

# **Application of Professional Licensure Examinations to Assess Academic Programs**

Christopher C. Mathewson  
Regents Professor of Geology, Texas A&M University  
Member, ASBOG Council of Examiners

Department of Geology & Geophysics  
3115 TAMU, College Station, TX 77843-3115

## **Abstract**

Examinations for professional licensure which are designed to measure “minimum competence” of entry level individuals are an excellent tool to assess the academic preparation and competence of recent graduates. Licensure as a professional geologist requires a college degree in geology plus a passing score on the National Association of State Boards of Geology (ASBOG) Fundamentals of Geology Examination. Similar academic and examination requirements also apply to most other professional license requirements, such as engineering, surveying, business, education and architecture. Licensure examinations are a knowledge-based exam drawn from a national task analysis of practicing professionals; as a result the examination does not test “trivia” or unrelated “facts”, but tests basic knowledge that is directly related to a specific task. The examination is also designed to provide sufficient time for each candidate to complete the examination. Examination validity is ensured through a complex system of reviews and checks by a Council of Examiners. The Council reviews each examination item (question) prior to distribution of the examination and reviews it again after the examination was administered but prior to final grading of the examination to ensure that there is only one correct answer, and that the item is a valid measure of fundamental knowledge. A national examination, designed to test fundamental knowledge of an academic subject, provides an academic entity with a means to assess the academic preparation of their graduates in a licensure profession against an unbiased nationwide evaluation based upon the knowledge required to complete specific tasks in the profession.

## **Introduction**

A major problem with assessing any academic program is that the assessment tools are often internalized, in that the individual faculty members have to set a standard for their course. The final assessment process is then integrated across the entire department and then applied. Each faculty member and department is faced with a biased opinion, because a low assessment rating reflects poorly on the instructor and the department. In order to avoid a biased, “pro-department” assessment an external assessment program is needed, however, this is expensive and time consuming. In degree programs that require licensure to practice, the fundamental licensure examination offers a national unbiased assessment if the primary objective of the degree program at the bachelor’s degree level is to prepare the graduate to successfully practice in the profession.

In degree programs that are not in licensure fields there is no nationally available licensure examination; however, the graduate record examination in a specific academic field could provide a valuable assessment of academic preparation. Care must be exercised when applying the GRE score because the GRE is a power-based examination designed to classify the academic standing of each person taking the examination. If an academic program is designed to prepare undergraduate students for a career in research, rather than to practice, the course work requirements may not be compatible with the tasks evaluated in the fundamentals examination. If the students are not intended to enter the practice as a licensed professional, they should be informed that the academic program is not designed for practice as a licensed professional. This advice reduces the risk that a student who graduates in a licensure field, but continues to fail the fundamentals examination, does not sue the academic department for failing to provide the required education.

If an academic department is to accept and approve the use of the fundamentals examination for licensure as a tool to assess their academic program, it is critical that each faculty member understands how the examination is prepared, reviewed and evaluated and recognize the amount of time and effort contributed to the examination by the Council of Examiners – many of whom volunteer both their time and resources for travel. Examination development follows a very specific process:

1. A task analysis committee, composed of Subject Matter Experts from across the country, meets to determine the basic “Task Domains” that reflect various aspects of the profession.
2. Each task domain is further subdivided into specific tasks that practicing professionals do within each domain.
3. Knowledge-based statements are generated that reflect the fundamental knowledge required to complete each task.
4. A national task analysis is sent to a statically representative population of licensed professionals in each governmental entity that licenses professionals.
5. The returned analyses, which often exceed 60% of those contacted, are statistically evaluated by professional psychometricians and the results of a statistical evaluation are reported to the task analysis committee.
6. The task analysis committee establishes the examination “blue-print”, which defines the percentage of items from each task that are included on the fundamentals examination.
7. Now examination item writing can start. Each Subject Matter Expert (SME) is asked to prepare items (usually four-option multiple choice style questions) that fit into a specific task.
8. Each item, generated by one SME on the Council of Examiners, must be reviewed and approved by four other members of the Council before the item can be added to the item data bank.
9. Based on statistical selection procedures, items in the data bank are selected to meet the examination blue-print.
10. The draft examination is presented to the pre-examination meeting of the Council to review the examination; each Council member “takes” the examination and evaluates the validity of each item.

11. The examination is then administered to all candidates for licensure.
12. Following the examination, the psychometricians grade the examination and generate examination statistics.
13. The examination is again reviewed and evaluated by the Council of Examiners, to compare the statistical results or the examination with reality. Any item that shows a poor statistical assessment is specifically evaluated by the Council. Upon review and discussion the Council can double-key (specify two correct answers) an item, drop it, re-key (change the correct answer) it or take any other action to ensure that the examination was fair and that it established minimal competence in the subject.
14. The Council also determines the “Angoff Rating” for each item. This establishes the percentage of “minimally qualified” candidates (C student at graduation) that **would** get the item correct.
15. After a history of successful examination administrations, the psychometricians no longer need Angoff Ratings to determine the relative significance of the examination, because they have the statistical value of each item based upon previous examinations.

Although this appears to be a long list of steps, it ensures that any candidate for licensure is evaluated in a logical and legally defensible manner which is designed to establish that the candidate is **minimally competent** to practice the profession.

**Step 1: Determination of Task Domains**

The Task Analysis Committee meets to determine what are the primary tasks carried out by licensed professionals who are required to protect the health, safety and well-being of the public. It is critical to recognize that the only constitutionally valid justification for the exercise of “police power” – licensure of professionals – is the “protection of the health, safety and well-being of the public”. As a result, the Committee must determine what tasks, in their opinion, are critical to the “protection of the health, safety and well-being of the public”.

With respect to the national licensure examination for geologists the following task domain list was developed (Figure 1).

<b>TASK</b>	<b>TASK DOMAIN</b>
1	General Geology
2	Mineralogy, Petrology, Petrography
3	Sedimentology, Stratigraphy, Paleontology
4	Geomorphology, Surficial Processes
5	Structure, Tectonics, Seismology
6	Hydrogeology, Environmental Geochemistry
7	Engineering Geology
8	Economic Geology, Energy

Figure 1. Table of the general Task Domains for the licensure of Professional Geologists in ABGOG states. Note that the percentage of questions within each domain has not been determined.

As an example of how a licensure examination is constructed, administered and reviewed, let me introduce a “new Licensure Program” – **History** – as a means to demonstrate the 15 steps in the development and administration of a knowledge-based fundamental licensure examination in history and its application to the assessment of a degree program in History. Please assume, with me, that the state legislature has decided that teaching history, consulting on historical events, reporting on historical events (Freedom of the Press is exempt from licensure) and historical site and data management requires a “Licensed Professional Historian” who must be proven to be minimally qualified because improper and incorrect historical information can cause significant political and social problems that can adversely impact the well-being of the public with respect to their history. Because all of us have had to study history throughout our academic careers also assume, with me, that you are a subject matter expert (SME) in some field of history.

The first responsibility is to establish the general Task Domains related to the practice of history. There are numerous classification systems that can be applied:

1. Year sequence: (1700-1750), (1750-1800), etc.
2. Historical events: Colonial Period, Civil War, Great Depression, etc.
3. Historical processes: Develop the Constitution, Establish Freedoms, Civil Rights, etc.

After much discussion the Council of Examiners and Subject Matter Experts select historical processes as the basis of the fundamental examination. What specific tasks and knowledge would fall within this task Domain?

1. Constitution: development and intent
2. International military conflicts and maintaining our freedom
3. Civil rights
4. International Terrorism

## **Step 2: Specific Task Statements**

Before task statements can be created for the Fundamentals of History Examination, the Council receives the following guidelines for task development from the psychometricians. Task statements shall meet the following criteria:

1. Describe tasks (tasks, responsibilities, duties) performed by members of the profession who are already registered/licensed and not entry-level personnel.
2. Describe important tasks of the profession that are related to public protection.
3. Describe entry-level tasks
4. Describe tasks that are normally completely executed by an individual and not a team.
5. Describe tasks that are reasonably identifiable as discrete units of work that have discernable beginnings and ends.
6. Begin with **action verbs** such as: “Measure, Write, Determine, etc.”
7. Be written in such a way that the “importance scale” (which is determined from the national task analysis) makes good sense to the reviewer.
8. Be clear, concise and unambiguous so that each task is easily understood and recognized by the professional (during the national task analysis).

9. Each task statement is mutually exclusive; and
10. Each task statement possesses an equal level of specificity to ensure that each statement has the same level of understanding and expectations.

The task statements developed for the national licensure examination in geology, engineering geology sub-domain shown below provide an example of this step in examination design and preparation. The following Task Statements for the Fundamentals Examination were developed:

1. Plan and conduct engineering geological investigations.
2. Interpret historical land use, landforms, or environmental conditions from imagery, maps, or other records.
3. Interpret and analyze geologic site characteristics, and provide recommendations for engineering and land use.
4. Identify, map, and evaluate geologic and geomorphic hazards.

With respect to the hypothetical “History Examination”, the Task Domain – Civil Rights – is selected for further development. Based upon the instructions on writing task statements from the psychometricians, the Council has to define the specific tasks related to the history of the civil rights actions. What are those tasks?

1. Plan and conduct a historical investigation and documentation program.
2. Interpret and evaluate Native American history (American Indian, Original Americans) – “Indian Reservations”.
3. Interpret and evaluate European Immigrant history (Italian, Polish, German, French, etc.) – “Urban Ghettos”.
4. Interpret and evaluate indentured servant programs.
5. Interpret and evaluate African American history (Slavery, “Negro” Black American) – Civil War/Segregation – voting rights.
6. Interpret and evaluate the history of the Cultural Revolution (Hippies, Anti-War Protests, Civil Disobedience) – Viet Nam.

### **Step 3: Knowledge-Base Assessment**

Knowledge-base statements define the fundamental knowledge required to complete each task. This step in the process is critical, items can not be generated if they do not have a fundamental foundation that defines what knowledge is required to complete a specific task related to the protection of the public. For someone to successfully write items for the Fundamentals of Engineering Geology examination, it is critical that the knowledge base required to safely and competently carry out the tasks in Engineering Geology be defined. Writing knowledge-base statements for a licensure examination is similar to the classical academic practice of defining and establishing teaching goals for a class. The knowledge base for the Fundamentals of Engineering Geology component of the national licensure examination is given below:

*Landform analysis*  
*Soil and rock weathering*  
*Groundwater and surface water*  
*Low temperature geochemistry*  
*Human-land interaction*

*Soil and rock mechanics*  
*Soil and rock classification and engineering properties*  
*Hazardous geologic processes*  
*Hazard and risk analyses*  
*Cost/benefit analyses, site investigation methods, tools, and applications*  
*Project management, organization, economics, and ethics*

For someone to successfully write items for the Fundamentals Examination in History, Civil Rights Task, it is necessary to establish what is the required knowledge needed to successfully impact the public well-being with relation to the history of civil rights in America? To establish this knowledge base, it is critical to determine the knowledge base for all specific tasks within the general domain.

For the purposes of this paper, the knowledge base for the sub-task African American History, which includes understanding and knowing the history of slavery, “Negro”, Black American, the Civil War, Segregation and ultimately the election of President Obama has been selected. To address this requirement, the Council must determine the basic knowledge required to understand the history of slavery in the United States and the impact it has on civil rights through modern history. What is required to fully understand the history of slavery and civil rights in America?

*Slave economy*  
*Source of slaves*  
*Marketing of slaves*  
*Function of slaves*  
*Legal Actions (Dred Smith v. Sanford)*  
*Civil War*  
*Emancipation Proclamation*  
*Segregated public transit (Rosa Louise McCauley Parks)*  
*Dr. Martin Luther King (“I had a Dream”)*  
*Voting Rights Act*  
*President Barack Obama*

#### **Step 4: National Task Analysis/Survey**

Once the task analysis committee, which is composed of members of the Council of Examiners and other Subject Matter Experts, has completed what they believe is a representative list of the tasks carried out by the professionals, the task list is sent to a statically representative population of licensed professionals in each governmental entity that licenses professionals. Each respondent to the survey is asked to determine the relative importance of each task with respect to the protection of the health, safety and well-being of the public. The rating scale ranges from 1-not important to 4-extremely important. Each respondent in the survey is asked to define a task as not important to extremely important, based upon his/her individual professional experience.

With respect to the development of the Fundamentals of History Examination, African American sub-task, how would the reader rate the following specific tasks with

respect to Civil Rights of the specified class of minorities (former slave/African American)?

1. Date of the Emancipation Proclamation
2. President who signed the Voting Rights Act
3. Source countries of slaves
4. Economic market in slavery
5. Role of Dr. Martin Luther King
6. Impact of the Dred Smith v. Sanford decision
7. Role of Robert E. Lee
8. Impact of President Abraham Lincoln
9. Impact of President Lyndon B. Johnson
10. Role of Rosa Louise McCauley Parks
11. Impact of the assassination of President John Kennedy
12. Election of President Barack Obama

### Step 5: Statistical Analysis of the National Task Analysis

The returned surveys, which often exceeds 60% of those surveyed, are statistically evaluated by the psychometricians and reported to the task analysis committee for review and analysis. The importance value for each sub-task is determined and rated in order of importance. The task analysis committee establishes the examination “blue-print” which defines the percentage of items from each task that are included on the fundamentals examination. The graph (Figure 2) shows the percentage of each task domain in the geologist examination that makes up the national licensure examination. Note that the impact of engineering geology based upon the task analysis represents only 9 percent of the total examination blueprint.

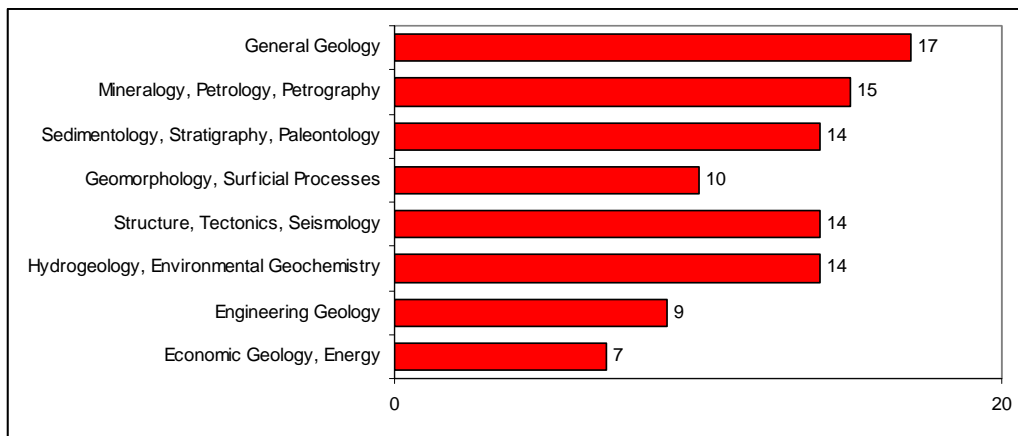


Figure 2. Task analysis based upon a national survey of Licensed Professional Geologists. Note that the total percentage of task domains represents 100 percent of the examination and that the engineering geology task domain represents 9 percent of the total examination.

In the development of the Fundamentals Examination in History assume that the twelve tasks established by the task analysis committee on civil rights were rated in the national survey of historians in the following manner, from highest to lowest:

<u>Task</u>	<u>Score</u>
Impact of President Abraham Lincoln.....	21
Role of Dr. Martin Luther King.....	19
Election of President Barack Obama.....	13
Impact of the Dred Smith v. Sanford decision.....	9
Role of Robert E. Lee.....	9
Impact of President Lyndon B. Johnson.....	8
Role of Rosa Louise McCauley Parks.....	6
Economic market in slavery.....	6
Source countries of slaves.....	5
Impact of the assassination of President John Kennedy.....	3
Date of the Emancipation Proclamation.....	1
President who signed the Voting Rights Act.....	1
Total.....	100

The results of the national task analysis are shown in Figure 3 below.

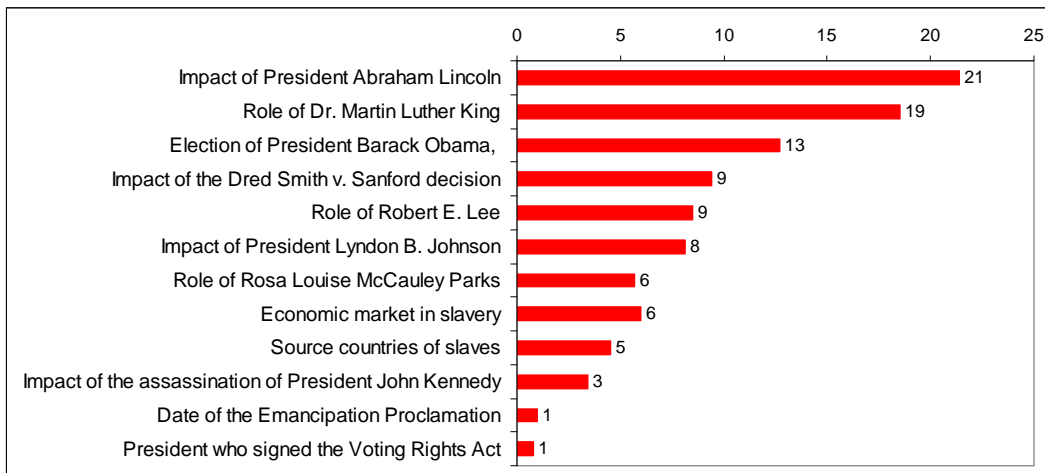


Figure 3. Distribution of items within the History of Black Americans portion of the Civil Rights Sub-Domain of the Fundamentals of History Examination as determined from a statistical analysis of the national task analysis survey.

The Civil Rights portion of the entire examination represents only one small part of the total Fundamentals of History Examination, as a result the final percentage of the examination will reflect the criticality scores of all tasks and task domains. The specific sub-task within the Civil Rights, History of Black Americans (from Slave to President), may ultimately be statistically important within the Civil Rights Domain at 20 percent and the total impact of the entire Civil Rights Task Domain may represent only 15 percent of the total examination.

The results of the task analysis must be reviewed and evaluated to ensure that the items in the examination represent the criticality of each task. Just how significant is a task that represents less than 1 percent of a sub-task, or even 3 percent? If the total number of items on the Fundamentals of History examination is set at 150 items and the

Civil Rights Task Domain represents 15 percent of the total examination, the total number of items in this sub-domain is 22 items. Of these 22 items, the History of Black Americans represents 20 percent of the entire Civil Rights sub-domain, which yields a total of 4 items on each examination related to the History of Black Americans (22 items  $\times$  20% = 4.4). Some editing is required to reduce the number of tasks so that only statistically significant tasks remain on the examination. Review Figure 3 and determine which tasks can be eliminated from the list to make the examination more statistically realistic. Why keep the lowest four tasks? Deleting the lowest 4 tasks, or reclassifying them into other tasks generates a new task analysis as shown in Figure 4 below.

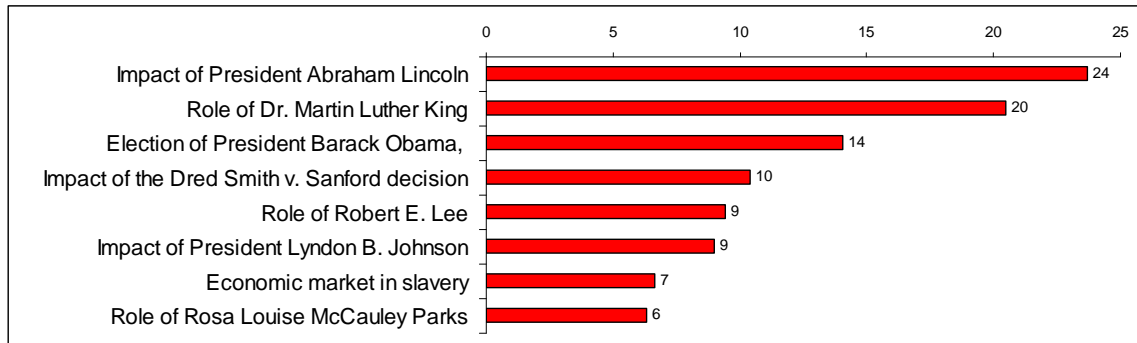


Figure 4. Revised task list for the History of Black Americans in the Civil Rights component of the Fundamentals of History examination. Note that the revised list allows the existence of an item that reflects the impact of the critical people in the historical movement for black civil rights to be included in the examination.

### Step 6: Develop the Examination Blueprint

The task analysis committee establishes the examination “blue-print”, which defines the percentage of items from each task domain that is to be included on the Fundamentals Examination. The basic data for the examination blueprints are the statistical results of the task analysis (Step 5). In this step the psychometricians rank each sub-task in order of criticality with respect to public well-being as determined by the licensed professionals who make up the practice. This process results in a chart listing each task domain that will make up the examination and the percentage of the examination dedicated to each task domain. The percentage distribution of the task domains established for the Fundamentals of Geology examination is shown in Figure 5.

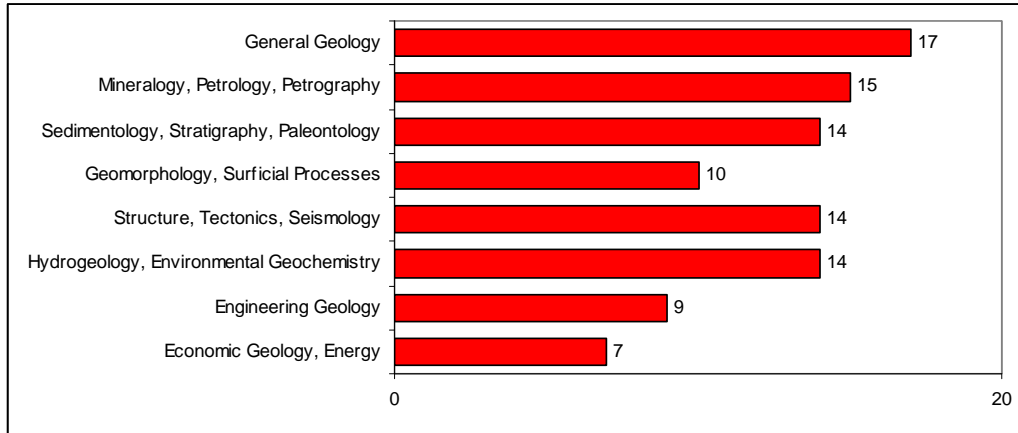


Figure 5. Statistical distribution of test items from each task domain to be incorporated in the National Fundamentals of Geology Examination.

The distribution of items included in each general task domain form the basis for the examination blueprint. The examination items are selected from the item bank, based upon the percentage of the total number of items on an examination. For example, if the total number of Fundamentals of Geology items on the examination is 130, then there are 22 items from the general geology domain ( $130 \times 17\% = 22$ ).

### Step 7: Generation of Items

The results of the task analysis and, more importantly, the development of the examination blueprint establish the number of items within each sub-task that will make up the examination. To meet the goal of having a realistic and reliable item data base each Subject Matter Expert (SME) is asked to prepare items (usually four-option multiple choice questions) that fit into a specific task. Each SME develops items based upon his/her particular professional expertise and establishes the “key” (correct answer) and three “distracters” (wrong answers, which are plausible) – the first step has been completed.

For example, assume that one of the Subject Matter Experts has developed the following items:

**Stem:** Which President of the United States signed the Voting Rights Act into Law?

- A. Abraham Lincoln
- B. Lyndon Johnson
- C. Thomas Jefferson
- D. Ronald Reagan

Key = B

or:

**Stem:** Who refused to move from their seat on a public transit bus when ordered to move to allow a “white” person to have the seat?

- A. Martin Luther King
- B. Barack Obama

- C. Rosa Parks
- D. Dred Smith

Key = C

or:

**Stem:** In what year did the U.S. Supreme Court rule that slaves are not citizens and cannot expect protection from the federal government or courts?

- A. 1837
- B. 1857
- C. 1901
- D. 1923

Key = B

### Step 8: Review of Test Items

Each item, generated by one SME on the Council of Examiners, must be reviewed and approved by four members of the Council before the item can be added to the item bank. This review process assures that each item has been carefully evaluated by four other subject matter experts. It is critical that each member of the Council understand and follow the criteria for the writing and evaluation of each item. There are twelve basic criteria that must be evaluated and answered before an item is approved (but not yet tested). These criteria are:

1. Does the item relate to public protection and well-being?
2. Is the item related to the practice of the profession?
3. Is the item written at an “entry-level” of difficulty?
4. Does the item have only one correct answer (key)?
5. Is the item properly classified according to the test blueprint?
6. Is the language clear and direct?
7. Does the stem of the question adequately describe the problem, conditions or situation?
8. Does the stem avoid negative phrasing?
9. Do the options avoid “none of the above” or “all of the above”?
10. Are the answer options approximately the same length?
11. Is the item free of **trickery**?
12. Does the item avoid assessing **trivia**?

Based upon the criteria established above, each SME in History evaluates the proposed items given below and answers the questions related to the item.

**Stem:** Which President of the United States signed the Voting Rights Act into Law?

- A. Abraham Lincoln
- B. Lyndon Johnson
- C. Thomas Jefferson
- D. Ronald Reagan

Key =B

1. Is the Key (answer) correct?
2. Is the item reasonable?
3. Is the item trivia?
4. What else can you conclude about this item?
5. Should it be approved?

A review of this item determines that it is keyed correctly (B) but that it also relates to a task that was deleted from the task list (Figure 4). As a result this item will be dropped from the item bank.

or:

- Stem:** Who refused to move from their seat on a public transit bus when ordered to move to allow a “white” person to have the seat?
- A. Martin Luther King
  - B. Barack Obama
  - C. Rosa Parks
  - D. Dred Smith

Key = C

1. Is the Key (answer) correct?
2. Is the item reasonable?
3. Is the item trivia?
4. What else can you conclude about this item?
5. Should it be approved?

A review of this item determines that it is keyed correctly (C) and that it directly relates to a task that was included in the task list (Figure 4). As a result this item will be added to the item bank.

or:

- Stem:** In what year did the U.S. Supreme Court rule that slaves are not citizens and cannot expect protection from the federal government or courts?
- A. 1837
  - B. 1857
  - C. 1901
  - D. 1923

Key = B

1. Is the Key (answer) correct?
2. Is the item reasonable?
3. Is the item trivia?
4. What else can you conclude about this item?
5. Should it be approved?

A review of this item determines that it is keyed correctly (B) and that it directly relates to a task that was included in the task list (Figure 4); *Dred Smith v. Sanford* decision, but this item is a “trivia” question. The date of the *Dred Smith v. Sanford* decision does not reflect any knowledge about the historical significance of the decision, only the date it was handed down. As a result this item will be dropped from the item bank.

### **Step 9: Develop the Examination**

Based upon statistical selection procedures, items in the bank are selected to meet the examination blue-print, which establishes the format and character of the examination. Each examination item selected for the examination is drawn from a specific task domain based upon the statistically determined contribution related to the protection of the public. In essence the psychometricians randomly select items from the item bank to develop the draft copy of the examination for review by the Council of Examiners before it is administered.

### **Step 10: Review the Examination**

The proposed examination is presented to a pre-examination meeting of the Council of Examiners so that they can review the examination. Each Council member “sits” the entire examination and evaluates the validity of each item. With respect to the Fundamentals of History Examination, each SME on the Council of Examiners evaluates each item and answers the review questions?

**Stem:** The Gettysburg Address presented by President Abraham Lincoln was interpreted by the nation as:

- A. an honor to those who gave their life for freedom.
- B. a prayer and memorial to the dead.
- C. a great battle success story.
- D. a statement that the union will prevail and slavery will end.

Key = B

1. Should this be included on the examination?
2. Should it be modified?
3. Is this item keyed correctly?
4. Is there more than 1 correct answer?

A review of this item determines that it is keyed correctly (B) and that it directly relates to a task that was included in the task list (Figure 4). It is also concluded that this is a valid item related to the historical impact of President Abraham Lincoln; as a result this item will remain on the examination.

or:

**Stem:** The December 7, 1941, bombing raid on Pearl Harbor, Hawaii, by the Japanese military was:

- A. a true surprise attack on the United States.
- B. a politically orchestrated event to justify entry into WW2.
- C. forced upon the Emperor of Japan by actions by the United States.
- D. a military justification to “real life” test a nuclear bomb.

Key = B

- 1. Should this be included on the examination?
- 2. Should it be modified?
- 3. Is this item keyed correctly?
- 4. Is there more than 1 correct answer?

A review of this item determines that it is keyed correctly (B) and that it directly relates to a task that was included in the task list (Figure 4). It is noted that distracter 2 should be edited to be WWII, not WW2. It is also concluded that this is a valid item related to world war history; as a result this item will be included in the examination.

After the Council of Examiners completes their review and evaluation of the examination it is finalized by the psychometricians and prepared for administration.

### **Step 11: Administration of the Examination**

The examination is given to all candidates for licensure. Each governmental entity that uses the national examination to evaluate the “level of qualification” of each applicant for licensure administers the examination to candidates for professional licensure. The Licensure/Registration Board returns the examinations to the psychometricians for **initial/draft** grading. Now the work of the Council of Examiners comes into play – the examination and the candidate comments must be reconciled so that the examination is fully defensible if ever challenged in a court of law.

### **Step 12: Examination Grading and Statistical Analysis**

Following the examination, the psychometricians grade the examination and generate examination statistics. The results of this step are critical to the final approval and acceptance of the examination by the Council of Examiners and eventually by each licensing agency.

### **Step 13: Examination Review and Item Revision**

The examination is again reviewed and evaluated by the Council of Examiners, to compare the statistical results of the examination with reality. The Council can double-key an item, drop it, re-key it or take any other action to ensure that the examination was fair and that it established minimal competence in the subject.

Following the examination the Council of Examiners reviewed and evaluated the question about the attack on Pearl Harbor, Hawaii.

**Stem:** The December 7, 1941, bombing raid on Pearl Harbor, Hawaii, by the Japanese military was:

- A a true surprise attack on the United States.
- B a politically orchestrated event to justify entry into WWII.
- C forced upon the Emperor of Japan by actions by the United States.
- D a military justification to “real life” test a nuclear bomb.

This item was keyed as “B”, **BUT** the best test-takers selected “C”. -- Now what? -- If the candidates that had the highest pass-rate selected choice “C” and not the Key “B” why did this happen?

Should this item be:

1. Double Keyed (B and C)
2. Re-Key = “C”?
3. Not graded or include in the examination
4. Return to Council of Examiners to revise
5. Delete item from data bank

Discussion amongst the Council of Examiners concluded that both option B and C are correct, because history shows that President Franklin D. Roosevelt claimed that the United States was neutral and not going to get “involved in the European war.” However, he needed a political justification to “save Great Britain” so he imposed a series of severe economic and supply blockades of Japan, an ally of Germany.

The discussion and evaluation of each examination item ensures that each is representative of the level of knowledge required for a minimally qualified professional historian to practice. Once the Council of Examiners has established the validity of the examination, the complex chore of determining the passing grade for each item and ultimately the entire examination is undertaken.

#### **Step 14: Establish the Passing Score of the Item**

During the initial stages of development of the Fundamentals Examination, the pass/fail criterion has not been set. The criterion to establish the passing score for a licensure examination is to determine the percentage of candidates that are “minimally qualified” (C student at graduation) that **would** (NOT Should!) get the item right; after all the purpose of the examination is to determine the candidate’s qualifications to ensure protection of the public. A common psychometric technique used to establish the minimum pass score is the “Angoff Rating” for each item, which is then averaged to establish the minimum pass score for the examination.

Subject Matter Experts on the Council of Examiners are asked to determine the Angoff Rating, which is the percentage of minimally qualified candidates that **would, NOT should**, get the item correct. This is a judgment call that is based upon the professional experience of each Subject Matter Expert on the Council. The interesting aspect of this exercise is that there is remarkable agreement between experts’ Angoff Ratings. The psychometric justification for this procedure is that all examinations, regardless of when they are administered, will have the same effective passing score regardless of which item was selected for a particular examination. Using the Angoff

Technique ensures that every examination is graded using the same pass/fail criteria and that a failing grade can be successfully defended should the examination ever be challenged as “unfair”, “biased” or “arbitrary”. The Council evaluates each of the following examination items and assigns an Angoff Rating:

- Stem:** Who refused to move from their seat on a public transit bus when ordered to move to allow a “white” person to have the seat?
- A. Martin Luther King
  - B. Barack Obama
  - C. Rosa Parks
  - D. Dred Smith

Key = C

What percentage of the minimally qualified historians **would, NOT should**, get this item correct? Did you get it right? The answer should affect your opinion. Do you agree with the Angoff Rating determined by the Council?

Angoff Score: \_\_\_\_\_70%

or:

- Stem:** The December 7, 1941, bombing raid on Pearl Harbor, Hawaii, by the Japanese military was:
- A. a true surprise attack on the United States.
  - B. a politically orchestrated event to justify entry into WWII.
  - C. forced upon the Emperor of Japan by actions by the United States.
  - D. a military justification to “real life” test a nuclear bomb.

Remember, this item was originally Keyed = B but revised during review to Key = B and C (double keyed).

What percentage of the minimally qualified historians **would, NOT should**, get this item correct if it is double keyed? Did you get it right? The answer should affect your opinion. Do you agree with the Angoff Rating determined by the Council?

Angoff Score: \_\_\_\_\_95%

or:

- Stem:** The Gettysburg Address presented by President Abraham Lincoln was interpreted by the nation as:
- E. an honor to those who gave their life for freedom.
  - F. a prayer and memorial to the dead.
  - G. a great battle success story.
  - H. a statement that the union will prevail and slavery will end.

Key = B

What percentage of the minimally qualified historians **would, NOT should**, get this item correct? Did you get it right? The answer should affect your opinion. Do you agree with the Angoff Rating determined by the Council?

Angoff Score: \_\_\_\_\_ 55%

### **Step 15: Establish Criterion Reference Standards**

After a history of successful administrations of the examination, the psychometricians no longer need Angoff Ratings to determine the relative significance of the examination, because they have the statistical value of each item based upon previous examinations. “Anchor” items are incorporated in each examination, at the exact point in the examination (question 39, for example) to ensure that there is a defensible basis for the ultimate criterion based passing score.

### **Discussion**

The psychometric justification and validation procedures, applied to the Fundamentals Examination for a licensed profession, creates an academic program assessment tool that is independent of the academic institution, national in scope, and designed to evaluate minimal competence of each candidate. Academic program assessments must be designed to evaluate the level of competence of each graduate against some standard set of criterion. The application of the knowledge-based licensure examination, rather than a power-based (SAT, GRE) examination, determines the minimum level of competence – required to protect the health, safety and well-being of the public – and thereby provides direct feed-back to the academic department about the level of professional preparation of their graduates. Careful evaluation of subject specific GRE examination scores could also be a valuable assessment tool for academic programs that are not designed to prepare the graduate for practice as a licensed professional.

The availability of a national Fundamentals Examination also provides a powerful tool to justify and defend any academic program designed to prepare graduates to enter a licensed profession. With respect to the Bachelor of Science degree in geology, engineering geology option, the primary objective of this program is to prepare graduates to pass the licensure examination in geology and to continue into graduate school to further advance their knowledge in geology by providing a more academically rigorous and demanding degree program. Figure 6, , shows the percentage of items in each Task Domain on the Fundamentals of Geology Examination and the percent of Texas A&M University credit hours in courses related to the professional practice of geology within each Task Domain.

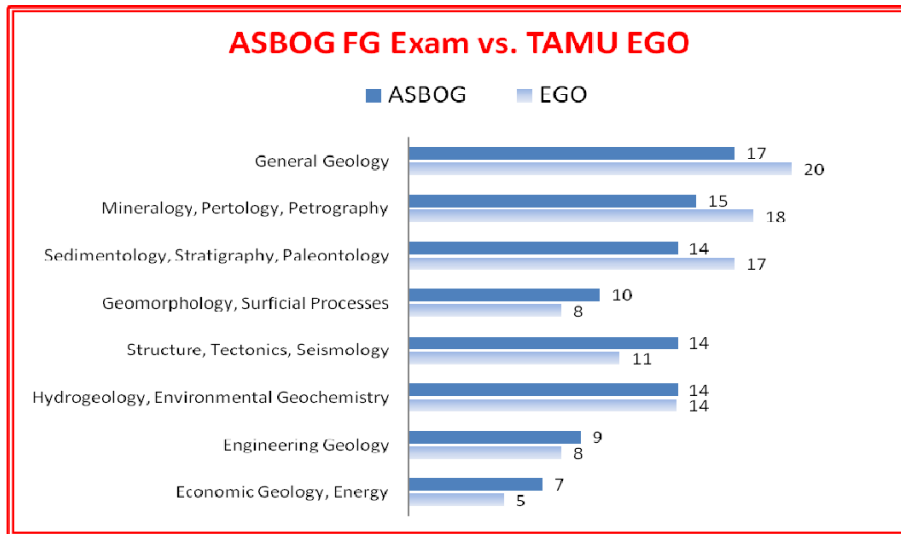


Figure 6. Comparison of the percentage of items on the National Association of State Boards of Geology (ASBOG) Fundamentals of Geology Examination and the percentage of geology courses required in the engineering geology option in the BS degree program in geology.

A proposed Bachelor of Arts Degree with a professional geologist option at Texas A&M University is designed to provide a professional career track as licensed professional geologists, for students graduating from small, limited resource high schools (Figure 7). The difference between the BS and BA degrees is the amount and degree of supporting science and technology courses required (Mathematics, Physics, Chemistry).

Both Figures 6 and 7 present the justification for the requirement of select classes in a student's degree program and provides the supporting evidence to justify a higher total number of credit hours currently set at 120 hours. Successful completion of these degree programs combined with a high percent of passing grades on the Fundamentals of Geology licensure examination provide the full assessment required to approve and continue a degree program.

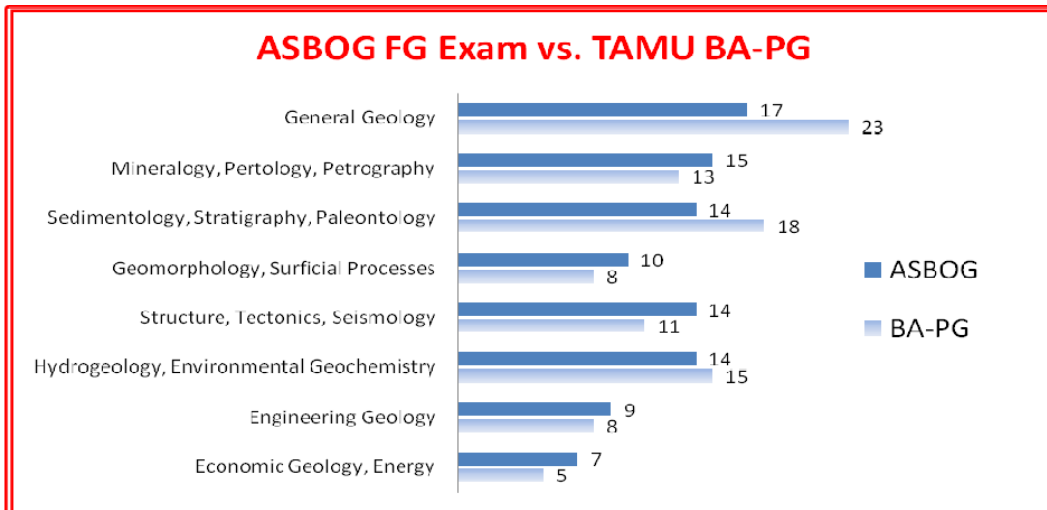


Figure 7. Comparison of the percentage of items on the ASBOG Fundamentals of Geology Examination and the percentage of academic credit hours in geology required for the proposed BA degree, professional geologist option.

### Administration of the Fundamentals Examination to Assess a Program

The utilization of the Fundamentals of the Profession Examination as an “Exit Exam” required of all students in the academic program for the purpose of assessing the academic program requires careful consideration. There are a number of administrative choices:

1. All students are required to take the examination during the last semester of their academic career, but there is no requirement that the student pass the examination in order to graduate. Students view this option as another administrative waste, they have to pay the examination fee, spend a day taking the examination (often requiring travel) and there is NO risk. A requirement to take the Fundamentals Examination, without risk or reward, can lead to a “Great Examination Drunk-In Party” the night prior to being required to take the “dumb” examination. An academic program does not need a collection of hung-over students taking an examination that is nothing but a pain to them, because this does NOT assess the quality of a degree program.
2. All students are required to take the examination during the last semester of their academic career, but they must pass the examination in order to graduate. This creates the opposite extreme in the mind of the student because it fails to recognize the student’s academic progress and performance throughout the entire four-year academic program. In essence passing the Fundamentals Examination is the only requirement for graduation. The particular risk of this administrative choice is that students and faculty will teach “to the examination” and not to the entire knowledge base of the profession.
3. All students are required to take the examination during the last semester of their academic career. Each student is required to pay the examination fee and costs of travel to take the examination, but if the student passes the

examination the student receives a “grant/scholarship” that reimburses the costs plus a reward. This administrative policy places the student in a position of responsibility, but rewards success. By implementing a policy that rewards those students who successfully pass the Fundamentals Examination it encourages each student to “do their best” – something needed in any academic program assessment process.

4. All students are required to take the examination during the last semester of their academic career. Each student has been made aware of this requirement since the student entered the degree program and that graduating with a passing grade on the Fundamentals Examination and, in some states, graduating as a “Geologist in Training” greatly enhances employment and career opportunities because the student is a proven qualified professional. This administrative option builds upon establishing a high level of self pride in both the university academic program and, more importantly, in the student.
5. Combining the desire to do well on the examination in each student and a reward incentive for successfully passing the examination creates an even greater incentive to “do the best” – pride in the student’s accomplishments and in the student’s degree granting institute and a cash reward for being a success.

It is critical that any application of a licensure examination to assess the validity and success of an academic degree program in a licensure field must be administered such that each student (candidate) believes that there is a clearly defined incentive to successfully perform. Fundamentals licensure examinations used as an assessment tool must be based upon a true belief that each student/graduate is committed to doing their best, without this commitment the examination is a waste of a student’s money and time and of no value to the academic department as an assessment tool.

### **Acknowledgements**

I am deeply indebted to Drs. Jack and Steve Warner, Professional Psychometricians, examination consultants for the National Association of State Boards of Geology (ASBOG). Both Jack and Steve have spent many hours teaching, training and advising this professor on the psychometric reality of writing a good examination. Not only did they prepare me to be an active member of the Council of Examiners, they greatly enhanced and improved the quality of my examinations in my formal Texas A&M University classes. Without their concern and encouragement, I would have been unable to prepare this paper and presentation. All sources of information used in this paper are a direct result of training I received from the “Warner Brothers”, while serving on the ASBOG Council of Examiners since 1992.