# ASSESSING GLOBALLY THEMED LEARNING OBJECTIVES USING OBJECTIVE EXAMINATION RESULTS

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## ABSTRACT

*In any course the instructor is faced with the need to structure the course material and pedagogy in such a way to promote student learning, and to assess the degree to which learning has happened. The added challenge in the courses of the author is that their courses are heavily laden with authentic learning projects, interventions to develop communication skills, and interventions to increase student motivation, all of which place increased demand on course time over and above what covering the material in a standard lecture format would require. An old standby—the multiple-choice examination—has been retained in the author's courses as a means to conserve on precious time while still assessing student learning beyond simply the level of student recognition of terms to comprehension, application, analysis, and evaluation cognitive levels. These higher cognitive levels indicate increasing student ability and sophistication with material in a course. Assessment of learning at these multiple cognitive levels can be achieved through use of Bloom's taxonomy of the cognitive domain in construction of examinations as well as evaluation of learning patterns with specific foci such as learning of international subject matter within a course. This paper outlines how objective exams can be analyzed to determine the level of cognitive learning attained, how existing exams can be modified or appended to reach higher levels of cognitive learning, and how an instructor can use the information distilled from the project to assess overall learning patterns in a course which in the case of this paper is focused on the attainment of learning goals related to global themes.*


## INTRODUCTION

As professors we are called to meet multiple goals in every class we teach. These include meeting course content and skill development learning goals, program

level learning goals, and mission and topic specific learning goals established in accordance with accreditation efforts. This is potentially a daunting task given limited class time and an ever-present drive for continuous improvement. The author has had great success in setting, measuring, and assessing attainment of these multiple goals using a combination of objective examinations with explicit cognitive level structuring ala Bloom's Taxonomy (Bloom, 1956) to create assessment opportunities that minimize class time usage, while providing learning goal feedback. These efficiencies in addition to providing needed assessment data, also allow for the use of additional assessment methods to meet goals objective exams cannot achieve, such as demonstration of writing skills. This work begins with examination of the general bias against objective examinations, followed by a methodology that takes objective exams beyond many of these criticisms. This is then used to show how the methodology has allowed the assessment of internationally focused program goals in a Principles of Macroeconomics class. This endeavor begins with the recounting of an experience likely shared by many educators.

While evaluating a multiple-choice exam using Bloom's Taxonomy of the cognitive domain, a colleague looked over the shoulder of the author and commented with a superior tone, "Multiple-choice exams, I used to give those." The author found the comment interesting for a number of reasons. First, she did not start her teaching career using this type of exam. Only with experience did she learn that they can be an integral and meaningful part of an arsenal of assessment methods/techniques. Second, she used to have the same superior attitude. At first she looked down on such assessment, but her attitude resulted from ignorance of the potential that such a method affords. Use of multiple-choice examinations has become an integral part of survey courses because of the flexibility they can offer.

This colleague's attitude as well as the authors' own in early years of teaching has been echoed by Bruce Alberts when president of the National Academy of Sciences. His criticism comes from his years teaching biochemistry to medical students where "he was appalled to find they 'were not learning anything.' The future doctors easily parroted back biochemical terms but failed to grasp the concepts. The culprit? Multiple-choice tests"(Carey, 1997) These are serious allegations from a prominent educator, but even as a novice in the field of biochemistry, one questions whether it is the particular use of the exam and not the multiple-choice exam in general that is lacking. The author has no problem accepting Alberts' claim that the exams show nothing if in fact the examinations are designed in such a way that they only test rote knowledge. "By emphasizing

memorization and word association over conceptual knowledge, these tests are poor judges of students' abilities." (Carey, 1997) But this criticism speaks largely to the construction of the exam. The author does agree that as a sole assessment tool, a multiple-choice exam can be insufficient to meet certain learning objectives, but the author proposes that it comprises a very effective component of a larger assessment architecture. Multiple-choice exams can be used to evaluate student ability on a variety of cognitive levels. The author believes that Alberts' comments and efforts would coincide with the proposal, as the direction he seeks is to get students to "analyze data, not regurgitate facts." (Carey, 1997) One needn't in this case throw the baby out with the bath water, instead, one can systematically evaluate and reconstruct multiple-choice exams to address multiple levels of the cognitive domain and situate these exams in a course assessment strategy.

Like many who came to teaching through content education rather than teaching education, the author has reinvented or attempted to reinvent many a wheel. The author began to use multiple-choice exams in survey courses for a very pragmatic reason—there was a lot of material to be covered and hence a lot of material for exams. While the author does not find it necessary to test on every single point examined in class or readings, relying solely on essay/short answer exams was untenable. When the author began using this testing method, she did not simply want definitions or something parroted back to her. She wanted students to think critically, to apply concepts, to discern among complex answers. This is a challenging goal, yet is still doable.

Just when the author was breathing a contented sigh from having accomplished the goal of testing varying abilities, the wheel invented in 1956 rolled by. Surprisingly enough, that was not a discouraging experience. There, before the author, was a structure for examining exactly what she was doing, not simply based on years of experience and a clear desire to develop critical thinking in students. Here was a framework based on educational research. Bloom's Taxonomy provided a logical and systematic articulation of what she intuitively knew and what she wanted to accomplish in the assessment of student learning, and it was expressed far more clearly and concisely than she could have done. It was akin to a roadmap and has become an indispensable tool in designing assessment for courses. Bloom's Taxonomy provides a great framework for an instructor to use when seeking to create assessments in general and multiple-choice exams in particular.

## BLOOM'S TAXONOMY

Bloom's Taxonomy is "a hierarchy of educational objectives…which attempts to divide cognitive objectives into subdivisions ranging from the simplest behaviour to the most complex." (Carneson, Delpierre & Master, 1996) This is a powerful tool for educators for it provides a system for creating assessment tools or evaluating existing assessment tools with an eye to the types of student learning the instructor seeks. The scheme below summarizes the hierarchy and is followed by descriptions of each of the levels.

EVALUATION
↑
SYNTHESIS
↑
ANALYSIS
↑
APPLICATION
↑
COMPREHENSION
↑
KNOWLEDGE

The base of the hierarchy is knowledge. Student ability at this level would require the recollection of material. For the purposes of the author, questions at this level have included definitions, identification of concepts, remembering facts. If an exam were to test only on this cognitive level, the concerns of Alberts identified above would be entirely on the mark. This is truly just parroting back information with no deeper application or use of the information. That is not to say that there is no place for such question on a multiple-choice exam. Ultimately the author's goal is to test at multiple levels of the cognitive domain for a number of reasons. First, the author wants to see how students perform at different cognitive levels. If the author determined that students are not performing at any of these levels up to their expectations, then the author can target teaching methods to address those deficiencies. Second, given the hierarchical nature of the taxonomy, the author wanted to include even the lowest level to measure student performance relative to other levels. Third, the author believed that the best examination has opportunities for all students to succeed at some level. Presenting an examination that is delivered

only at the highest cognitive level can discourage learning and thwart motivation. This is particularly so in the introductory level courses where the authors use multiple-choice exams.

The second level of the hierarchy is Comprehension. "Comprehension is defined as the ability to grasp the meaning of material…These learning outcomes go one step beyond the simple remembering of material, and represent the lowest level of understanding." (Carneson, Delpierre & Master, 1996) Comprehension questions require the student to be aware of the context from which a fact or definition or concept is derived. For example, defining price elasticity of demand would be a knowledge level question, while restating this elasticity in mathematical form would represent comprehension. Again, at this level there is not a high cognitive achievement. Students are still recalling information, but at a slightly more sophisticated level since they are expected to translate words into a mathematical form.

Application is the level at which students begin to take what they have from the first two levels and use it in a meaningful way, that is to begin creating something from what they have gained in Knowledge and Comprehension. At this level the student would be able to take the mathematical formula for price elasticity of demand and apply it to new data to calculate what the actual value is.

At the analysis level of the hierarchy students "break down material into its component parts so that its organizational structure may be understood." (Carneson, Delpierre & Master, 1996) Students at this level need to have competence at the previous levels in a topic to perform at the analysis level. In the elasticity example, a student would be required to interpret the meaning of a particular value for the price elasticity of demand and analyze the potential impact of that value in a context.

The fifth level of the hierarchy is synthesis. This level poses a significant obstacle to the instructor seeking to use the various levels of the cognitive domain to structure objective examinations. Synthesis involves the creation of something new from the cognitive achievements of the previous levels. Because objective examinations by their nature are not a venue for "creation," the author has sought to address this cognitive level through alternative assessment methods.

Evaluation is also a challenge in the use of multiple-choice exams, but it is not an impossibility to test for this cognitive level in such exams. In the evaluation level a student is expected to judge that which they are examining. "Learning outcomes in this area are highest in the cognitive hierarchy because they contain elements of all the other categories, plus conscious value judgments based on clearly defined criteria." (Carneson, Delpierre & Master, 1996)

## USING BLOOM'S TAXONOMY TO EVALUATE MULTIPLE-CHOICE EXAMINATIONS

The appeal of Bloom's taxonomy lies in the systematic way it allows one to construct assessment for student learning. The author initially used the taxonomy not to create new exams, but to evaluate existing examinations. In the hierarchy, the author saw much of what she was trying to accomplish, that is, assess student learning at many different levels. Their terminology differed from that of Bloom, but she wanted students to know the fundamental concepts, understand what they mean and then use those and understand the importance of those concepts. The author was seeking "real-world" knowledge. The challenge was to find out whether the author was actuality testing the different levels sought, through use of Bloom's taxonomy. Additionally her intent was to examine the cognitive level of student learning in particular with respect to globally themed questions. This would allow the author to establish achievement levels not only for course level program learning objectives, but also those relating to program level goals consistent with AACSB accrediting standards.

Evaluation of exams revealed internationally focused questions ranging from the knowledge through the analysis cognitive levels. The author found that the exams did have a high proportion of application and analysis question (the type of cognition they seek), but there were still questions at the two lower levels of the hierarchy. There were no evaluation level questions, but in the process of research have come across ideas for formulating some of these difficult questions for inclusion in the multiple-choice exam. Student achievement levels were commensurate with expectations for the different cognitive levels, that is, higher percentage correct scores at lower cognitive levels than at higher ones. In this analysis, the average percentages of correct answers for the different cognitive levels were as follows: Knowledge, 89.25%; Comprehension, 72%; Application, 51.1%, and Analysis 25%. This reveals the level of learning at different levels and provides data for determination of whether learning objectives and program level learning goals are being met.

By cross referencing the Bloom's levels with content areas the author was also able to determine areas where questions were bunched in certain areas of the hierarchy, and this allows the author to address this to get a better spread of cognition levels across content areas to track student performance at each level. This additional layer of data, student performance at different cognitive levels and by content, also reveals where students are excelling and where they are faltering.

This allows the author to address areas of concern through teaching interventions. For example, analysis of the Principle of Macroeconomics exams evaluated for international learning objectives revealed also that students were not performing as well in equilibrium analysis as in other areas. The instructor, armed with this information, can then focus teaching to address this deficiency. The analysis also showed that students as a whole were performing very well at the application/analysis levels. This validates many of the techniques used in the course to foster student learning.

## STRUCTURING EXAMS USING BLOOM'S TAXONOMY

The author has evaluated a number of exams in different disciplines, but is focusing in particular on the international focus of two exams administered multiple times from a Principles of Macroeconomics course. Working with a colleague to evaluate exams helps not only in categorization of the questions that do not obviously fit into a particular category but also allows for inter-rater reliability in classifications.

The analysis performed on the Principles of Macroeconomics examinations revealed that exam A had 5 comprehension level questions, 3 application questions, and 1 analysis level question. Exam B had 1 knowledge, 2 comprehension, 4 application, and 1 analysis level question(s). Although the author was pleased that the largest single share of questions was at the application/analysis levels, which reflected the objectives set for this introductory level course, there were no evaluation level questions and disproportionately fewer questions from the lower cognitive levels on exam B. The analysis revealed an area to be expanded (more lower level questions) and an area to be developed (evaluation level questions) but was also validating insofar as the other content categories and cognitive levels reflected the distribution of questions mirrored by goals.

Bloom's taxonomy gives an instructor the opportunity for such analysis for the improvement of assessment techniques, but can also be a starting point for the creation of assessment that reflects the desired learning outcomes set by an instructor in a course. To aid in either of these outcomes, examples of multiple-choice questions drawn from the exams at each of the cognitive levels are presented. These can serve both as examples to compare questions for assessing their cognitive level, or to initiate creation of new questions.

Knowledge: The benefits from international trade include:

A. Increased world output of goods and services.
B. Greater efficiency in the use of the world's limited resources.
C. Higher national standards of living throughout the world.
D. All of the above.

Comprehension: When tariffs are imposed, the losers include:

A. Domestic consumers and the domestic government.
B. Foreign consumers and domestic producers of import-competing goods.
C. Domestic consumers and domestic producers of import-competing goods.
D. Domestic consumers and foreign producers.

World output of goods and services increases with specialization because:

A. he world's resources are being used more efficiently.
B. Each country's production possibilities curve is shifted outward.
C. Each country's workers are willing to work harder than they did before specialization.
D. All of the above.

Application: Suppose the United States can produce 2000 cars or 2000 trucks. Japan can produce either 2000 cars or 1000 trucks. In terms of car production we can conclude that:

A. Japan has an absolute advantage.
B. The United States has an absolute advantage.
C. The United States has a comparative advantage
D. Japan has a comparative advantage.

Farmers are most likely to be in favor of:

A. Free trade for fertilizer and crops.
B. Free trade for fertilizer but restricted imports of crops.
C. Restricted imports of fertilizer and crops.
D. Restricted imports of fertilizer and free trade of crops.

Analysis: The elimination of import restrictions will:

A. Alter the mix of output from export industries toward domestic industries.
B. Redistribute income from import-competing industries to export industries.
C. Alter the mix of output from export industries to import-competing industries.
D. Redistribute income from domestic to foreign producers.

These multiple choice questions were used directly or adapted from questions the test banks accompanying Schiller's *The Macro Economy Today*.

Recall that the exams did not include questions at the evaluation level of cognition, but research has shown to me how that can be achieved.

Evaluation: A student was asked to do the following: "Briefly describe the economic rationale and impact of NAFTA in both the United States and Mexico."

As an answer the student wrote the following:

"NAFTA, The North American Free Trade Agreement, was designed and implemented to take advantage of gains from free trade. These gains are increased production in areas of comparative advantage and increased consumption possibilities. It is expected that there are adjustments in economies that go to free trade. The goods and services that are produced without comparative advantage will decline. It was expected that the U.S. would lose manufacturing and agricultural producers and jobs especially with fruits and citrus crops, but it would be made up in other areas. This was the case when the U.S. had its largest economic expansion ever in the 1990's. This was also experienced in Mexico with great growth, decreasing poverty, and diminishing illegal immigration to the United States."

How would you judge the student's answer?

A. EXCELLENT (All statements about policy and outcomes correct, answer is logically consistent, answer is complete)
B. GOOD (All statements about policy and outcomes correct, answer is logically consistent, but is not clearly argued.
C. MEDIOCRE (Some statements about policy or outcomes are incorrect and/or the answer lacks logical consistency and/or is unclear.)
D. UNACCEPTABLE (Policies and outcomes incorrect, not logically consistent, incomplete.)

## CONCLUSION

Meeting course learning objectives and program level learning goals certainly involves content acquisition, but professors also seek to determine whether the student in the course can operate at higher cognitive levels. Multiple-choice exams can play a role in measuring both content and cognition in students especially if they are designed to cover a range of skills showing varying cognitive skills. Bloom's taxonomy provides a great framework for evaluating, revising, and creating multiple-choice exams that can assess such student achievement.

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