Using Online Quizzes in Moodle for e-Assessment

Background

Over the past five to ten years, the botany practical assessment as part of the second year Biology of Aquatic Organisms module in the BSc Applied Freshwater and Marine Biology degree course has focused on the correct identification and labelled drawings of a number of plant species along with two calculations on diversity indices. The assessment mimics tasks conducted by students in practical classes however it does not assess information provided in pre-practical lectures and/or practical handouts. When practical assessments are scheduled, students simply learn the names of plants off and study the diversity calculations without spending any time learning the background information from the lectures and/or handouts. To combat this learning problem, the intended learning outcome of this project report is to develop a web-based artefact, online Quizzes, to improve information retained by students on the topics covered in the botany pre-practical lectures and handouts. To achieve this learning outcome, I decided to create an online Quiz in Moodle which would test all aspects of the botany pre-practical lectures and practical content and assess the student's knowledge of the subject area before they take their final summative examinations in the summer.

I choose online quizzes because they are currently a common and flexible e-Assessment (summative and formative) tool used to test learner knowledge, skills and abilities; are a useful and fun alternative to written examinations and other course work, which motivates students; promotes course engagement and participation; and provides independent marking and feedback (Kwan, 2011; Cushard, 2013; Jisc Digital Media, 2015). A key advantage of using quizzes, for the learner, is the prompt feedback which allows the student to improve their knowledge of the subject area (Kwan, 2011; Tuttle, 2011; Jisc Digital Media, 2015). While, for the teacher, is the data obtained on how well students are meeting module learning objectives, and identifying learning gaps and misunderstandings which reflects how effectively the course content was presented (Rathburn and Connors, 2008; Tuttle, 2011). The latter is of particular interest to my developing teaching skills and style as sometimes it is hard to judge what students understand and what they do not.

Steps Involved in Developing the Online Quiz

Step 1 Designing the Quiz Questions
I revised the learning objectives and course content covered in the botany pre-practical lectures and aligned these with appropriate questions which would engage student participation and increase long term retention of information and knowledge. Before I designed the questions, I investigated the different kinds of questions Moodle offered and tried to pick question types which would best suit my quiz. Quiz strategies by Moodle docs (2015a) listed some key considerations for setting effective question design strategies such as 1. each question should be linked to a course objective, 2. ask multiple questions about each key learning idea, and 3. write questions that require students to think at different levels hence use a mixture of recall questions, comprehension questions and some application and analysis questions. The latter is a particularly important consideration and helps identify where students of different abilities are having problems in their thinking – can they recall the information but not apply it (Moodle docs 2015a). Bearing these three considerations in mind, I choose three types of fixed choice questions: multiple choice questions (MCQ), short answer questions and true/false questions (T/F).

Multiple Choice Questions (MCQ) – single answer questions

I used MCQ single answer questions which allowed one or only one answer to be chosen from four fixed options in an effort to survey student factual knowledge (CTL, year unknown a; Moodle docs, 2014a). MCQ's offer many advantages such as rapid scoring and feedback to students however, for the teacher, they do require plenty of time for writing, reviewing, and revision (CLT, year unknown a). Effectively written MCQ's best measure student learning and I employed the following hits and tips for effective MCQ's (CLT, year unknown a; Lucero and Connor, year unknown a) when writing my own MCQ's:

- I wrote the question first, then the correct answer, along with two distractors and made sure the distractors matched the correct answer in terms of length, complexity, phrasing and style
- I based each item on a learning outcome for the course
- I minimised the amount of reading required for each questions by having short questions
- I kept the vocabulary and tone of the questions consistent with the students level of understanding
- I avoided language in the question and/or others answers that gave clues to the correct answer

Short Answer Questions

I used short answer questions which allowed the student to type in a word or phrase in response to a questions (CLT, year unknown b; Moodle docs, 2014b). Short answer questions are typically used to test student recall and lower levels of cognitive ability (CLT, year unknown b). I employed the following hints for composing short answer questions (CLT, year unknown b; Lucero and Connor, year unknown b) when creating my own short answer questions:

- I omitted only key words
- I avoided statements that were answered equally well by several terms
- I used direct questions as oppose to statements

True - False Questions (T/F)

I used true/false questions which gave the students only two options (Moodle docs, 2014c) and are used to measure the ability to identify whether statements of fact are correct (CLT, year unknown c). There are many strength and weaknesses to T/F questions and some of the limitations need to be considered such as 1. false statements provide no knowledge that the student knowns the correct answer, 2. scores are more influenced by guessing than any other question type, and 3. the teacher cannot discriminate between students of varying abilities (CLT, year unknown c). Based on these limitations, I only added four T/F questions to the quiz to try them out. To get the best return on these T/F questions, I employed the following tips on composing T/F questions (CLT, year unknown c; Lucero and Connor, year unknown c):

- I constructed statements that were definitely true or false
- I used short statements of approx. the same length
- I tested only one idea in each statement

Having chosen the three different question types and previewed the five pre-practical botany topics covered, I decided to award 20% per botany topic where each botany topic would contain between 5 and 7 questions (Table 1). This resulted in a 100% summative assessment for the Botany Practical Assessment Quiz. I felt this appropriately covered the three key quiz strategy points above where each question should be linked to a course objective, ask multiple questions about each key learning idea, and use a mixture of question types (Moodle docs 2015a).

Table 1 The number of questions proposed for each of the three question types for each botany topic and the total number of questions proposed for each botany topic.

Practical Topics	Multiple Choice Questions	Short Answer Questions	True/False Questions	Total Number of Questions
Cyanobacteria	2	4	1	7
Diatoms 1	1	4		5
Diatoms 2	4	2	1	7
Brown seaweed	1	3	1	5
Aquatic plants	2	3	1	6
				30

Step 2 Set up Quiz Activity in Moodle

There are two stages to setting up quizzes in Moodle, firstly you have to create a quiz activity and specify the settings for interacting with the quiz and secondly, you add questions to the quiz from the question bank (Moodle docs, 2015 b, c). To get started, I set up a Quiz Activity in Moodle 2.0 and set about following the step-by-step guides detailed by Quiz Settings and Quiz Module in Moodle Docs (2015 c, d).

The following steps were taken to set-up the quiz in Moodle (Moodle docs, 2015c):

a. Log in – turn editing on - add an activity or resource – select quiz activity – click add

b. *General section*:
   Name: Botany Practical Assessment Quiz
   Introduction: This Quiz will assess your knowledge and understanding of Botany topics covered in semester 2 of 2014-2015. Five topics are covered: P1 Cyanobacteria, P2 Diatoms, P3 Diatoms, P4 Macroalgae and P5 Aquatic Plants. Information for the quiz was taken from practical lectures, class handouts and practical material used in class. There are a total of 30 questions across a mixture of multiple choice, true/false statements and short answers. You have 1hr 30mins to complete the quiz. You will receive a final grade and feedback once you have submitted your quiz.
   Best of Luck
   Clicked "display description on course page"

c. *Timing Section*:
   Open the quiz: the quiz started on Tuesday 3rd March 2015 at 16:30pm
   Close the quiz: the quiz closed on Tuesday 3rd March 2015 at 21:30pm
   Time limit: 90 minutes
   When time expires: Attempts must be submitted before time expires or they are not counted
   Submitted grace period: none
   Due to the large class size (29 students) but small computer suite availability, I ran two practical assessment quizzes back-to-back and so had the quiz open for a total of 5hrs. However, you did need a password to access the quiz content and students only had one attempt so this reduced the chances of students no present taking the quiz or students from the first session reattempting the quiz at home. I felt 90 minutes was enough time to go over the instructions to the quiz and still provide ample time to complete the quiz for students of all levels. I gave no grace period as it was a summative assessment.

d. *Grade Section*:
   Grade category: Uncategorised
   Attempts allowed: 1

Grading method: Highest grade (the final grade is the highest (best) grade in any attempt)

As it was a summative assessment I gave each student one attempt. This also helped control cheating by the first group of students while the quiz was still open for the second group of students. As this point the first group would have had the password.

e. *Layout Section*:
Question order: Shuffled randomly (the order of questions in the quiz will be randomly shuffled each time a student starts a new attempt at the quiz).
New page: Every question
Navigation method: Sequential

I chose to randomly shuffle the questions so that neighbouring class mates could not easily cheat from each other. I felt one question per page was enough for the student to focus on and would reduce panic during the quiz by not seeing a list of questions they had to attempt straight up. I selected sequential navigation so the students could work through each question easily and in order however during the quiz this proved difficult for the students as they were not free to go back to missed or flagged questions. This is something I will change in the future

f. *Question Behaviour Section*:
Shuffle within questions: Yes (each time the student takes the quiz the parts of the question will be shuffled randomly)
How questions behave: Deferred feedback
Each attempt builds on the last: No

I chose yes to randomly shuffled again in an effort to control cheating by neighbouring class mates. I also selected deferred feedback as it was the optimum option.

g. *Review Options Section*:
Much of these options are controlled automatically by GMIT
During the attempt: No options available
Immediately after the attempt: The attempt, Marks and General feedback
Later, while the quiz is still open: The attempt, Marks, General feedback and Overall feedback
After the quiz has closed: The attempt, Marks, General feedback and Overall feedback

After the student submitted the quiz, I chose to provide them with overall feedback on their grade. They then had the opportunity to go through each question one-by-one to see what marks they had received for each question and what the general feedback was. The general feedback in this quiz provided details of the correct answer. This is something I would change in the future as I provided no structured feedback on improving student understanding and thinking of botany.

h. *Display Section*:
Show the users picture: No
Decimal places in grades: Two
Decimal places in question grades: Same as for overall grade
Show blocks during the quiz attempts: No

I kept the defaults here and stopped the use of side blocks during the exam in an effort to reduce the chances of cheating.

i. *Extra Restrictions on Attempts Section*:
Require password: Yes
Require network address: No
Enforced delay between 1st and 2nd attempts: No
Enforced delay between later attempts: No
Browser security: No

I employed a password protected quiz which was useful as only students who attended the assessment could actually do the quiz.

j. *Overall feedback Section*:
Overall feedback provided students with an overall grade and grading positons.
70-100%: Congratulations on completing the Botany Practical Assessment Quiz. You have received a 1.1
60-70%: Congratulations on completing the Botany Practical Assessment Quiz. You have received a 2.1
50-60%: Congratulations on completing the Botany Practical Assessment Quiz. You have received a 2.2
40-50%: Thank you for completing the Botany Practical Assessment Quiz. You have received a Pass
0-40%: Thank you for completing the Botany Practical Assessment Quiz. Unfortunately you have failed the quiz. Please arrange a meeting with your lecturer.

k. *Common Module Settings*:
I hid the quiz until the whole quiz set up was complete and questions had been added from the question bank. All other settings were set as default.

l. *Restrict Access Section*:
All settings were set as default.

m. Save and Display

Step 3 Uploading Quiz Questions to the Quiz and Question Storage in the Question Bank
The following steps were taken to add questions to the quiz and store them in the question bank in Moodle (Moodle docs, 2015b) with MCQs (Moodle docs, 2014a), short answer questions (Moodle docs, 2014b) and T/F questions (Moodle docs, 2014c) all requiring a similar set up process. Examples of each question type are provided.

a. Log in – turn editing on –click on Botany Practical Assessment Quiz – edit quiz – add a question

b. *Add a question*:
   Select a question type: MCQ, short answer questions, or T/F questions
   Click next

c. *Information needed for MCQ questions*:
   General:
   Question name - Practical 1 Cyanobacteria
   Question text - How many algal units do you need to count to acquire a phytoplankton counting precision of 30%
   Default mark - 2
   General feedback - To provide a counting precision of 30%, at least 23 algal units for the most dominant algal taxa should be counted
   One or multiple answers – One answer only
   Shuffle the choices – Yes
   Number the choices – a,b,c,d
   Answers:
   Choice 1 – 23
   Grade – 100%

Feedback – none
Choice 2 – 30
Grade – 0%
Feedback – none
Choice 3 – 40
Grade – 0%
Feedback – none
Choice 4 – 50
Grade – 0%
Feedback – none
<u>Combined Feedback</u>:
For any correct response - Your answer is correct
For any partially correct response - Your answer is partially correct
For any incorrect response - Your answer is incorrect
<u>Save Changes</u>

d. *Information needed for short answer questions*:
<u>General</u>:
Question name - Practical 3 Diatoms
Question text - What is the name of the mounting agent used to make a permanent diatom slide ?
Default mark - 3
General feedback - None
Case sensitivity - No, case is unimportant
<u>Answers</u>:
Answer - Naphrax
Grade - 100%
Feedback - None
<u>Save Changes</u>

e. *Information needed for True/False questions*:
<u>General</u>:
Question name - Practical 5 Aquatic Plants
Question text - MTR applies to both lotic and lentic habitats
Default mark - 2
General feedback - MTR applies to lotic habitats **ONLY**
Correct answer - False
Feedback for the response "True" - This is the **incorrect** answer
Feedback for the response "False" - This is the **correct** answer
<u>Save Changes</u>

For all question types, the most important thing was to keep the question format clear and concise. All 30 questions were stored in the question bank in Moodle for future use. In the future, I would provide more feedback for all the question types. For MCQ's and short answers, I need to provide feedback on each question choice and provide clues which could help improve the students understanding of why they did or did not get the correct or incorrect answer. For all questions types, I need to remove the correct answer from the general feedback section and again provide advice on improving student understanding and thinking of botany topics.

Step 4 Checking and Assess the Quiz Questions

Before putting the quiz live on Moodle, I went through a number of previews to double check the quiz was operating effectively and I also got a colleague to test run the quiz to ensure I had a clear understanding of what the students would see.

After the quiz, I investigated the quiz statistics in more detail to ensure consistency across the questions especially the coefficient of internal consistency which measures whether all items in the quiz text are consistent (Moodle docs, 2014d). The co-efficient of internal consistency for the current quiz was 65.24% so I felt this was ok for my first attempt but this statistic is something I should keep an eye on for future quizzes to ensure no faulty questions are present. I must say I couldn't get any information on if there are threshold limits teachers should use. Quiz statistics reports in Moodle docs (2014d) suggested a high number but didn't indicate what that might be in reality.

Step 5 Conducting the Quiz

The students to be tested were Y2 Botany students. The quiz was carried out on Tuesday 3rd March 2015 in the freshwater computer suite with Group A between 5-6:30pm and Group B between 6:30-8pm. There were 15 students per group with 29 students sitting the exam.

As this was the first time the students had used online quizzes as part of an assessment, I produced a rough screencast (https://www.screenr.com/qLYN), using screen r, to guide them through the set-up process and interpretation of the feedback and marks. As students entered the room before the quiz there was a hint of anticipation as to what was ahead but they settled into it well, once started.

I stood at the back of the class so I could see the computer screens and monitor student web browsing activity if any occurred. There was a little confusion surrounding flagged questions and returning to questions at the end of the quiz but as highlighted above this was a quiz setting I had imposed. The results at the end also caused some confusion as some of the short answer questions were not read properly by the computer and therefore not graded resulting in most students failing the quiz. This again was my fault as I should have incorporated essay type question for answers requiring 3-5 sentences or lists instead of short answer questions. I did mitigate this problem by manually marking the short answer questions that night and issuing edited marks the following morning.

Step 6 Analyses of the Quiz Results

The mean grade from the Botany Practical Assessment Quiz was 45.55% ± 10.86% (standard deviation) with overall grades ranged from 21 – 67% (Figure 1). The grades were not as high as expected but after having a chat with the class the following day the consensus was they don't spend enough time studying botany or attending botany lectures and practicals. When they went through the answers and the notes together they realised all the questions had come from their pre-practical handouts and other material given in class. For some students, it was a worry because the botany practical assessment quiz marked the end of the botany module and there were still almost 2 months before the final written examination in the summer. They were worried they will not remember anything so I have suggested running another quiz in study week for those interested in revising some of the botany terms and processes; I have heard nothing back yet.
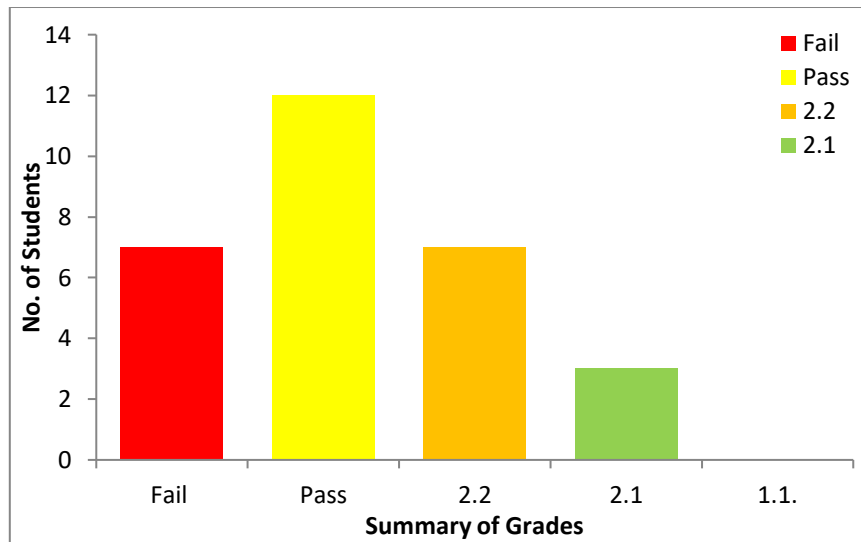
Figure 1 Number of students achieving grades fail, pass, 2.2 and 2.1 for the Botany Practical Assessment Quiz

Lessons Learnt

1. Use Free instead of Sequential as a question navigation method in the quiz to allow students better access to flagged and skipped questions while doing the quiz
2. Gain a better understanding of the Quiz Statistics Reports and how to identify faulty questions
3. Use Essay Questions along with short answer questions using essay questions for answers with 3-5 sentences and short answer questions for one word or statement answers
4. Produce a clearer and more concise Screencast of the quiz procedure and get a proper head set to reduce interference
5. Provide more detailed feedback on how the student can improve their botany learning and understanding. I provided general and overall feedback but was not specific enough in how students could better there understanding of botany to increase their grade next time
6. Remove the correct answer – instead provide structured feedback on improving understanding and thinking of botany
7. Use formative quizzes during term or after every practical to allow students time to engage with the topic
8. Use final summative quizzes only at the end of the module

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