

Engaging Assessment: More than Just a Test

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Traditional examination-type, end-of-semester tests are seen by educators as a necessary part of the education process. We need to assess what the student knows and if they have met the learning outcomes for the course or the lab (or both), and this provides the basis for assigning the final grade (summative assessment). There is, however, another purpose for assessment, and that is to assist in learning (formative assessment). This type of assessment can assist student learning in a number of ways. The Instructor can gain valuable insight into the student's strengths and difficulties in mastering a topic/skill/concept and make adjustments to their teaching. It can allow the student to assess their learning, and what they still need to master and what adjustments they need to make to reach their learning goals (metacognition). The type of assessments that we give students can have a real, and improved, impact on their learning. By using assessment tools that are engaging, and also testing for skills higher up in Bloom's taxonomy of learning, such as evaluation, synthesis and analysis, we can emulate the competencies that our students will need in the modern day world. In this hands-on workshop we will describe and then practice some of the different types of assessment tools that we have used to engage students in the lecture and the lab, and then we will discuss their impacts.

Keywords: formative assessment, engagement, tools

Introduction

As Biology laboratory educators we are keenly aware of the importance of assessments to gauge how much our students have learnt from the laboratories we teach. We often use assessment tools, such as quizzes and exams to assign grades. These types of assessments are called summative assessments and they are used to measure a student's competency and achievement after having completing a certain unit or task in the lab. Eric Mazur (Assessment, 2013) a prominent physicist and educator contends that assessment can be 'the silent killer of learning' when the types of assessment tools we use are those which are solely focused on regurgitation of information (memorization of facts). He contends they are not achieving the goal we hope for in student learning. Information learned by such assessments is not remembered for very long after the exam; he has found that thirty-five percent of information memorized for a test by using flash cards is retained by a typical student after one week. Also in high-stakes exams students are also isolated from their peers and penalized for their mistakes. We can argue that this is the point of the exam, where students are tested on their own knowledge or

competency, and there should be no chance for collaboration or second chances.

Mazur (2013) contends that our students in the 21st century require more out of their education than just the ability to memorize information. Information is at our fingertips; what students need to be able to do is know how to apply this information to solve problems. They need to know how to make correct assumptions; how to develop conceptual models and then apply this model to varying situations; they need to use different approaches to solve a problem (i.e. be able to fail and try again). They also need to learn how to work cooperatively with other people to solve problems.

Luckily we can also use other types of assessment tools called formative assessments. These are used by students to gauge their own learning – how much do they already know, and how much more do they need to do to close the gap if they don't think they have achieved competency (Wiggins 1998). Also formative assessments can be engaging and even fun, thus increasing a student's motivation to learn. Pellegrino (2014) urges educators to design assessments that require deeper learning and more sophisticated skills. He includes such activities as getting students to design and conduct their own experiments (something which we are

increasingly doing in Biology laboratory education), he also lists critical reading, writing and speaking skills which require reflective analysis, and having students be able to evaluate the validity and relevancy of disparate information. Such skills are not gained through the traditional summative types of assessments, by via more innovative types of assessment tools.

The benefits of formative assessments to improve student learning have been well documented (Black and William 1998, William 2007). Students can use the information from such assessments to determine which skills and information they need to study further, and what adjustments in their thinking they need to make. Commonly the formative types of assessment include coursework, such as projects, assignments and small quizzes at the end of every class or lab. If these are removed due to resource constraints then students typically do not do the associated studying on their own and do more poorly in their final exams (Gibbs and Simpson 2004-2005). However these authors found that if periodic peer assessment of problems, requiring little or no marking from the instructor, was instigated as part of the course requirements, the overall performance of the students improved. So without giving ourselves a huge increase in workload, if we use and/or design formative assessments that assist students in their learning but do not require us to do a lot of extra marking, then this can be a win-win situation.

In the following we list a variety of formative assessment tools that we use in our labs as well as lecture classes to provide ‘engaging’ assessment for our students.

Biology 1040 Environmental Biology (Susan Purdy)

Instant Feedback Assessment Technique

In this course we use team-based learning where students work in teams of three to five students to answer problems. Once teams have completed their team assignment each member of the team individually takes a multiple-choice quiz. Once the students in the same team have all completed their own quiz they worked together to answer the same questions using an **IFAT card** (Instant Feedback Assessment Technique, Figure 1). This is a scratch card where the correct answer is identified with a star when the cover is scratched off. If the correct answer is found after the first ‘scratch’ the team scores 4 marks, if it takes two scratches they score 2 marks, if it takes 3 scratches they score 1 mark, and any more scratches results in a zero. This allows the team to choose an incorrect answer, but still keep trying --something that a traditional test does not allow.

The whole process of the team deciding on the correct answer creates a lot of discussion, and often there is strong debate among the team members arguing ‘their

case’ to the rest of the team. We find this part of the process the most interesting to listen in on, as there is usually at least one team member who has the right answer, and they are articulating the reasons for their choice to the rest of the team members. The process is very engaging for the students in that they are actively participating in their learning. If the team chooses wrong answer, then they keep debating until they select the correct one. By the end of this process, those team members who chose incorrectly when they did the quiz individually should now know where they went wrong with their understanding or thinking, and how to fix it.

Students mark and record their own scores on a team score-sheet that is always located in their team binder. We then transfer these scores to an excel spreadsheet that calculates the individual score and team score for all the quizzes over the semester. The team scores are always higher than the average score for the individuals in the team. We have only had positive feedback from students about this process, and it is something they actually look forward to as part of the class. One of the drawbacks is that the IFAT cards can only be used with multiple-choice questions. This type of assessment has been criticized for its inability to have student write longer in-depth answers to questions so we can gauge their understanding of a problem. To help compensate for this the types of multiple-choice questions we have tried to use are those that are higher up in Bloom’s taxonomy of learning and are more complex in their nature where students have to truly understand the topic and be able to extrapolate to other situations or use the information to solve problems in a different context.

IMMEDIATE FEEDBACK ASSESSMENT TECHNIQUE (IF AT)
 Name Team # 3 Test # 1
 Subject _____ Total 23
SCRATCH OFF COVERING TO EXPOSE ANSWER

	A	B	C	D	Score
1.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	4
2.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2
3.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	4
4.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1
5.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4
6.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4
7.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0
8.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	4
9.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
10.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Figure 1. IFAT Card

Anatomy and Physiology Labs (Christine Petersen)

Open Book Quizzes

Our Anatomy & Physiology labs for nursing and respiratory students are by necessity “show and tell” with slides, models and dissections. Many students seem to be unengaged and not very self-motivated to study and learn during the labs. They quickly look at the material and then leave with little feedback about what they have or have not learnt. We have tried quizzes on the subsequent labs material at the beginning of the next lab but many students still don’t bother studying and complain they don’t have time. Getting poor quiz marks seems irrelevant to many. To address this lack of immediate accountability we have switched the timing of the quizzes. Once students complete the lab they all have to write an open book quiz covering the material they just looked at before they leave. The response has been immediate and very positive. The students work very hard trying to get a perfect quiz mark and come more prepared to lab by pre reading material. We include a “setup” question where the students must either look at a slide to identify tissue or glands or at a dissection or model to identify a structure etc. This question makes them directly responsible for working with the material in the lab. To avoid cheating in labs we have three different versions of each quiz. Interestingly the 10 quizzes themselves are worth very little (0.5% each) for a total of 5% of their overall course grade. Yet they are fully engaged in their attempt to achieve immediate perfection!

3D Scale Model and Mock Lab Exam Review Session

Based on “Anatomy & Physiology Art Show” by Drs. Kronberg & Griffin (Parkersburg, West Virginia University), our students in the Nursing Anatomy & Physiology lab create a detailed 3D scale model of an anatomy subject such as the kidney, with 12 features labelled A to L (but no answers) and accompanying student written questions involving form and function. The students work in pairs on their own models in the weeks prior using simple materials such as cardboard, fun foam, wooden, modelling clay etc. Then during the last week of classes they put them all out in the lab room as a mock lab exam. The pairs of students move around the models and identify the labelled parts on the models. They can then check their answers with a structural key. They also attempt the questions that examine form and function of that particular model. At the end of class the students go over the answers to the questions with the instructor moderating. Thus this is a student driven review session - another form of engaging assessment. The models and questions are marked for quality, effectiveness and correctness with a detailed rubric (available on request).

Plant Biology Lab Exams (Christine Petersen)

Use of Illustrated Journals

Students in second and third year botany courses are asked to document materials taught in the laboratories. By “document” we ask them to capture what they are seeing in the various classes through illustration and writing in journals. Students draw from live plants (whole or cut) or dry specimens, using microscopes as well as prepared slides. They are told to draw the outlines and general features of the plant being studied i.e. stem in whole and as sections to see tissue/cell structure. The key is to be observant - look at the mass of different colours, shapes and details and try to find a pattern. They use references to identify the various features and add labels to their drawings. The students are asked to give context and meaning – the how, what, why and where of the material. Otherwise it is just a drawing. The drawing process itself forces them to slow down and focus on the details and spatial relationships. Thus, through the act of drawing, they will hopefully learn the material better than just looking quickly at an existing picture. The drawings themselves are therefore tools for remembering - their journals serve as review material for lab exams. They receive a mark for the quality of the journal. Finally, by making the student engage in “active observation and inquiry” through the illustrated journals they are modelling the scientific approach (Baldwin and Petersen 2011).

To encourage the students to fully engage and value their efforts in creating a useful illustrated journal we have created an opportunity for the students to use their own journals during part of the lab exams. The traditional lab exam consists of a 75% closed book portion where students visit stations to identify plants and their structures. This portion is run first separately and the students then hand in their tests. The second portion of the lab exam is handed out and is “open book” where they may use their own illustrated journals to help answer the questions. Amazingly the students do equally well on either portion – rarely do they do better on the illustrated journal portion. The quality of their answers is directly related to the quality of their illustrated journals. If they are not prepared they do poorly on both. We have seen an improvement in their dedication to their illustrated journals.

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Christine Petersen received her BS (Zoology) and Professional Teaching Certificate from the University of British Columbia in 1986. She also obtained a Medical Laboratory Certificate from Cariboo College in 1989. After working several years as a medical laboratory technologist and assistant for various hospital labs, she obtained her current position as a Biology Laboratory Instructor at Thompson Rivers University. During the past seventeen years, Christine has taught and prepped several different biology laboratory courses for both nonmajors and majors. She recently obtained her MS (Ecology) in Environmental Science from Thompson Rivers University in 2010.

Susan Purdy is a senior lecturer in the Department of Biological Sciences at Thompson Rivers University and teaches environmental biology to non-science students as well as being the lab coordinator for one of the large first year biology majors classes, and she also teaches the second year animal body plans labs and the third year animal behaviour labs. She has an undergraduate degree in Biology from the University of Kwazulu-Natal in South Africa and a Master's degree in Natural Resources Management from the University of Manitoba, Canada.

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