

# Creating Learning management system using randomly selected question banks for Effective e-Learning

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**ABSTRACT:** *This document aims at explaining how more control could be added to quizzes based on randomly selected question banks by simply infusing the questions banks with non-randomly selected categories created as needed. We will explain the standard quiz creation model based on the use of randomly selected question banks, then a comparative explanation will be presented on the suggested method displaying its advantages. The suggested method and the model method are both using Moodle as a learning management system.*

**Keywords:** Moodle, Quiz, Question bank, Randomized Questionsets, Non-randomly selected question sets

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## 1. Introduction

In 2001, Prensky noted that today's students, from kindergarten to university, "represent the first generations to grow up with new technology." These students, whom Prensky (2001) coined "digital natives," have lived their entire lives surrounded by computers, mobile phones, video games, email, and other digital tools. They expected similar technology in the classroom.[1] That was true back in 2001. The yet newer generations have in actuality practiced this technology in the classroom. They understand it, work around it and can unlock most of its secrets.

Newer approaches and better utilization of this technology is, therefore needed. Assessment of students' learning is achieved through online quizzes in several universities. Setting up an online quiz, which truly tests this learning is proving harder and harder every day as students tend to get over the security measurements associated with quizzes. Moodle quiz engine is a powerful, flexible tool for monitoring and diagnosing student performance with certain types of knowledge. Using this tool effectively can boost your course's effectiveness, and promote student performance. While a computer-scored quiz is a different performance than more open-ended assessments, it does give a valuable window onto student thinking, especially when you use good strategies, and a little creativity [2].

Moodle.org website warns under the title 'Effective Quiz Practices' that there will be printed copies of your questions available to students who want them. Most instructors don't realize students frequently have copies of old paper based tests, and electronic test delivery is another way for students to get copies of the questions. I know one professor who had over 1100 questions in his online test bank. At the end of the semester, he confiscated a printout from a student. It had every question with the correct answer, neatly formatted and divided by textbook chapter. We decided if students wanted to memorize 1100 questions and answers to the level where they could answer a small number of them displayed at random, then they would have learned more than if they had just studied. Of course, we used timed quizzes and other strategies to minimize using the print-out as a reference manual [2].

Faced with these new obstacles, we were determined to develop more intelligent approaches that will help us maintain online testing while at the same time preventing students from copying and printing repeated questions, thus achieving results that do not mirror their true learning achievements. You could see students preparing for quizzes with color formatted sheets handed out from one to the other. In their answers, some of the answers were misplaced under the wrong question. Quizzes in the current format were testing memorization skills rather than true course understanding. This was deeply reflected in their final examination grades. A big gap between quiz average results and final average results was noted. Quizzes were not preparing students for their final examination as should be the case.

## **2. Standard Method For Setting Up A Quiz**

### **2.1 Creating a question bank**

In most reviewed quiz setup guides, you are generally advised to first create a question bank with a clear plan and good category structure. In the HSU Faculty Guide to Moodle- Spring 2006 [3], it is suggested that Categories can be used to manage random questions. For instance, you may create a category for a topic, and then have Moodle pull a set number of questions from this category at random for each different student. This is another feature that helps to prevent students from cheating. The use of randomly selected questions pulled out from a pool of questions seems to be the norm in almost all quiz setup references. Randomly selected questions are highly appraised as the best technology to overcome repetitions, cheating and tedious preparations of question banks. Several ideas are suggested on how to intelligently make good use of this technique.

### **2.2 The example of Open University UK**

Moodle.org sites as a good example of creating questions' variants, the Open University, UK [2]. It can be seen at <https://students.open.ac.uk/openmark/mul20.m5omdemo/>. If you take that test once, make a rough note of the questions you are asked, then after you have done 'End test', do 'Restart entire test' and see that you are asked a different set of questions that have different answers, although they test the same knowledge. This sort of strategy is easier to implement in some subjects than in others. This technique depends on creating questions' variants such as the example, this might be a Embedded answers (Cloze) question type. The question text might be:

Below is a plan of a proposed garden. The scale is that each division in the plan represents a length in the garden of 0.5 metres. What is the proposed length and width of the Patio in the garden?

To easily create a variant, click the edit icon next to the first question, make the changes you need to turn it into the second variant, then use the 'Save as new question' button to create the second variant. Repeat this process to create as many variants as you want.

In our example, (figure 1) we might change the word Patio, and the scale factor each division represents 0.5 metres. We would also need to change the answers and the associated feedback in the {CLOZE syntax} bits.

Once you have created all the questions, add them to the quiz using the 'Add random question' feature. Select the first category (Reading a plan variants). Use the controls to Add 1 random question to the quiz. Repeat for each of the other categories in order.

One issue you have to worry about is, are all the variants you have made of each question really equally difficult? Moodle 2.0 will feature a new Statistics report which should help you analyse your quiz results to see how difficult each variant is.

Experience shows that 'a few variants' can normally be taken to be 3 variants. This is enough to ensure that two students working at neighboring computers will mostly get different questions to each other. More is better (providing you can ensure equal difficulty) but is more work, so you get diminishing returns [2].

The example above, although intelligent poses some difficulties in implementation. It is applicable to limited numbers of topics. You are required to think creatively and create variants. This is not easy work.

### 3. The Self-Test

Teachers can also prepare zero point quizzes [4] in order to help students prepare better for the real quiz. The use of the self-test, although helpful, proved to be rather unhelpful in the end. As teachers created the zero self-test from the same question bank they will be using for the real quiz, students started memorizing the self test question set rather than really using it for its original purpose, testing their quiz preparation. In the comment above from moodle.org website, printed copies of the self-test were passed around by students preparing for the quiz. Upon observation in the case of students taking a course in Arab Open University, Saudi Arabia branch, high results were achieved in quizzes that were created using the same question bank of the self-test. This high result though was not mirrored in the paper-based final examination of the same course. This highlights the fact that students memorized the question bank rather than learned the concepts and information covered by it. In a 30 marks quiz in one of the Arab Open University courses in Saudi Arabia branch, an average of 23/30 marks was achieved in a quiz that was created based on the same question bank used in the self-test. Whereas an average of 11.8/30 was achieved in a quiz that was created based on a percentage of the randomly selected question bank plus the infused non-randomly selected question set.

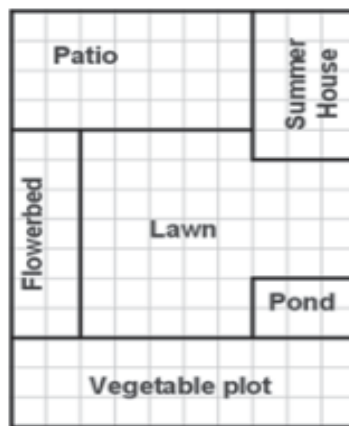


Figure 1. Question creation model

### 4. The Standard Method For Creating Quizzes

As seen above, the standard method for creating quizzes based on a question bank with random question selection has several advantages. The technique has intelligence and provides good results. However, it is efficient in the presence of two factors: the creation of a rather large question bank, and the controlled environment of the quiz deployment. The number of questions available in a question bank depends in fact on the number of students who will sit for the quiz. The larger the number of students, the larger the number of questions needed. In a course of 1000 students, a huge question bank will be needed. This entails long time in preparation, review of questions difficulty and diversity levels. If the quiz is to be performed on a controlled time and date setup, then better results could be achieved. However, if the quiz is to be available for several days, then leaks of the question banks will definitely happen.

### 5. The Case Of saudi Arabia Branch

Arab Open University, Saudi Arabia branch boasts a large number of enrolled students spanning 6 regional centers with varying density. Quiz implementation of all students at the same time proved to be a difficult endeavor. Communication among students at the various regional centers was a helping factor in spreading the question bank contents even faster. A more efficient approach was required.

### 6. New Approach To Quiz Setup

Teachers can virtually split quiz contents into two parts. Part 1 of the quiz will be based on randomly selected question from the available question bank. Part 2, however, will be based on a set of non-randomly selected questions that will be manually infused into the quiz. An example of this setup is provided below:

### **6.1 Create the standard question bank**

We will follow all the suggestions above and create a question bank of reasonable size and good category structure.

### **6.2 Split the quiz virtually into 2 parts.**

- Assume part 1 is equal to 30% of the quiz mark. 10 questions each of 3 marks value will cover this percentage.
- Assume part 2 is equal to 70% of the quiz mark. 7 questions each of 10 marks value will cover this percentage.

### **6.3 Create the non-randomized sets**

Create an appropriate number of categories to include the non-randomized sets. Assume the creation of 7 categories to follow the above example. Each category might include 5 questions. Categories could be created either based on a certain topic/ chapter or on quiz form number that will be discussed later.

### **6.4 Setup the quiz**

- Add the 10 questions that makeup part 1 from any of the categories you have previously prepared.
- Select manually one question out of each of the 7 nonrandomized sets
- Name the quiz as Form A.
- To create a new quiz, you will repeat the steps above. Each time selecting a different question from each of the 7 non-randomized sets, and you will give the quiz a different name, Form B for example.

## **7. The Suggested Model**

In retrospective, you will note that the suggested model depends on infusing the question bank with only 35 extra questions coming from 7 different categories. The different combinations of these 35 questions will give  $57 = 78125$  different sets of the virtual part 2 of the quiz setup. Accordingly, if we assume that we need to create a huge number of different quizzes, then the effort will be mainly in creating extra questions in the non-randomized set rather than the need to add hundreds of questions to the open question bank. The suggested model gives the students a breath of air through the 30% that was drawn from the pool of the question bank. It gives the real test through the infused 70% coming from the non-randomized question sets.

Newer forms could be created as needed. Newer questions could be added to the non-randomized categories ensuring that students will get a new set of questions as they were written, rather than adding newer questions to the randomized pool and expecting that they might appear randomly to some students.

The creation of newer forms could be done on daily basis or by regional center. Older forms already exposed to students could be closed.

The self-test could have a separate category set. This way, students will still get an idea of how questions are formed, yet they will not see the same question repeated in the real quiz. Questions that might get leaked could be easily eliminated from the manually added pool of questions without the need to re-work the question bank.

In the above example, an addition of 7 new questions, one in each of the seven categories, will grant 279936 sets of the virtual part b, adding 201811 new sets to the original number. Ensuring that neighboring students get different questions could be achieved through creating different forms and assigning each student a form different from the other. Students should be notified that they might get a fresh set of questions rather than the ones seen in the self-test to avoid disappointments.

When downloading the grades of the course to an Excel file, for example, MAX function could be easily used to get the grade of the quiz form the student took. If the university allows taking the quiz multiple times, then MAX function would still give you the highest quiz mark achieved.

## **8. Disadvantages**

One main disadvantage was that students could take the quiz several times even if it is not allowed since Moodle treats each

form as a separate quiz. It would be practical to have the quiz activity linked in some way to other quiz activities. Thus it will ensure that each ID or student will get any of the forms only once.

Being able to copy and paste the quiz activity to create multiple forms of the quiz could help in faster creation of different forms. A suggestion to do this through backup and restore is yet to be tried to test its validity. Arrangements must be done to ensure that all tutors working on the course are aware of which forms to give to students and how to deploy the idea behind multiple quiz sets.

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