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IUCEL 2022

INTERNATIONAL UNIVERSITY CARNIVAL ON E-LEARNING

INNOVATING EDUCATION FOR A BETTER TOMORROW

INTERNATIONAL UNIVERSITY CARNIVAL ON E-LEARNING (IUCEL)
PROCEEDINGS 2022

**Innovating Education for A Better Tomorrow
International University Carnival on E-Learning (IUCEL) Proceedings 2022**

eISBN 978-967-26517-1-0

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First Print 2022

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Book cover illustration and design: Muhammad Farhan Azmi

Published by
Centre for Academic Development (CADe)
Bangunan Canselori Putra
Universiti Putra Malaysia
43400 UPM Serdang, Selangor



03- 9769 6175



<http://www.cade.upm.edu.my>

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Preface

by the Editors

Centre for Academic Development (CADe) Universiti Putra Malaysia had the privilege and honour of organising the International University Carnival on E-Learning 2022 (IUCEL2022) in collaboration with the Ministry of Higher Education Malaysia (MoHE). The event was supported by the Department of Higher Education, MoHE and the Public University e-Learning Council (MEIPTA). IUCEL2022 which was organized virtually on Gather, a metaverse platform from 28th to 30th June 2022, has marked UPM's capabilities to unearth the talents of 294 e-learning innovators representing 38 institutions from 10 countries (Malaysia, Germany, China, South Korea, Jordan, Iraq, Singapore, Philipines, Indonesia and Myanmar). IUCEL2022 was successful in providing a platform for educators to facilitate the dissemination and sharing of their innovation on e-learning which are aptly reflected through the papers presented in this e-proceedings.

We invited all presenters of IUCEL2022 to submit their extended abstract in June 2022. The selection of 163 articles from diverse disciplines was then concluded in September 2022. All papers were subjected to substantial peer review to ensure their originality, significance and impact on higher education..As a result, we are confident that this e-proceedings will be of interest to a diverse readership.

The theme of IUCEL 2022 inspired the title of this e-proceedings, "Innovating Education for a Better Tomorrow". We would like to take this opportunity to thank Professor Dr. Ismi Arif Ismail, the Advisor of IUCEL2022 as well as Associate Professor Dr. Wan Marzuki Wan Jaafar, the Chairman of IUCEL2022, for their vision and exceptional leadership in making the event a reality. We would also want to express our profound gratitude to all authors (as well the reviewers) who put in immense effort to contribute to these e-proceedings.

Finally, we would like to put on record our gratitude to all staff members at CADe, who made IUCEL2022 a resounding success.

Think Before You Answer: Fostering Deep Thinking among Students Through Moodle's Certainty-based Marking (CBM)

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Abstract

The quality of students' grasp of what they have learned in class is unclear to the instructors in multiple-choice assessments. Multiple-choice assessments do not allow students to elaborate on their answer arguments because they are evaluated simply on the answers they have supplied. The student's level of understanding, on the other hand, is unknown to them. We used Moodle's certainty-based marking (CBM) to encourage students to think deeply before settling on their final answers to these tests and quizzes. This CBM method feedback will reveal whether the students are overconfident in their knowledge. CBM assigns weightage to correct and incorrect responses, as well as certainty levels that students must select before settling on their final answers. After using this method in quizzes and multiple-choice assessments, students are more in tune with their knowledge levels, and they are aware of the learning units that they need to improve in their courses. Through this study, both students and instructors will be able to have the benefits to assess the class knowledge level on units and topics learned in class.

Keywords: CBM, certainty-based marking, assessments, multiple choice, deep thinking

Background of the Research

Confidence judgments made alongside test answers can stimulate more careful thinking, assisting learning and recall. In class, students need understanding: knowledge of how different facts relate, and how they can be used to check one another. During formative and summative assessments, the quality of students' grasp of what they have learned in class is unclear to the instructors, especially in multiple-choice assessments. Multiple-choice assessments do not allow students to elaborate on their answer arguments because they are evaluated simply on the answers they have supplied. The student's level of understanding, on the other hand, is unknown to them. This study explored on how to bridge this knowledge gap using the Certainty Based Marking (CBM). The CBM concept was introduced by Prof Emeritus Tony Gardner-Medwin, University College London, and originally called Confidence-based Marking. When the name changed to Certainty-based Marking, the aims and principles have not changed which is to provide a more reliable assessment than simple right/wrong marking.

The CBM method fosters the practice of "How sure are you?" when students undergo multiple-choice types of assessments. The CBM challenges students to look for justifications and reservations, which according to Prof Gardner-Medwin, are seldom explored in objective testing.

Description of the Research/ Innovation/ Invention/ Design

In this project, we are doing the preliminary steps of introducing CBM to students, mainly for them to get used to the assessment method. The CBM works as follows (assuming the default mark per question is 1 mark):

Table 1: The Marks Awarded at Each C Level for Correct and Incorrect Answers.

Certainty level	Mark if correct	Penalty if wrong
C3 (high)	3	-3
C2 (mid)	2	-2
C1 (low)	1	0
No response	0	0

Table 1 shows the level of certainty that will be chosen by students when answering questions in multiple-choice assessments. The certainty level will determine the CBM marks depending on if the student gets correct or incorrect for their answers. For example, if a question has 1 mark weightage, and the student answers with high certainty (student chose C3), the mark if the students answer correctly will be 3. If they choose incorrect answers, the penalty will cause the mark to be -3.

The same goes for certainty level 2 (unsure or not very confident of the answers), and low certainty (very unsure of the correct answer), the CBM marks will reflect after the answers are checked for correctness.

We introduced the CBM to students as a series of activities, for Database Concept and Design course, which consists of 48 students. In these activities, the difficulty of the questions is generally at the same level of difficulty, with the freedom to refer to notes when answering the questions.

Figure 1 shows the sample of the question given to the students, mainly testing their fundamental understanding of the concepts of database design, using multiple-choice assessment. The quiz was given right after students learned about the unit in class. For each question given, there are certainty-level options given for students to choose, based on how sure they think their answer is correct.

Refer to the figure below.

Why does the supertype and subtypes show **overlapping with partial completeness constraint**?

- a. Because all employee must be both administrator and professor.
- b. Because every employee must be an administrator or professor only.
- c. Because any employee can be both an administrator and professor.
- d. Because an employee can be either administrator or professor only.

Certainty(?) : C=1 (Unsure: <67%) C=2 (Mid: >67%) C=3 (Quite sure: >80%)

Figure 5: Sample of Activity Questions to Test Students' Understanding, with CBM at the Bottom.

Started on	Monday, 11 April 2022, 9:00 AM
State	Finished
Completed on	Monday, 11 April 2022, 9:06 AM
Time taken	6 mins 37 secs
Grade	0.00 out of 6.00 (0%)
	For CBM, the grade above is shown relative to the maximum for all correct at C=1.(?)
Results for the whole quiz (6 questions)	
Average CBM mark	0.00
Accuracy	66.7%
CBM bonus	-6.7%
Accuracy + Bonus	60.0%
Break-down by certainty	
C=3	Responses: 1. Accuracy: 0%. (Optimal range 80% to 100%). You were over-confident using this certainty level.
C=2	Responses: 5. Accuracy: 80%. (Optimal range 67% to 80%). You were OK using this certainty level.
C=1	No responses

Figure 6 : Sample of Feedback in a Student's View

Figure 2 shows a sample of the feedback in a student’s view right after they finished answering the quiz. In this feedback, we only emphasized the *Break-down by certainty* part, because throughout the experiment we focused on working with students’ level of certainty, so they understand their own knowledge level.

In this example, there are six 1-mark questions, and five of the questions the student chose

certainty level 2, and one question with certainty level 3. Four out of the five questions were correct (80% accuracy); hence the feedback told the student that it is okay to choose the certainty level. There is one question with a high level of certainty, C3, but unfortunately, the answer was incorrect, hence the feedback showed that the student was over-confident using the C3 certainty level for that question. To summarize these findings, the student did not truly understand the concept that he/she chose C3 for, but for the rest of the questions that he/she was unsure about, he/she understood well in class. This came as a surprise to the student, and it gave the overview of which concepts he/she are better at.

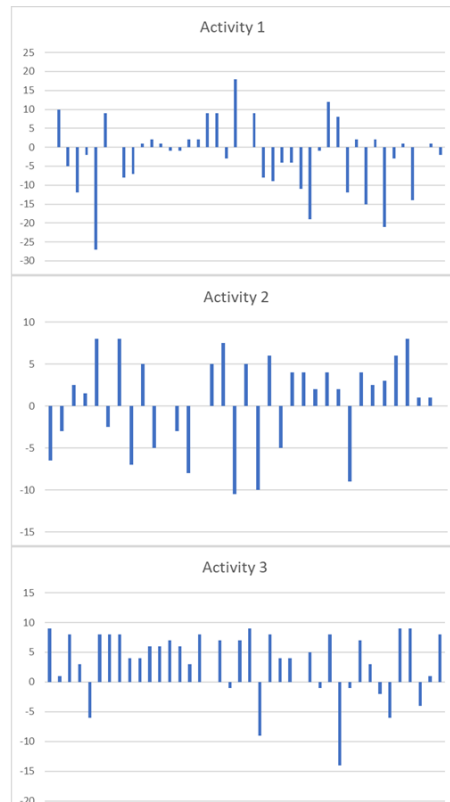


Figure 7 : Students' Results after Three Activities

Figure 3 shows the CBM marks of students in each quiz (labeled as activity). The bars above the lines indicate positive marks, and below the lines are negative marks. Negative marks were obtained if there are answers with high certainty levels that are incorrect, which contributes to -3 penalties. Each activity has six simple concept questions to test the students, which has the cognitive level of C2 and C3, to ensure the difficulty of each activity was in the same range. The activity was given after lecture sessions.

After a series of activities, there is a subtle reduction in total students who obtained penalty or negative marks (high certainty chosen, but incorrect answers). Although it is a possible indicator that the students are more in tune with their level of understanding in the course's learning units and taking time to ensure they are confident with their answers before submission.

Significance of the Research

This project shows the benefit of using CBM as one of the assessment methods to assist instructors to gauge students' understanding of learning units. It is beneficial to help students see if they misunderstood the learning materials as well.

Impact of the Research Towards Education or Community

CBM as one of the assessment methods used during teaching and learning could elevate the mutual understanding of the course materials, for instructors and students, and this impact leads to better learning environments. After using this method in quizzes and multiple-choice assessments, students are more in tune with their knowledge levels, and they are aware of the learning units that they need to improve in their courses. Through this study, both students and instructors will be able to have the benefits to assess the class knowledge level on units and topics learned in class.

Commercialization Potential

CBM method is very suitable for evaluating the theoretical and practical understanding of high-level skill-based training, for example, in the medical and aerospace domains. These domains need accurate knowledge skills and the CBM method can be used to test trainees' knowledge to gauge the correctness of their theory understanding before undergoing practical training.

Conclusion

Students have a range of different strengths and weaknesses. CBM makes a diverse mixture of questions work well, helps students identify their own knowledge strength and weaknesses, as well as to build confidence of their understanding. After using this method in quizzes and multiple-choice assessments, students are more in tune with their knowledge levels, and they are aware of the learning units that they need to improve in their courses.

Acknowledgement

Thank you to Faculty of Computer Science and Information Technology, UNIMAS

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