View of student performance using online final examination in semester affected due to COVID-19 pandemic: Bachelor of Electrical Engineering case study

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Keywords: Assessment OBE; higher order thinking Skills (HOTS); open-ended (OE)

ABSTRACT – Higher educational institutions have faced a variety of obstacles in their teaching and learning activities due to the COVID-19 pandemic. Particularly conducting online assessment during COVID-19 has posed extraordinary challenges for higher education institutions. To overcome this issue, the Faculty of Electrical Engineering took an obligatory approach that the evaluation of final examination assessment must contain 30 or more out of 100 marks open-ended (OE) or higher-order thinking skills (HOTS) questions to guarantee the quality of assessments in line with the objective of Outcome-Based Education (OBE). The paper presents the assessment's results of the selected courses offered in semester 2 for the academic session 2018/2019 (no COVID-19 issue) and session 2019/2020 (during COVID-19 issue) for the Bachelor Electrical Engineering (BEKG) program in the Faculty of Electrical Engineering (FKE), Universiti Teknikal Malaysia Melaka (UTeM). According to the findings, the distribution of grade success follows a standard bell shape, with most students receiving ordinary grades (B or B-).

1. INTRODUCTION

Since the COVID-19 pandemic lockdown situation, the teaching and learning in higher education institutions (HEI) have converted their focus in teaching and learning from face-to-face to virtually using many platforms synchronous and asynchronous so that the education activities can be conducted and are not affected. The most critical part HEI is facing is how to conduct the assessment, especially the final examination. Many HEI has reported alternative approaches, such as take-home exams, time-constrained assessments, pass/fail options, professional presentations, and E-portfolio [1,2].

To monitor and maintain the quality of online assessment during the COVID-19 pandemic, the strategy and some preventative approaches are being considered, such as virtual invigilation; however, this approach has a huge expense [3]. It is critical to adjust the technique of the evaluation following the distribution of grade achievement. Given the previous way strategy that is being studied, the other way is by implemented method assessment of final examination questions, which is the 30 marks out of 100 marks use higher thinking skills (HOTS) or open-ended (OE) questions. HOTS and OE concepts focus on student comprehension in the learning process using their own techniques, and they are capable of teaching students to think creatively, critically, and innovatively. Because of the benefits of HOTS and OE questions, this pattern of questions is promoted in the context of an online final examination [4].The assessment method is important to the teaching process. In general, HEI uses the summative and formative assessments in the courses to determine the actual outcomes match the anticipated learning goals of the educational programs.

The summary of the statistical analysis and interpretation of empirical evidence given in the Bell Curve has been introduced [5]. Grading on a bell curve is a method of awarding grades in education that produces a desirable distribution of grades among a class's students [6]. The normal distribution of grade achievement is presented in bell curve shape [7] as shown in Figure 1. The normal distribution is a continuous probability distribution that is symmetrical on both sides. The center's right side is a mirror image of the left side, and the center contains the most significant number of a value.

This paper focuses on analysing the assessment results of selected courses before and during the COVID-19 pandemic for the BEKG program in FKE. The courses that applied 30 or more marks out of 100 in the final examination question must be higher thinking skills (HOTS) or open-ended (OE). Section 2 presents detail on the method assessment for course evaluation that has been implemented in FKE. The grading system in courses evaluation is also offered in Section 2 for the BEKG program in FKE. The validation of the grade achievement before and during the COVID-19 situation is summarised in Section 3.

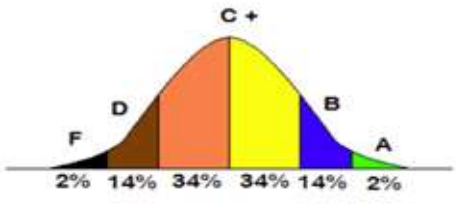

Figure 1 Bell Curve Grade Chart [7]

2. COURSEWORK ASSESSMENT APPLIED DURING COVID-19

The courses evaluation for the BEKG program can be divided into two methods: coursework and final examination. The percentage of coursework marks is 40%, and the final examination marks are 60% [8]. The coursework can be evaluated by formative or summative (quiz, mid-term test, and assignment). This assessment was not affected too much during the COVID-19 pandemic except for the mid-term test. Figure 2 shows the distribution of course assessment for the BEKG program (program core course). The coursework has test (20%), quiz (5%) and assignment (15%). While another 60% marks are allocated for the final examination assessment (summative assessment). The achievement (percentage) of the course for grading is calculated in Equation (1).

$$M_{achievemen}\ (\%) = \sum_{i=1}^{n} A_i + \sum_{j=1}^{m} B_i \qquad (1)$$

where:
$M_{achievement}$ = Student's mark of the course (%)
$A_i =$ coursework marks for i
$i = 1$ to n (eg. $i = 1$ is the mark from the quiz,
$i = 2$ is the mark from test etc.)
$n =$ the total number of coursework's type
$B =$ final examination mark question j
$j = 1$ to m (eg. $j = 1$ is the mark from question 1,
$j = 2$ is the mark from question 2, etc.)
$m =$ the total number of questions in examination

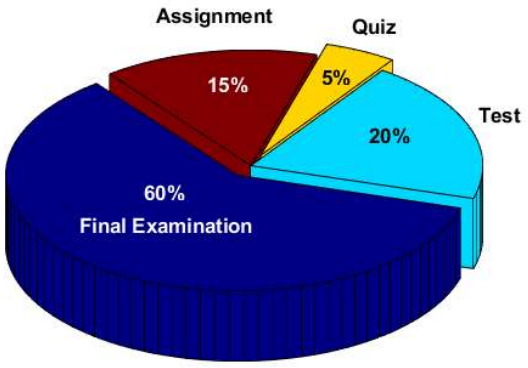

Figure 2 Distribution of assessment evaluation for BEKG Programme in FKE

Since the COVID-19 pandemic, FKE re-distributed the assessment evaluation in the final examination to become a Final Assessment. However, the students still need to answer the final examination paper online with the same time allocation (basically 3 hours for a 3 credits course) but with modifications in the level of difficulty of the questions.

All the core program courses in BEKG must have 30 marks (or more) out of 100 HOTS or OE in the final examination question. It contributes 18% (or more) of total marks ($M_{achievement}$) to maintain the quality of assessments according to the objective of Outcome-Based Education (OBE). Figure 3 shows the contribution of the Final Assessment during the COVID-19 pandemic.

The HOTS and OE questions are helpful to practice in outcome-based educational (OBE) systems, which are made up of four sub-thinking skills: complex problem-solving, critical thinking, creative thinking, and decision-making. Referring to Engineering Programme Accreditation Standard 2020 [9], the range of complex problem solving are defined with depth of knowledge – WP1, range of conflicting requirement -WP2, depth of analysis required -WP3, familiarly of issues -WP4, the extent of applicable codes - WP5, the extent of stakeholder involvement and level of conflicting requirements –WP6 and interdependence -WP7. Hence, the HOTS and OE questions, which consist of 18% marks, are included in the final examination assessment to assess students' abilities in the context of complex problem solving and monitor the quality of their grade achievement.

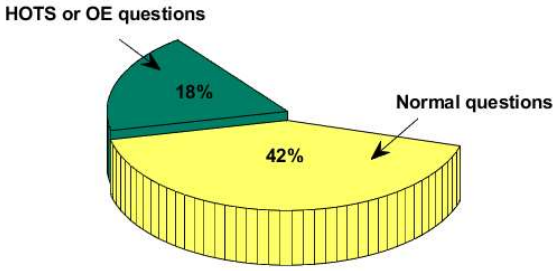

Figure 3 Distribution of final assessment for BEKG Programme in FKE during Covid-19 pandemic

Grading achievements and mark percentages are shown in Table 1. From here, it indicates the justification that 18% must be HOTS or OE questions. This is because the allocation marks are significant can be used to differentiate between excellent and honours students. Student's performance in every course is evaluated based on the grade obtained. Generally, the minimum passing grade for a course is Grade D in UTeM. Grade D up to C- is categorized as a conditional pass, and the students are allowed to improve their grades by repeating the course only once [10]. All students must obtain at least grade D for all courses to graduate.

Table 1 Grading System for BEKG program in FKE.

Grade Achievement	Marks percentages
A (Excellent)	80-100
A- (Excellent)	75-79
B+ (Honours)	70-74
B (Honours)	65-69
B- (Pass)	60-64
C+ (Pass)	55-59
C (Pass)	50-54

C- (Conditional Pass)	47-49
D+ (Conditional Pass)	44-46
D (Conditional Pass)	40-43
E (Fail)	0-39

3. RESULTS AND DISCUSSION

The analysis of results (grade achievement) has been done for selected courses for BEKG's students. For comparison, the evaluation of these results (same courses) obtained from two academic sessions in semester 2, 2018/2019, and semester 2, 2019/2020 as consideration of non-COVID-19 and COVID-19 situation, respectively. Table 2 shows the selected courses and the number of BEKG students taking the courses. Figures 2, 3, 4, and 5 show students' distribution grade achievement for particular courses offered in Semester 2 before COVID-19 (Semester 2, 2018/2019) and during COVID-19 (Semester 2 2019/2020).

In Figure 2, the standard normal distribution of grades is presented. The difference percentage grade achievement of grades A and E, only 0.5 % and 0.3 %, respectively. For course BEKG 2433, as shown in Figure 3, grade B contribute 25.4% during the COVID-19 pandemic and 10.7% before the COVID-19 incident. Figures 4 and 5 demonstrate that the percentage of students who received a C- have almost the same pattern between the two academic sessions.

In general, when implement 30% of HOTS or OE questions in final examination, the grade achievement for all selected courses are comply with the normal curve distribution (majority of students receives grade of B or B-) for grading achievement.

Table 2 Number of students taking courses in Sem 2 2018/2019 and Sem 2 2019/2020

Course (Code)	No. of BEKG students	
	2018/2019	2019/2020
Principles of Instrumentation & Measurement (BEKG1233)	147	79
Electrical System (BEKG2433)	178	177
Instrumentation & Control (BEKC3663)	163	197
Energy Utilization & Conservation (BEKP 4853)	164	159

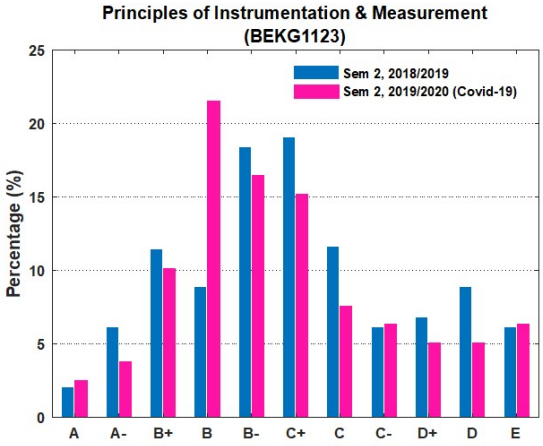

Figure 2 BEKG1233 Grade achievement distribution.

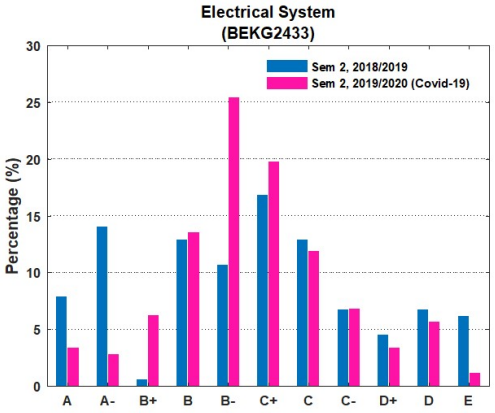

Figure 3 BEKG2433 Grade achievement distribution

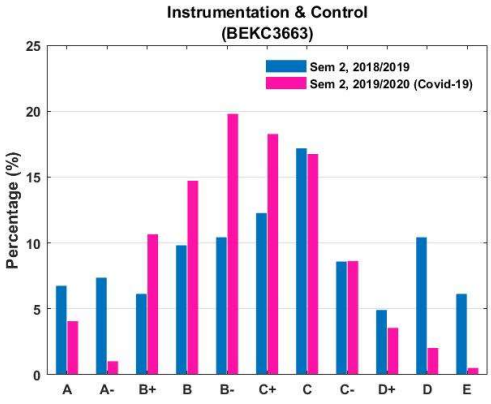

Figure 4 BEKC3663 Grade achievement distribution

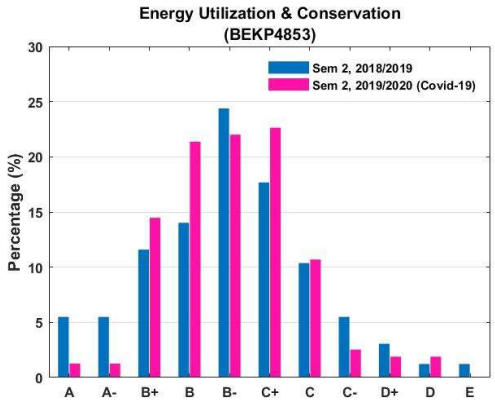

Figure 5 BEKP4853 Grade achievement distribution

4. CONCLUSION

Based on the discussion and findings, it was evident that improving method assessment in the final examination by employing HOTS and OE questions can results in a standard bell shape in the current COVID-19 pandemic. The majority of students receive an average grade (B or B-), with a smaller percentage receiving a B+ or C, and the lower proportion of students receive a grade E or an A. This demonstrates that the suggested technique (30% of HOTS or OE questions in the final examination) will allow students to be screened based on their performance in comparison to their classmates. In the future, at least 30% marks of the final examination questions contain of HOTS and OE will be implemented, in order to increase the quality of students' performance.

REFERENCES

[1] Gamage, K. A. A., de Silva, E. K. & Gunawardhana, N. (2020). Online Delivery and Assessment during COVID-19: Safeguarding Academic Integrity, *Eduation. Sciences* https://doi.org/10.3390/educsci10110301

[2] Guangul, F. M., Suhail, A. H., Khalit, M. I. & Khidhi, B. A. (2020). Challenges of remote assessment in higher education in the context of COVID-19: a case study of Middle East College. Educational Assessment, *Evaluation and Accountability 32,* 519–535.

[3] TestReach. Available online: www.testreach.com/remote-invigilation-online-proctoring.html (accessed on 16 June 2021).

[4] Owi, W. P., Ahmad, A., Adnan, M. & Ang, K. H. (2017). Effectiveness of higher order thinking skills (HOTS) based i-Think map concept towards primary students (2017), *AIP Conference Proceedings* 1847, https://doi.org/10.1063/1.4983886.

[5] Sartori, R. (2006). The Bell Curve in Psychological Research and Practice: Myth or Reality? *Quality and Quantity 40*, 404-418.

[6] Tan, Y. L., Yuen, B. Loo, W. L., Prinsloo, C. & Gan, M. (2020). Students' Conceptions of Bell Curve Grading Fairness in Relation to Goal Orientation and Motivation. *International Journal for the Scholarship of Teaching and Learning 14(1)*, 1-9.

[7] https://www.austincc.edu/sziser/Biol%202404/Grading%20on%20a%20Curve.pdf, (Accessed on 18 Jun 2021).

[8] Academic Regulations & Guidelines for the Academic Regulations System, Bachelor Degree & Diploma Programme, UTeM, (2019).

[9] Engineering Accreditation Council [EAC]. (2020). Engineering Programme Accreditation Standard 2020. https://www.eac.org.my/web/document/EAC%20Standard%202020_approved%20BEM19April2020%20upload%2015June2020.pdf

[10] Fakulti Kejuruteraan Elektrik [FKE]. (2020). Academic Handbook Session 2020/2021 for Bachelor Degree and Diploma Programmes, Faculty of Electrical Engineering, Universiti Teknikal Malaysia Melaka.