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Writing Outstanding MCQs that Match Your Objectives: Why Keep Assessing Your Student's Performance a Secret?

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ABSTRACT

Assessing student performance begins with first understanding what you expect from the student and then the development of effective tools or strategies to measure your expectations. Most faculty have a good intuitive sense of what they are teaching and how well students are learning, but they do not always take the needed steps to translate that into effective descriptors to guide students' learning, guide their assessments of students' performance, and to provide easy replication of their learning activities. The later task is critical in providing a scholarly approach to the art of teaching. The purpose of this article is to provide faculty with some tools to help clarify what they expect from a learning situation, develop effective tools to measure the impact of that situation, and consider viewing their teaching efforts from a scholarly perspective.

Keywords: behavioural objectives, learner objectives, Multiple Choice Questions, outcomes assessment, scholarship in education

INTRODUCTION

When I first started my role as Associate Dean of Curriculum Development at the Duke-NUS Graduate Medical School Singapore (Duke-NUS), I was asked what I knew about Team-Based Learning (TBL)^{1,2}. I had heard of it, been to a workshop on it, and had participated in a learning activity using it, but had never actually tried to develop a session or teach someone else how to do it. My task when I started was to introduce this learning strategy to the faculty and help them to build the best curricular material possible, and to execute a school-wide implementation of TBL. I realised that there were 3 major skills that faculty need to have in order to effectively design and implement quality TBL sessions. They need to be able to effectively write behavioural objectives, write quality and higher-order multiple choice questions (MCQs), and comfortably and effectively facilitate small group activities. In this paper, I focus on tips for writing objectives and creating effective MCQs.

WRITING OBJECTIVES

When faculty are first learning to write objectives, they often start by thinking about what they are going to do

or present. Let us consider a teacher giving a lecture on the history of Standardised Patients. A common set of objectives that might be written would be: "I will:

- describe the history of Standardised Patients (SPs) and their role in clinical learning;
- show a movie demonstrating their use; and
- review key literature about the efficacy of SPs."

While these objectives are helpful for the teacher in planning the lecture, it does not help the teacher assess how well the student has learned the information or even determine if giving a lecture and showing a movie was the best learning strategy.

Assessing performance requires the instructor to view the learning activity from a different perspective — from the students' perspective. These types of objectives are called learner objectives. These are framed from the perspective of both describing the knowledge, attitudes, and skills a student is expected to have gained following the educational activity,

Table 1. Key questions to ask.

Goal: To achieve	Objective	Learning Strategy	Assessment Strategy
Knowledge	<ul style="list-style-type: none"> How will you know if student has achieved the Knowledge, skills, attitudes desired? 	What learning strategy will best help student achieve the objective(s)?	What tool/strategy will help you measure if objective(s) is met to defined standard?
Skills	<ul style="list-style-type: none"> What will you be able to observe them doing which will tell you? 		
Attitudes	<ul style="list-style-type: none"> Under what circumstances will they do this behaviour? What level of performance do you expect? 		

as well as the way in which the instructor will assess those components. The questions the faculty should ask are: what should the student be able to do and how will you (the faculty member) know that the students are able to do it? Viewing the learning from this perspective can also help the faculty set the “ground rules” or clarify for the students what is really expected to be mastered, open the door for considering other learning strategies, and assist in defining the most effective assessment.

A well written learner's objective is behavioural and has 3 components:

1. a description of what a student who has mastered the objectives should be able to do;
2. under what conditions the student will be able to do the objective; and
3. to what extent the student will be able to do it³.

Why would one care if the objectives are observable? The primary reason is that if you cannot observe a behaviour, it becomes difficult if not impossible to assess. This helps the instructor to be sure that learning has actually occurred. In addition, the way that the objectives are written will help define the most effective teaching modality, type and level of assessment. Different types of objectives usually require different methods of instructions to achieve expected results. The clearer an instructor is on what s/he wants to achieve, the clearer it will be on how to present the material and assess what has been learned. Table 1 suggests the types of questions faculty should ask when setting up their learning activities.

Faculty commonly begin writing objectives from the perspective of the knowledge content. They generally say that “At the end of this programme the student will have a good understanding of ...”. The challenge with this type of objectives is that it is not clear what “a good understanding” might mean. It is not clear to the student, those trying to assess the student or other faculty attempting to replicate the programme elsewhere exactly what the faculty member had in mind. This level of detail (or lack of detail) in the objectives can result in unreliable or inconsistent scoring of a student's performance, based on variations of the interpretation of “good understanding.”

People may argue that we cannot see the inner workings of a student's mind — thus would not be able to describe “to know” with any accuracy. However, as difficult as it may seem, being able to define the characteristics of what a student who “knows” versus a student who “does not know” is able to do is the only way we can consistently, reliably, and hopefully accurately measure the accomplishment of an instructional endeavour and assure ourselves that learning occurred.

Many faculty become skilled at writing component 1: “What should the student be able to do”, because they have been frequently instructed to use “action verbs” when writing their objectives. Table 2 has a list of action verbs often recommended when creating knowledge, skills, and attitude objectives, adapted from Bloom's taxonomy of educational objectives⁵. Unfortunately, faculty often limit themselves to recall and comprehension behaviours when writing their objectives. One reason may be that they only expect students to be able to learn simple recall or a description of some core facts from their lectures. Another reason,

Table 2. Sample List of Terms That Can Be Used In Defining Your Expectations of Students. Adapted from Kapfer³.**Terms That Reflect Knowledge**

At the end of this experience the student will be able to:

In order of increasing difficulty

<i>Recall</i>	<i>Comprehend</i>	<i>Apply</i>	<i>Analyze</i>	<i>Synthesize</i>	<i>Evaluate</i>
<ul style="list-style-type: none"> • Define • Repeat • List • Record • Name • Recall • Recognize 	<ul style="list-style-type: none"> • Translate • Discuss • Describe • Locate • Identify • Explain 	<ul style="list-style-type: none"> • Interpret • Apply • Use • Demonstrate • Operate • Sketch 	<ul style="list-style-type: none"> • Distinguish • Appraise • Calculate • Question • Solve • Categorize 	<ul style="list-style-type: none"> • Propose • Design • Manage • Prepare • Plan • Collect 	<ul style="list-style-type: none"> • Appraise • Rate • Assess • Measure • Judge • Revise

Terms That Reflect Attitudes And Values

At the end of this experience the student will be able to:

<i>Receive information</i>	<i>Respond to stimuli</i>	<i>Value</i>	<i>Shows commitment toward</i>
<ul style="list-style-type: none"> • Attend • Listen to • React to • Be sensitive to 	<ul style="list-style-type: none"> • Visit • Read • Display • Use • Obey 	<ul style="list-style-type: none"> • Enjoy • Take active role • Assume responsibility • Show preference for • Initiate 	<ul style="list-style-type: none"> • Form judgment • Defend • Develop ideas, plans • Debates • Influence

Terms That Reflect Skills

At the end of this experience the student will be able to:

Have the skill to do things

<ul style="list-style-type: none"> • Manipulate • Arrange • Attach • Operate • Draw • Insert 	<ul style="list-style-type: none"> • Connect • Cut • Stitch • Wrap • Administer • Perform
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may be that when trying to carry out their objectives to the level of specificity relating to the conditions under which the assessment will occur or the degree of mastery, these basic ones lend themselves quite nicely to simple recall MCQs.

When faculty begin to use higher-order skills in their objective writing, they find that it may impact both the assessment strategy and the most effective learning modality. For example, if you want your students to know how to conduct a basic physical exam, you might start with the behavioural objective that says:

“At the end of this session the student will be able to *describe* the steps of a complete physical exam.”

This type of objective is nicely suited for a lecture and an MCQ. However, if you wanted the students to be able to accurately *perform* a complete physical exam, this will dramatically change both the way the session might be taught and how you might assess it.

To further improve the objectives, you would need to elaborate on steps 2 and 3 of an effective behavioural objective by describing under what conditions the student would perform the expected task, what constitutes “complete and accurate” and what level of mastery would be sufficient. Would this be a demonstration of a focused exam based on chief complaint, or would this be a complete head-to-toe exam from a standard checklist you have used to instruct the students? Would you want the student to be able to achieve 100% mastery or would 80% be sufficient? Are you more interested in the order and memorisation of the skills or would it be OK if given in any order and would it be OK if prompted as long as the student was accurate? Would the results be recorded by a faculty or by a Standardised Patient? All of these additional clarifications could change the nature of the educational experience and the types of assessment tools used to determine mastery. It is a little like having a road map, a clear destination, and a strategy on how to get there, rather than just wandering around looking for a nice

Table 3. Sample Objectives.

Usual Objective	Typical Objective with Action Verb: Student should be able to:	More Comprehensive Objective: Student should be able to:	Teaching strategies	Assessment strategies
Understand the pathophysiology, clinical presentation, investigations, and therapy for Thyroid Gland	Palpate the Thyroid gland	Describe the appropriate location and strategy to palpate the thyroid in a written exam	Lecture or reading to present information	Short answer exam
		Palpate the Thyroid gland on a real patient in the appropriate spot on the neck	Skill session on other students or manikins to learn where and practise palpating	Identifying real patients on whom thyroid can be palpated. Must be observed for location
		Palpate the Thyroid gland on a standardised patient in the appropriate spot on the neck and with appropriate pressure	Skill session with standardised patients to learn where, how much pressure, and practice palpating appropriately	Train standardised patients to provide feedback on the accuracy of palpation (both in terms of location and pressure)
	Describe the Thyroid's relation to other structures. e.g.: (Thyroid and cricoids, cartilages, strap muscles, Superior and inferior thyroid arteries, Parathyroid glands, Recurrent laryngeal nerve)	Describe on a written short answer test the Thyroid's relation to at least three other structures	Lecture or reading to present information	Short answer exam
		Describe to a patient in non-technical language the location of the Thyroid	Lecture or readings on location and then skill session on describing location	Train standardised patients to ask question about the Thyroid. Have observer record response and grade for accuracy
	Discuss implications to surrounding structures with surgery to thyroid (e.g. risk of hypothyroidism, RLN palsy, hypo-parathyroidism, neck haematoma)	Discuss in an oral presentation at least three risks to surrounding structures if a patient were to have surgery to remove the Thyroid	Lecture or reading on risks	Oral exam, presenting risks associated with surgery
		Discuss with a standardised patient needing a thyroid surgery, the risks to surrounding structure	Lecture or readings on risks. Skill session with standardised on obtaining informed consent and giving patients bad news.	Train standardised patient to give feedback on accuracy of reporting risks and process of giving communicating with patient

place to go. Table 3 provides some examples of how variations in writing objectives can impact both the learning strategy as well as the assessment.

WRITING EFFECTIVE MCQS

Many people do not like MCQs, because they feel they do not measure higher order thinking. I would argue that well written questions can tap into more than just rote memory. Since team-based learning uses MCQs as a means of facilitating learning, it is important to learn how to avoid some of the miscues in writing good test items. One of the best resources for writing quality medical MCQs is Constructing Written Test Questions For the Basic and Clinical Sciences⁶ which can be found at the National Board of Medical Examiners (NBME — www.nbme.org). Much that follows is a synthesis of the key principles from this book.

WHY ARE MCQS IMPORTANT?

Good MCQ questions define for the student what is important. For TBL in particular, they are an effective tool to motivate students to study. Most importantly, for both the student and the faculty, good questions can identify areas of deficiency and areas in need of remediation or further learning. Of course, they also help determine final grades or make promotion decisions and can even give feedback to course directors and deans about areas where the course/curriculum is weak.

So how do you decide on what to test? There are some general guidelines. "The test items should clearly map to the course/clerkship objectives. Naturally, more important topics should be weighted more heavily than less important topics. In addition, the testing time devoted to each topic should reflect the relative importance of the topic" (pg10)⁶.

Types of Questions to Avoid

Most faculty write questions that are essentially a series of True/False Questions. These questions typically end with: “Which of the following is Correct (or Incorrect)?” Or “All of the following are correct EXCEPT ...”. Or, they may include “none of the above” or “all of the above” in the response options. These types of questions essentially require the student to examine each option and try to determine if it is True or if it is False.

In order to write good quality T/F questions, the:

- **Stems** must be clear and unambiguous. Imprecise phrases such as “is associated with”, “is useful for”, “is important”; and words that provide cueing such as “may” or “could be”; and vague terms such as “usually” or “frequently” should be avoided.
- **Options** must be absolutely true or false; no shades of grey are permissible; avoid phrases and words noted in the first item above” (pg 16)⁶.

The NBME does NOT recommend using these types of questions for the following reasons:

- Too often the question stems are vague and unclear;
- The response options also often have vague terms;
- It is hard to find items that are not unequivocally correct/incorrect;
- Given that “truth” sometimes changes over time, it is often hard to reach consensus on right answer;
- And, in an effort to avoid ambiguity, the questions tend to focus on isolated facts (not application, synthesis, evaluation – or higher order questions)⁶.

Unfortunately, these T/F type questions are easier to write. So, how do you go about writing a good single best answer MCQ? One of the best places to start is with the “cover the options” rule⁶. If you could imagine that you were actually writing a short answer or fill-in the blank question, then everything the student would need to know to best answer the question would be in the stem. This also permits you to begin to build higher order thinking questions, rather than isolated facts.

Another tip for writing effective MCQs is to make sure that all the responses seem plausible. They may have common errors in judgment or understanding about the concept. When I have time, one strategy I use to

generate the response options, is to actually pose the question as a short answer, and see how people answer it. Another strategy is to think about typical errors of omission or commission — that would lead one to the wrong answer. Lastly, you want the options to be along a single content dimension. This helps with the grammar and the logic of the options.

GUIDELINES

- “Test application of knowledge using clinical vignettes to pose medical decisions in patient care situations.
- Focus items on common or potentially catastrophic problems; avoid “zebras” and esoterica.
- Pose clinical decision-making tasks that would be expected of a successful examinee.
- Avoid clinical situations that would be handled by a (sub) specialist.
- Questions should focus on specific tasks that the successful examinee must be able to undertake at the next stage of training (e.g., determine the most likely diagnosis; indicate what additional laboratory studies should be ordered; formulate the next step in management; predict the most likely additional finding). For each topic, the areas in which mistakes are commonly made should be the focus of a question” (pg55)⁶.

BASIC RULES

- **“Each item should focus on an important concept, typically a common or potentially catastrophic clinical problem.**
 - Don’t waste testing time with questions assessing knowledge of trivial facts. Focus on problems that would be encountered in real life. Avoid trivial, “tricky,” or overly complex questions.
- **Each item should assess application of knowledge, not recall of an isolated fact.**
 - Item stems may be relatively long; the options should be short. Clinical vignettes provide a good basis for a question. For the clinical sciences, each should begin with the presenting problem of a patient, followed by the history (including duration of signs and symptoms), physical findings, results of diagnostic studies, initial treatment, subsequent findings, etc. Vignettes

may include only a subset of this information, but the information should be provided in this specified order. For the basic sciences, patient vignettes may be very brief; “laboratory vignettes” are also appropriate.

- **The stem of the item must pose a clear question, and it should be possible to arrive at an answer with the options covered.**
 - To determine if the question is focused, cover up the options and see if the question is clear and if the examinees can pose an answer based only on the stem. Rewrite the stem and/or options if they could not.
- **All distractors (i.e., incorrect options) should be homogeneous.**
 - They should fall into the same category as the correct answer (e.g., all diagnoses, tests, treatments, prognoses, disposition alternatives). Rewrite any dissimilar distractors. Avoid using “double options” (e.g., do W and X; do Y because of Z) unless the correct answer and all distractors are double options. Rewrite double options to focus on a single point. All distractors should be plausible, grammatically consistent, logically compatible, and of the same (relative) length as the correct answer. Order the options in logical order (e.g., numeric), or in alphabetical order.
- **Avoid technical item flaws that provide special benefit to testwise examinees or that pose irrelevant difficulty. (Technical flaws are reviewed in great detail outlined in the NBME book.)**
- Do **NOT** write any questions of the form “Which of the following statements is correct?” or “Each of the following statements is correct EXCEPT.” These questions are unfocused and have heterogeneous options” (pg33)⁶.

SCHOLARSHIP OF TEACHING

Teaching Faculty devote a great deal of time devising strategies to share their knowledge, skills, and attitudes with young learners. Yet, they do very little to share their strategies for enhancing learning and assessing the impact of their teaching efforts. Thus another very important value of writing effective objectives and MCQs is that other faculty can better understand what you are doing, how you are doing it, how you are assessing impact, the degree of impact, and quality of your work. To view educational work with the same rigor as any scholarly work will further enhance the quality of the teachers’ efforts and share with others the power of what is being accomplished.

CONCLUSIONS

As William Deterline⁴ said, the goals of learning and assessment should not be a “secret” that only the instructor knows. How can it be inappropriate to explain what you want your students to know and how you are going to assess their skills? They still have to master the content and develop the skills — keeping it a secret does not make it too easy for the student or make you a better teacher.

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