the medication used to treat the patient's cardiovascular disorder EXCEPT one. Which one is the EXCEPTION?
- A. Inhibition of Na^+Cl^- symporter in the distal tubule
 - B. Impaired Na^+ reabsorption in the proximal tubule
 - C. Decreased osmolarity in the filtrate
 - D. Prevention of aldosterone from entering the principal cells in the late distal tubule
5. Which would be the most likely consequence of the patient's delay in having the lost restoration replaced?
- A. Supra-eruption of tooth 14
 - B. Loss of vertical dimension
 - C. Loss of canine disclusion
 - D. Mesial drift of tooth 18
6. A periapical radiograph of the affected tooth shows a radiolucency at the apex of the mesial root. Biopsy of the radiolucency reveals a granuloma. The predominant cell type would be
- A. macrophages.
 - B. eosinophils.
 - C. neutrophils.
 - D. mast cells.
7. The radiograph also shows a horizontal radiolucency with parallel radiopaque borders located inferior to the teeth. This is most likely the
- A. bony trabeculae.
 - B. mental foramen.
 - C. alveolar ridges.
 - D. mandibular canal.
 - E. oblique ridge.
8. Endodontic treatment is needed on the affected tooth. What configuration of pulp canals is expected?
- A. Two - one in each root
 - B. Three - two in the mesial root and one in the distal root
 - C. Three - one in the mesial root and two in the distal root
9. The patient calls the day following the endodontic procedure complaining of pain at the local anesthesia injection site and inability to open fully. The most likely cause is
- A. spasm of the temporalis muscle.
 - B. trauma to the inferior alveolar nerve.
 - C. injection into the medial pterygoid muscle.
 - D. damage to the facial nerve during the injection.
10. At a routine recall appointment two years later, a 6 mm x 5 mm focus of induration is noted on the lower lip right of the midline. The most likely diagnosis is
- A. lymphoma.
 - B. sarcoma.
 - C. melanoma.
 - D. carcinoma.

Item Shells

An item shell is a template used to generate a number of similar items. Since each shell represents a good item structure, a number of high quality items can potentially be generated from a small number of item shells. This process helps to accelerate item writing, though not all types of content or cognitive tasks are amenable to this type of item development. This method of item development is particularly convenient and appropriate for the novice item writer.

Haladyna (1999) suggests the following steps in developing an item shell:

1. Identify the stem of a good performance item.
2. Underline the key words or phrases representing the content of the item.
3. Identify variations for each word or phrase.
4. From each list generated, select an alternative word or phrase.
5. Write the new stem, correct answer, and distractors.

An example of these steps is presented below.

Steps 1 and 2

A 6-year-old child is brought to the hospital with contusions over the abdomen and chest as a result of an automobile accident. What should be the initial treatment?

Steps 3 and 4

infant

abrasion

bicycle

Step 5

An infant is brought to the hospital with severe abrasions following a bicycle accident involving the mother. What should be the initial treatment?

- A. Conduct a visual examination.
- B. Treat for infection.
- C. Administer pain killers to calm the infant.
- D. Send for laboratory results.
- E. Clean the wounds with an antiseptic.

Additional item shell examples:

1. (Patient complaint) What is the most likely (treatment, cause, diagnosis)?
2. A (patient description) has (symptoms, disease) and is being treated with (drug).
3. Which best describes (disorder, disease, drug effect)?
4. What is the most common (cause, complication, symptom, or consequence) of (a procedure, disorder, action)?
5. What is the most common (cause or symptom) of a (patient problem)?

ITEM WRITING GUIDELINES

Haladyna, Downing, and Rodriguez (2002) conducted a review of specific literature over a 12-year period to compile an established list of item writing guidelines. This is an edited and abbreviated version from their initial 31 guidelines, which are consistent with the guidelines in this publication. They are presented here as a succinct reference.

Content Concerns

1. Every item should reflect specific content and a single specific mental behavior, according to the test specifications.
2. Keep the content of each item independent from content of other items on the test.

Writing the Stem

3. Avoid window dressing (excessive verbiage-irrelevant material).
4. Word the stem positively, avoid negatives such as NOT or EXCEPT. If negative words are used, use the words cautiously and ensure that the word appears capitalized and boldface.
5. Include the central idea in the stem instead of the choices, keeping responses brief.

Writing the Responses

6. Ensure that the item has only one correct or best answer.
7. List choices in logical or numerical order.
8. Keep choices homogeneous in content and grammatical structure.
9. Keep the length of choices about equal.
10. Keep choices independent; avoid overlapping or partially inclusive choices.
11. Avoid use of all-of-the-above and none-of-the-above.
12. Make all distractors plausible. Conversely, avoid obvious or absurd choices.
13. Avoid giving clues to the right answer, such as
 - A. specific determiners: *always, never, completely, all, etc.*
 - B. clang associations: choices similar or identical to words in the stem
 - C. grammatical inconsistencies

(Adapted from Haladyna, Downing, & Rodriguez (2002) p. 312)

WRITING STEMS

The stem of every multiple-choice item tells the examinees what is being presented and tested. Before reading any of the alternatives, examinees should have a good idea of what is being asked and what is to come in the alternatives. Examinees should not have to read the alternatives in order to make sense of the stem. In most cases, the stem can achieve this by fulfilling two general functions:

1. It should set up a problem or set of circumstances.
2. It should contain at least one verb.

Questions and Incomplete Statements

Although some research indicates that stems written in the form of a question are more effective than those written as partial statements, both are still currently acceptable forms for multiple-choice items. The argument for the question-form stem lies in the belief that a question communicates more completely the problem or circumstances of the item. Seeing the stem in question form helps examinees conceptualize the item's context.

The following is an example of an item written in a poorly formed incomplete sentence.

Trigeminal neuralgia (tic douloureux)

- A. is a paralysis of one side of the face.
- B. manifests as uncontrollable twitching of one eye.
- C. can be in the form of prolonged episodes of pain in one side of the face.
- D. is a dull pain when pressure is applied over the affected area.
- E. is characterized by sharp pain when light pressure is applied to the affected area.

Because the stem lacks a verb, it communicates no context to the examinees. Here is the stem with a verb that gives some indication of what knowledge is expected.

Trigeminal neuralgia (tic douloureux) is characterized by

- A. paralysis of one side of the face.
- B. uncontrollable twitching of one eye.
- C. prolonged episodes of pain in one side of the face.
- D. dull pain when pressure is applied over the affected area.
- E. sharp pain when light pressure is applied to the affected area.

An even more effective item might be to put the stem in the form of a complete question.

Which symptom best characterizes trigeminal neuralgia (tic douloureux)?

- A. Paralysis of one side of the face
- B. Uncontrollable twitching of one eye
- C. Prolonged episodes of pain in one side of the face
- D. Dull pain when pressure is applied over the affected area
- E. Sharp pain when light pressure is applied to the affected area

Keeping It Simple

The stem should include only the information needed to solve the problem. All irrelevant material should be omitted because it adds to examinees' reading time, slowing them down and threatening the reliability of the candidate's performance.

Read the following item, noting the “extra” information included in the stem.

Bruxism, the rhythmic grinding of teeth in other than chewing movements of the mandible, can result in overdevelopment of a muscle of mastication. Which muscle might be overdeveloped in a patient with bruxism?

- A. Masseter
- B. Geniohyoid
- C. Buccinator
- D. Glossopharyngeal
- E. Lateral pterygoid

Here is the same item with unnecessary information omitted from the stem.

When a patient bruxes the teeth, which muscles might become overdeveloped?

- A. Masseter
- B. Geniohyoid
- C. Buccinator
- D. Glossopharyngeal
- E. Lateral pterygoid

Generally, statements of a controversial nature do not make good objective items, though there are instances when knowledge of different viewpoints on controversial issues may be important. When this is the case, the item should clearly state whose opinion or what authority is to be used as the basis for answering.

Positive and Negative Stems

Generally, stems written in a positive way are more effective than those written negatively, simply because testing what examinees know to be correct is more productive than finding out what they know to be incorrect or a poor solution.

However, it is sometimes appropriate to ask examinees to distinguish the one incorrect response among several correct alternatives. In these cases, it is more effective to use *exceptions* than it is to use sentences with the word *not*.

Here is an example.

Each of the following is a part of the initial preparation of a periodontal treatment plan EXCEPT one. Which one is the EXCEPTION?

- A. Root planing
- B. Occlusal adjustment
- C. Home-care instructions
- D. Surgical pocket elimination
- E. Extractions of hopeless teeth

Making Stems Inclusive

As much as possible information should be included in the stem to avoid repeating words in each alternative.

The following is an ineffectively written stem.

Histologically, the normal dental pulp most closely resembles

- A. nervous tissue.
- B. endothelial tissue.
- C. granulomatous tissue.
- D. loose connective tissue.
- E. dense connective tissue.

The repetitive words should be incorporated into the stem.

Histologically, the normal dental pulp most closely resembles which of the following tissues?

- A. Nervous
- B. Endothelial
- C. Granulomatous
- D. Loose connective
- E. Dense connective

WRITING ALTERNATIVES (Answers and Distractors)

Correct Responses and Best Responses

A multiple-choice item can ask for either the correct response or the best response. While both formats are appropriate, requiring examinees to choose the best alternative obliges them to make finer distinctions than that between correct and incorrect. It therefore tests higher levels of learning. For this format to test at the desired level, it is especially critical that the distractors be at least plausible. The following is an example of a correct-response item.

Which antibiotic shows an incidence of approximately 8 percent cross-allergenicity with penicillins?

- A. Cephalexin
- B. Neomycin
- C. Bacitracin
- D. Vancomycin
- E. Tetracycline

The following is an example of a best-response item.

Which statement best describes the purpose of potassium sulfate in a mix of irreversible hydrocolloid?

- A. It acts as a filler material.
- B. It retards the setting of the hydrocolloid.
- C. It helps produce a hard, dense stone cast surface.
- D. It controls consistency of the mix.
- E. It keeps the mix from separating.

Alternatives, both the correct response and distractors, can be in the form of words, phrases, sentences, numbers, equations, images, or symbols.

Keeping Alternatives Similar

Probably the greatest challenge to item writers is assembling three or more homogeneous alternatives. Writing alternatives that bear superficial resemblance to the correct response gives minimal clues to examinees and ensures a more reliable item.

The following is an item whose alternatives might alert less knowledgeable examinees to the correct response.

In acute pulpitis, when does sensitivity to percussion occur?

- A. Only rarely
- B. At the onset
- C. Before there is any pain
- D. When the inflammation involves the periodontal ligament space

Alternative D stands out as the longest and most specific of the alternatives. While an examinee might not be sure of particulars, the context of the alternatives will tip him/her off.

The following is an item written more effectively because of its homogeneous alternatives.

Which drug is a local anesthetic subject to inactivation by plasma esterases?

- A. Lidocaine
- B. Prilocaine
- C. Tetracaine
- D. Mepivacaine
- E. Bupivacaine

It is important to avoid writing a correct response and one distractor that are opposites of each other, thus, canceling each other out and eliminating the other distractors in examinees' minds.

In the following example, alternatives A and B cancel each other out.

Which of the following best determines the mechanical and physical properties of any restorative material?

- A. Internal structure
- B. External structure
- C. Bonding strength
- D. Resistance to shear

However, an item with two pairs of alternatives can be an effective testing tool. In the following item, alternatives B and C and D and E make plausible pairs without cueing the poorly prepared examinee.

If a susceptible person were given tetanus antitoxin, what kind of immunity would result?

- A. Innate
- B. Natural active
- C. Natural passive
- D. Artificial active
- E. Artificial passive

Avoiding Overlapping Alternatives

Each alternative in an item must be distinct from the others. Ranges should not overlap thereby causing more than one response to be correct. Numbers and ranges should be listed chronologically, and ranges ideally should be equal to one another in interval.

The following is an item written with two of the responses, C and D, overlapping. Additionally, the responses are not in numerical order with consistent time intervals.

During which age range should a child be brought to a dentist for a first visit?

- A. 0 to 1 year
- B. 6 to 12 years
- C. 2 to 3 years
- D. 3 to 5 years
- E. 5 to 7 years

Here the item is rewritten in a more effective way.

During which age range should a child be brought to a dentist for a first visit?

- A. 1 to 2 years
- B. 3 to 4 years
- C. 5 to 6 years
- D. 7 to 8 years
- E. 9 to 10 years

Making Alternatives Specific

In order for distractors to be effective, they must include specific options and solutions. The distractors *all of the above* and *none of the above* should be avoided.

Writing Plausible Distractors

Because distractors are designed to lure away poorly prepared examinees, they should be reasonable though incorrect (or less correct) possibilities. Distractors are effective when they represent commonly held misconceptions about a subject. Implausible or humorous distractors do nothing to distinguish differences between prepared and unprepared examinees.

The following is an item with inappropriate distractors.

The patron saint of dentistry, recognized as the patroness of those suffering from toothache, is

- A. Eva Marie Saint.
- B. Jill St. John.
- C. Sault Sainte Marie.
- D. St. Apollonia.
- E. St. Joan of Arc.

The following item includes more plausible distractors.

Which of the following legally protects health professionals who provide emergency treatment at the scene of an accident?

- A. Good Samaritan Act
- B. States' Human Rights Act
- C. Americans with Disabilities Act
- D. Health Professional Protection Act
- E. Occupational Safety and Health Act

GENERAL GUIDELINES

Using Absolute Terms

Just as there are few absolutes in life, there are few absolutes in dentistry. Terms such as *always*, *never*, *all*, and *none* should be used sparingly and only to make very specific points since they are often cues to the poorly prepared examinee.

Repetition of Key Terms

Repeating a key word from the stem in the correct response will tip off unprepared examinees.

The following is an item with a key word repeated.

Pulp testers used for evaluating a tooth's sensitivity to pain stimulate which receptors?

- A. Pressure
- B. Touch
- C. Heat
- D. Cold
- E. Pain

The item can be improved as follows.

Pulp testers evaluate a tooth's sensitivity to which receptors?

- A. Pressure
- B. Touch
- C. Heat
- D. Cold
- E. Pain

Consistent Grammar

Grammar and word use should be consistent in all alternatives. The following item alerts examinees to the correct response.

A widening of the periodontal ligament space seen along one side of a tooth represents the radiographic manifestation of an

- A. osteosarcoma.
- B. fibrous dysplasia.
- C. multiple myeloma.
- D. metastatic breast carcinoma.
- E. Burkitt's lymphoma.

The item is improved easily by changing the indefinite article (an) in the stem.

A widening of the periodontal ligament space seen along one side of a tooth represents the radiographic manifestation of a(an)

- A. osteosarcoma.
- B. fibrous dysplasia.
- C. multiple myeloma.
- D. metastatic breast carcinoma.
- E. Burkitt's lymphoma.

Consistent Construction

Alternatives should be similar in construction and of approximately equal length.

The following is an ineffective item since the correct response stands out as the longest, most specific response.

Which best describes the purpose of potassium sulfate in a mix of irreversible hydrocolloid?

- A. Filler
- B. Reactor
- C. Retarder
- D. Controls consistency of the mix
- E. Helps produce a hard, dense stone cast surface

Here is the improved item.

Which best describes the purpose of potassium sulfate in a mix of irreversible hydrocolloid?

- A. Acts as a filler material.
- B. Controls the consistency of the mix
- C. Provides a dense stone cast surface
- D. Retards the setting of the hydrocolloid
- E. Helps produce a hard, dense stone cast surface

STAGES OF ITEM DEVELOPMENT

Item writing is one step in the cycle of item development. The following stages describe the progression of a test item from item construction, review, and revision to test administration, data collection, and analysis.

Stage 1 – Item Writing

An orientation is presented to item writers on item development guidelines. The test development staff provides the test specifications and guides the item writing process

Stage 2 – Item Review

Test development staff organizes the new test items for test construction committee review. The items are edited and processed for pretest administration. Test constructors, the test developer, and consultant reviewers:

- review and revise items
- verify the right answer
- verify the content
- conduct sensitivity check
- document the item: reference, cognitive level, etc., and
- proof the item against item guidelines.

Stage 3 – Pretest of Item

The items are embedded in existing examinations or prepared as a separate battery for pilot administration.

Stage 4 – Analysis of Item Performance

Test development staff reviews the item performance data to see if the item behaves in an acceptable manner. Pretest performance information is entered in the item bank and the item is refined and retested accordingly. Pretested items within acceptable limits enhance the quality of the examination and item bank, as well as the reliability of scores.

Stage 5 – National Examination Administration

Test construction committees draft operational examinations with embedded pretest items according to the test specifications. The examination receives a final review by test development staff and a consultant review committee.

Stage 6 – Analysis of Item Performance

The examination is administered, scored and item performance (difficulty, discrimination, and response frequency) data are reviewed. A decision is made to keep the item, revise and retest the item, or retire the item. On average, each item has an estimated value of \$1,000 as it passes through the item development process.

If you would like to submit items for the National Board Dental Examinations or have any questions, please contact the Department of Testing Services at the following address:

*Joint Commission on National Dental Examinations
American Dental Association
Department of Testing Services
211 East Chicago Avenue, Suite 600
Chicago, IL 60611-2637*

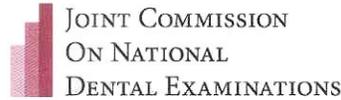
An item submission form is located on page 23. With any item submission, we require the signed *Copyright Assignment* on page 21. We appreciate your interest in our National Board Dental Examinations, and hope you will contribute to the National Board Dental Examination Program.

References

Haladyna, T. M. (1999). *Developing and validating multiple-choice test items*. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Haladyna, T. M., Downing, S. M., & Rodriguez, M. C. (2002). A Review of Multiple-Choice Item Writing Guidelines for Classroom Assessment. *Applied Measurement in Education*, 15(3), 309-334.

Mislevy, R.J. (1993). Foundations of a new test theory. In N. Frederiksen, R. J. Mislevy, & I. Bejar (Eds.) *Test theory for a new generation of tests* (pp. 19-39). Hillsdale, NJ: Lawrence Erlbaum Associates



COPYRIGHT ASSIGNMENT

The undersigned, _____, whose address is _____
_____, is involved in a special project for the American Dental Association that involves copyrighted or copyrightable materials. S/he acknowledges and agrees, individually and collectively, that all such materials belong solely to the American Dental Association, Joint Commission on National Dental Examinations, and that the Association holds any and all rights to obtain and retain ownership of copyrights for such materials in its own name. The undersigned represents that any and all contributions s/he makes to such materials will be original works, not copies in whole or in part of works of third parties. The undersigned hereby acknowledges and agrees that the American Dental Association is the sole owner of such materials, s/he has no ownership rights whatsoever in such materials, the Association has all rights to obtain copyrights for such materials, and such materials constitute "work made for hire" under copyright laws. The undersigned hereby assigns any and all ownership rights s/he may have to the American Dental Association, and s/he agrees that s/he will execute any additional documents necessary to effect this assignment to the Association upon request.

Signature

Date

Witness

**TEST ITEM SUBMISSION FORM
FOR NATIONAL BOARD DENTAL EXAMINATIONS**

DISCIPLINE: _____

SUB-TOPIC: _____ (test specification area)

COGNITIVE LEVEL: 1 2 3
(Circle one) Understanding Application Reasoning

ITEM STEM:

RESPONSES: Develop 3-4 responses. KEY: _____

A.

B.

C.

D.

REFERENCE: _____

ITEM WRITER'S NAME: _____

PHONE/FAX #'S: _____

Please check that the test item adheres to the guidelines in the *Test Item Development Guide*.