DEVELOPMENT OF A STUDENT-SEARCHABLE DATABASE OF VETERINARY MCQS WITH EDUCATIONAL FEEDBACK, FOR INDEPENDENT LEARNING

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Abstract

The OCTAVE Project aims to provide the students of the English veterinary schools with a database of Multiple Choice Questions (MCQs) to support their learning. The questions have been written by veterinary academic staff and practitioners, and contain educational feedback to aid the students' understanding of the correct response. There is always a problem when assembling a database to serve multiple institutions in that the curriculum content and sequence is likely to be different. Therefore, it is essential that the students can select the appropriate categories of questions to use.

In order to make the database readily searchable, questions have been meta-tagged so that students from any institution can make selections in a defined subject area. The search tags for the questions are:

- Stage of course: i.e. preclinical or clinical
- Species
- Body system
- Discipline- scientific/clinical
- Sub-disciplines

The search occurs as each tag is chosen and the number of questions available after each search is indicated. This allows students to decide whether they want to focus

the search further or whether they are happy to be presented with all the questions in a certain area.

Students can choose to attempt the selected questions in three different ways:

- Assessment mode correct/incorrect score given only
- Assessment /Revision mode with correct/incorrect indication and running total given, and with individual question feedback available after taking all questions
- Revision mode/instant feedback which is given after attempting each question

Student activity is recorded and students may retake a previous test or may choose to review/retake only those questions which they previously answered incorrectly.

The feedback that is offered to the student has three components:

If the chosen answer was incorrect the feedback:

- explains why that option is not correct
- gives a hint to the correct answer- but does NOT give the answer
- provides a reference for further study

If the correct answer is chosen, the feedback:

- confirms and reinforces that the answer IS correct.
- gives some further useful information (like icing on the cake)
- provides a reference for further study

This form of feedback follows best educational practice in identifying deficiencies of logic, stimulating student reflection, and offering extra references and information as a "carrot" for completion.

The database may also be used by lecturers at each institution in similar modes, or to select questions for use in institutional assessments. The responses given by students for each question are recorded so that subsequent analysis can determine: the effectiveness of the question, frequency of choice of each distracter and the level of difficulty of the question. This will allow lecturers to choose questions of known difficulty to present to students for formative examinations or use in summative examinations.

3072 questions have been authored onto a Microsoft Word Template, peer reviewed, assembled into an Excel spreadsheet, tagged and imported into the Speedwell Database 'WebQuest'. This will be made available to be accessed through the web by authenticated veterinary students at each of the English veterinary schools after testing is completed.

Introduction

In this short preliminary paper, we will detail the different criteria that have been considered when developing a database of MCQs with formative feedback, that are intended to be used for CAA by staff and students in the English Veterinary Schools. For a number of reasons, the database has not yet been formally used by students, so that analysis of student use and the effectiveness of the database as an elearning tool has not yet been under taken. The reporting capacity of the database and surveys of student use and experiences will be presented at a later date.

As a consequence of the differences in curricula and teaching strengths of the Veterinary schools, and the individual Institutional requirements, it was agreed that the database would be a standalone facility aiming to improve the learning experience of veterinary students and not institution orientated.

Authoring of questions was based around the learning objectives at each institution which were perceived as being different in detail but broadly similar. As well as staff at the institutions, a number of questions were authored by students at one of the partner institutions. Each question was based on a specific learning objective and for the student authored questions these were reviewed by academic staff prior to their acceptance to the database. In addition, questions were commissioned from Veterinary Surgeons not associated with the teaching institutions. However, even in this instance, questions related to specified learning objectives.

At the start of the Project, the only universal acceptable form of MCQ used at the partner institutions was the 'single best answer' format. However even in this there was not complete agreement. One institution preferred one correct out of four options, the other three institutions requested one correct out of five options.

The database currently comprises 3072 questions of the single best answer from five options format. A little more than 300 of the questions contain images. These questions were collected into an Excel spreadsheet, metatagged and imported to the Multiquest (Speedwell Computing Services, Wellingborough) database.

The questions of the database are 'core' for the Bachelor of Veterinary Medicine program (BVetMed). These will be used in a number of ways by students for formative self testing or the database will be used staff of the veterinary schools, as a depository of peer reviewed, validated questions for setting electronically delivered assessments in various formats.

A specific requirement of the project was that the database should be compatible with Questionmark Perception, (QTI XML format), used by one of the Institutions to hold high stakes examinations. Also it had to be compatible with the Institutional emerging Virtual Learning Environments (VLEs) such as Blackboard. Finally, it was required that the questions could be readily converted for use in PowerPoint, so that time controlled formative or summative assessments could be readily performed; this being used by yet another of the veterinary teaching institutions.

Topic-specific Question Search Facility

A major difficulty when developing a common database for multi-institution use is that the user should be readily able to access the questions that they require without referring to a specific course component. In order to make the search facility generic, the questions have been meta-tagged to allow students from any institution to make selections in defined subject areas. After consideration of highly defined tagging systems e.g. SNOMED CT®, we have been forced to be pragmatic and have adopted a simple but effective system. Each question is metatagged for

- Stage of course: i.e. preclinical or clinical
- Animal Species
- Body system
- Discipline- scientific/clinical
- Sub-disciplines

The content of each list refers only to items that are present in the database, eliminating the possibility for searching for items that are not available. As further questions are added to the database, it may become necessary to add more items into these search lists and the software is designed to readily allow this.

We have designed the search facility to be user friendly, the major choice items - 'Animal Species', 'Body System' 'Discipline', 'subdisciplines' - being viewed within the same screen.

The choice of an item is made by clicking on it's tickbox in the list, although, in some instances, more than 1 item within the list may be chosen. Re-clicking on a chosen item removes it from the chosen items. We have decided to adopt this scheme after discussion with a number of students who are already users of e-media. Dropdown lists or free text are not considered effective for this activity.

After choosing a tag, the computer searches for appropriately tagged questions occurs and the number of questions available after each search is indicated. This allows students to decide whether they want to focus the search further or whether they are happy to be presented with all the questions available in the chosen area(s). Indeed not all topics need be chosen, if only a particular species is chosen, then the presented questions will be of any relating to that chosen species.

Should the situation of 'zero questions available' occur after an item choice, the user will be able to readily identify which choice led to the prompt. The user may alter that chosen item, or any other chosen area so that selected questions may be found.

Staff Use

The database was designed to fulfil a number of requirements of staff from the different institutions, although the overall principle is as a repository of questions that have been previously used and validated for discrimination and difficulty.

Staff will be able to use the database to select questions for use in a number of situations:

- in a high stakes summative assessment, which may be run in Questionmark Perception (Questionmark Computing Limited) or in a VLE such as Blackboard (Inc) or in Multiquest (Speedwell Computing Services, Wellingborough) or in Microsoft PowerPoint in a time-controlled manner.
- in a formal formative assessment, being presented in the formats noted above.
- as an end of lecture brief test, which may, in addition, use an electronic classroom communication system to gain immediate student 'feedback'. The presentation for this use is likely to be Multiquest or PowerPoint, both of which may run without any further interaction.

• for setting a formative assessment for later use by students within a set period for student self-assessment / e-learning.

Student Use

The database of questions is designed through formative feedback to aid students in self -assessment so that they can develop learning strategies which enhance their factual knowledge. In addition, about one third of the questions in the database are not merely memory recall, rather they provide students with information or material in the stem, and the responses require that students analyse, interpret, or make choices about that material.

Students may use the database to search for relevant questions as defined already.

Questions are presented with a stem and 5 possible responses, only 1 of which is correct. Subsequent viewing of a particular question will present these 5 possible responses in a different order so that the content of the response is important not its position in the choice list.

Students may use the database to self assess/ e-learn in a number of modes:

• Self-Assessment mode, where the feedback is the correct/incorrect score only.

In this mode the student attempts the chosen questions in groups of 10, or as many available if less than 10. On completing the questions the score for the questions answered correctly is given. In addition, there is indication of whether each question was answered correctly or not. There is no other feedback, although the questions may be attempted again in retake mode.

• Self-Assessment /Revision mode.

In this mode the student may attempt the chosen questions but after completion of all questions, the score is given, together with an indication of whether each question was answered correctly/incorrectly. However, in this mode, each question may be reviewed, together with the feedback about the chosen answer, be it correct or incorrect.

• Revision mode/Instant feedback.

In this mode, immediately after attempting each question there is feedback on the answer chosen. The question may be re-attempted in order to achieve the correct answer before moving on to the next question. A score is not given to the student. However, the first choice answer to that question is recorded within the reporting system of the database for subsequent analysis related to question difficulty.

• Review of previous tests.

Every use of the database by a student is recorded within the system. This will allow students to re-view and re-attempt questions that they have previously attempted. On choosing a particular previously attempted set of questions, they are presented with a list of question numbers in the order previously attempted and an indication of whether they answered each question correctly or not. They can choose to view and answer the complete set of questions again, or to attempt only those that they answered incorrectly at their first attempt. They can also choose to answer them in one of the modes discussed above; Self-assessment, Self-assessment and Re-vision, or Revision. The distracters will be presented in a different order from that used previously.

In all modes chosen, student data is recorded for production of reports on student activity, and details relating to first responses made are stored to allow analysis of the question characteristics.

The establishment of a database of focused questions will allow more informal formative assessment in veterinary courses and for the first time self assessment on material chosen by the student. A similar but less extensive and non- searchable web based database of questions exists for medical students at Birmingham University School of Medicine (MedWeb). Cook (2001) has reported that students' final examination marks were closely related to the number (and frequency) of computer marked assessments that students had tackled and the development of this database is intended to give veterinary students this opportunity for self-directed improvement.

Educationally Instructive 'Feedback'

The term feedback has different meanings to different authors and different forms of feedback have different outcomes (Yorke 2001, Gibbs & Simpson 2004). Members of the different Veterinary schools expressed different wishes in relation to feedback. Some considered that the mark that a student obtained was necessary, others considered that feedback required only giving of the correct answer, and another group considered that marks and a commentary on the student's response were needed.

There are different outcomes from feedback, dependant on the type of feedback given. Feedback given as marks or grades alone has been shown to have negative effects on the self esteem of students of low ability (Craven et al 1991, Wootton 2002), whilst Butler (1988) has demonstrated that comments alone, which may be termed 'remedial feedback', improved students' subsequent interest in learning and performance.

We have taken account of the principles for providing feedback that will stimulate student's current learning suggested by Nicol & MacFarlane –Dick, (2004).

The definition of feedback that we have adopted is that feedback is 'correction of errors' (Bruner, 1974), and that feedback must be effective in leading to a change of student behaviour (Yorke 2003). In other words, the student is required to make some kind of response to complete the feedback loop (Sadler 1989).

According to the format in which the database is used by a student, the feedback given may offer some or all of the following:

- A) Scores achieved (ie total score for the entire assessment).
- B) Notification of the correctness or not of a response (ie each question answered correctly or not).

C) Guidance based on a student's response – i.e. educationally instructive information designed to stimulate the student to think again and re-answer the question.

Educationally Instructive Information

The model that we have adopted for educationally instructive feedback is an amalgam from various authors but strongly based on results discussed by Gibbs & Simpson (2004).

Feedback can perform several functions:

- correct errors
- develop understanding through explanations
- generate more learning by suggesting specific study tasks

This has been interpreted in a practical manner so that for most questions in the database, the feedback gives an:

1) Explanation of why the answer chosen is not correct, and, if appropriate, an explanation of what the chosen answer actually is/ or does.

2) Offers a hint to the correct answer- or suggests an alternative way of thinking. However the feedback does NOT give the correct answer.

3) Provide a reference to where more information can be found. The Reasoning for this is that

- The student obviously missed looking/reading this before. i.e. "You did not use this before. Read this NOW!"
- The students' Understanding of the concepts is poor and if a student re-reads a topic whilst a question is still uppermost in their minds they are more likely to learn.
- The explanation given in the database may necessarily be brief, the reference giving a greater coverage of the material.

This is to make the students think! Rather than merely paste facts/answers onto their memory banks. There is evidence that students learn best if guided rather that just supplied with teacher packaged factual information (Sadler, 1989).

Conclusion

We acknowledge that this database of MCQs is not targeted on what might be regarded as higher order skills and higher order e-learning experiences achievable through interactive multimedia experiences and e-portfolios. However, in many of the basic and clinical sciences, there is a core of underpinning factual information which needs to be assimilated, and which students, staff, and, ultimately, the general public, need some reassurance, through assessment, has been assimilated. The use of computer-aided methods for both formative and summative assessment of factual information frees valuable academic staff time for the facilitation of learning in areas of identified difficulty, rather than the process of assessment of lower order skills. It also frees time for the development of valid and reliable assessments of both practical skills and higher order thinking skills, such as those related to problemsolving synthesis and extrapolation of knowledge to novel fields.

The authors of the database have tried to achieve two important advances in comparison to existing computer-aided assessment materials. The way in which the assessments have been structured follow good pedagogical principles in relation to either recognising a correct response, or pushing an examinee towards recognising and learning the correct response. The feedback has also been arranged to stimulate further learning, even for those who know the correct response to an individual guestion. In addition, with increased diversity of students, and more demand for individual preferences to be incorporated into computer-aided assessment formats, this interface allows examinees to choose, in a user-friendly fashion, both the content of the test, and also its structure, in relation to whether it is scored without feedback, or whether feedback is provided, and how it is provided. Some students clearly are focused on obtaining maximum marks, whereas other students are much more interested in understanding why an answer is correct, and other answers are regarded as incorrect. Even where students have particular preferences as to how they use multiple choice examinations, these are likely to vary according factors such as the closeness of a large degree examination, and their familiarity with the subject area. Therefore, the system provides variety, meaning that individual students can choose, on separate occasions, any of the different modes of use that best suit their needs and favoured styles of learning at a particular time.

Further Development

A further 200 plus questions are being finalised for incorporation into the database and suitable questions (with feedback) from a current e-learning program for veterinary students (CLIVE) will be incorporated. However authoring quality instructive feedback is difficult and many MCQs were intended merely for assessment. The use of the database will be evaluated and reported. In addition there is discussion regarding a including a choice for the use of questions which have a component of confidence testing.

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