CAN THE COMPLETION RATE OF A COURSE BE INCREASED BY LOWERING THE ELIGIBILITY CUTOFF MARK IN CONTINUOUS ASSESSMENT?: A CASE STUDY

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INTRODUCTION

Formative and summative assessments play a vital role in any academic programme leading to a degree. Summative assessment apprises student learning with respect to learning outcomes and is essential for determining the terminal attainment of a student. As such, an end-of-course examination is a purely summative assessment. The facilitation of the teaching and learning process is the major role of formative assessment[1]. Any evaluation activity that provides feedback to the learner, but is not used in determining the final grade, is a purely formative assessment.

Continuous Assessment (CA) is an assessment strategy that depends on the frequency of assessment events[2], and may have both formative and summative components. CA plays multiple roles in an Open and Distance Learning (ODL) study programme[3]. It motivates the isolated distance learner to study continuously throughout a semester, and thereby avoid last minute cramming for a Final Examination (FE). (Continuous engagement in studies is somewhat automatic in a study programme conducted in face-to-face mode where the learner has to attend lectures regularly.) CA improves communication between the instructor and learner through the provision of continuous feedback and builds up confidence in the learner[3]. Due to its importance, ODL institutions not only include a certain fraction of the CA Mark (*CAM*) in the final grade, but also set thresholds in the *CAM* that must be attained to obtain a pass grade in a course[4]. This threshold condition may be viewed as an interim goal set in enhancing motivation and improving engagement by the student in the learning process.

Each course, with a non-zero credit rating, offered in the BSc in Natural Sciences programme at the Open University of Sri Lanka (OUSL) has both CAs and a FE. The Overall Mark (*OM*) is the average of the *CAM* and the FE Mark (*FEM*). A student is considered eligible to sit the FE of a course only if he/she has attained a $CAM \geq 40\%$. This eligibility cutoff in the *CAM* (i.e. 40%) is a threshold condition imposed on the *CAM*. It is important to note that the minimum attainment in the *OM* to acquire a pass grade in a course is also 40%.

If one considers only the formative aspect of CA, then he/she can question whether setting the threshold in a *CAM* that is equal to the pass mark in *OM* is reasonable since a student with a $CAM < 40\%$ may be able to improve and score a higher mark in the FE, and thereby obtain an *OM* that is required for a pass grade. If that is the case, then the completion rates of courses (defined as the fraction of students who obtain a pass grade in a course, out of the students who have registered in the course) may be improved by decreasing the eligibility cutoff in the *CAM*, and thereby allow more students to sit the FE. One cannot answer this question by just examining the available *CAM*s and *FEM*s (or *OM*s) of the students in a course since the *FEM*s of students having an $CAM < 40\%$ are not available simply because such students do not sit the FE. The work reported here is a case study undertaken on the course (coordinated by the author), CMU2220 - Concepts in Chemistry, at OUSL to search for an answer to the above question.

CMU2220 is a course at Level 4 (equivalent to the 2nd year in a conventional university) of

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the BSc in Natural Sciences programme. It is conducted over two semesters and has an OUSL credit rating of 6 (240-300 notional learning hours). It has a 5-day laboratory component that is assessed continuously in the laboratory itself, and which leads to a Practical Assessment Mark (*PAM*). Continuous assessment of the theory component involves 3 CA Tests (CATs) of one-hour duration each. The Theory (continuous) Assessment Mark (*TAM*) is a weighted average of the 3 CAT marks. The *CAM* is calculated as a weighted average of both the *TAM* and the *PAM*.

The OM is calculated according the following rules:

$$OM = \begin{cases} FEM & if \;\; FEM < 30\% \\ (CAM + FEM)/2 & if \;\; 30\% \le FEM < 40\% \;\; \text{subjected to a maximum of 40\%} \\ (CAM + FEM)/2 & if \;\; FEM \ge 40\% \end{cases} \qquad (1)$$

Research questions:

1. Do the continuous assessment in the CMU2220 course fulfill its formative role by enhancing student learning?
2. Is it possible to increase the number of students attaining a pass grade in the CMU2220 course by lowering the eligibility cutoff in the *CAM* to below 40%?

METHODOLOGY

The population of students studied consists of all who sat the FE in the CMU2220 course in the academic years 2011/2012 and 2012/2013. The course delivery methods and assessment techniques were uniform over these two years. The total population size was 206. After a careful study of a scatter plot of the *FEM* versus the *CAM*, three were rejected as extreme cases, resulting in the population that was used in studying correlations to be 203. Each student was represented by a couple of values (*CAM and FEM*) in the study. The linear correlation between the *FEM* and the *CAM* was examined in answering the first research question.

In answering the second research question, first, the 203 data points (*CAM and FEM*) were binned based on the *CAM*. Then, for each bin, a relative frequency polygon, $F(FEM;\beta)$, of the *FEM* was constructed using the data points in it. This polygon was assumed to represent the FEM distribution at the *CAM* corresponding to the midpoint of the bin, represented by $CAM = \beta$. This assumption becomes better and better when the bin width decreases (and becomes exact in the limit of zero bin width). This approximation is at the same level of precision as the assumption frequently made in converting a histogram into a frequency polygon. Then, $f(\alpha;\beta)$, defined by $f(\alpha;\beta) = \left[\int_{\alpha}^{100} F(x;\beta)dx\right] \Big/ \left[\int_{0}^{100} F(x;\beta)dx\right]$ gives an estimate of the faction of students with a $FEM \ge \alpha\%$ and a $CAM = \beta$ in the population of students under study. In Figure 1, $f(\alpha;\beta)$ represents the shaded area under the frequency polygon as a fraction of the total area

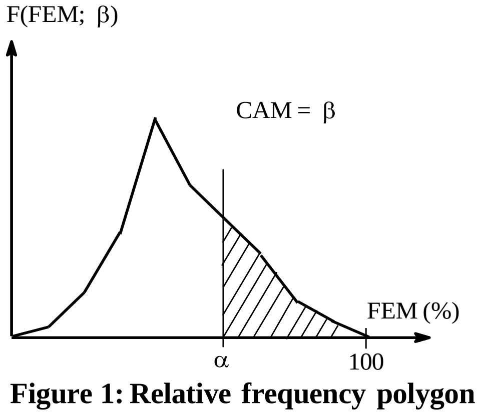

Figure 1: Relative frequency polygon of *FEM* at *CAM* = β

under the same frequency polygon. For a given value of α, $f(\alpha;\beta)$ may be viewed as a continuous function of β, i.e. *CAM*. Hence, as shown later, $f(\alpha;CAM)$ can be extrapolated to a *CAM* that is below the eligibility cutoff (where *FEM* data is nonexistent) to reveal valuable information that is necessary in answering the second research question.

RESULTS AND DISCUSSION

The scatter plot of the *FEM* versus the *CAM*, with its linear regression curve, is shown in Figure 2. The Pearson's correlation coefficient is 0.63 ($p < 0.01$). According to Borg and Gall[5], a correlation coefficient between 0.65 and 0.85 makes possible group predictions (of one quantity using the other) that are sufficiently accurate for most purposes in education. The correlation of the *FEM* and the *CAM* in the CMU2220 course has almost reached the said range. Hence, one may safely say that, in general, the *FEM* increases with an increasing *CAM*. In other words, CA has improved the learning of students as reflected in the summative assessment mark, the *FEM*. This, in turn, suggests that CA has fulfilled its formative role.

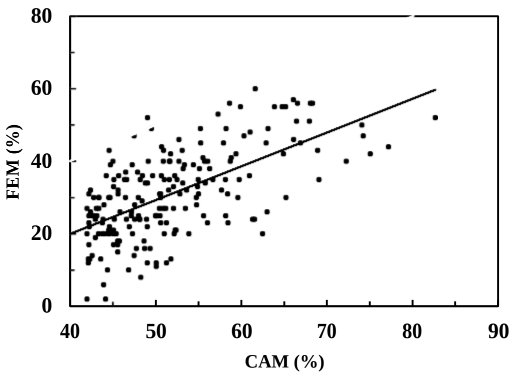

Figure 2: *FEM* Versus *CAM*

Examination of the *FEM* and the *CAM* revealed that only 3 students, out of 206, have obtained a *FEM* greater than his/her *CAM*. Hence, we conclude that CA has not led to an improvement of the *FEM* over the *CAM* in a large majority (98.5%) of students, although it has improved their learning.

Bining, according to the *CAM*, commenced at $CAM = 42\%$ (the minimum *CAM* in the population) and each bin had a width of 3%. Figure 3 depicts the plots of $F(FEM;CAM)$ constructed for the 3 bins (42%–45%), (45%–48%) and (48%–51%). As expected, the distributions of the *FEM* shift to higher values of the *FEM* with an increasing *CAM* due to a substantial positive correlation between the *FEM* and the *CAM*. Using these three distributions, three $f(40\%;CAM)$ were calculated that are considered as the values of $f(40\%;CAM)$ at *CAM* = 43.5%, 46.5% and 49.5%, respectively. Figure 4 shows the scatter plot of $f(40\%;CAM)$ versus the *CAM* with the corresponding linear regression curve.

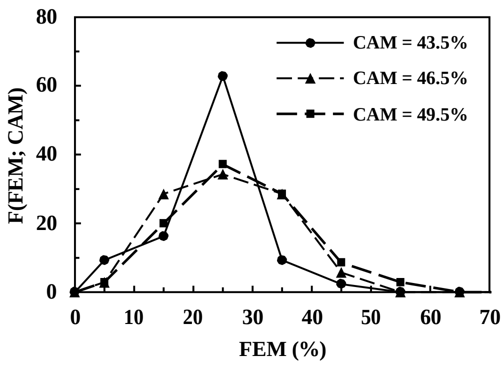

Figure 3: Relative frequency polygons of *FEM* at 3 different *CAM*s

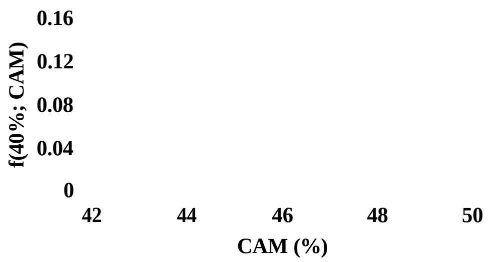

Figure 4: Scatter plot of $f(40\%;CAM)$ versus *CAM*

We found that the correlation between $f(40\%;CAM)$ and the *CAM* is perfect with a Pearson's correlation coefficient of

0.99997 ($p<0.01$). Hence, the corresponding linear regression curve can be used in estimating $f(40\%;CAM)$ at any CAM close to the interval 42% – 51%. Extrapolation of the curve revealed that $f(40\%;CAM)=0$ at CAM = 41.6%. This means that the minimum CAM required to have a $FEM \geq 40\%$ is 41.6%. However, the width of a bin introduces an uncertainty in this estimate of a minimum *CAM* that is, at most, half the width of a bin; viz. $\pm 1.5\%$. This uncertainty pushes the estimated minimum *CAM* for obtaining a $FEM \geq 40\%$ down to 40.1%. Hence, we conclude that it is highly unlikely that a student with a $CAM \leq 40.1\%$ can obtain a $FEM \geq 40\%$ by sitting the FE.

In other words, a student who attains a $CAM < 40\%$ will almost certainly attain a $FEM < 40\%$ if he/she sits the FE. Since the *OM* is, at most, the average of the *FEM* and the *CAM* (see equation (1)), such a student cannot attain a $OM \geq 40\%$ and, hence, cannot obtain a pass grade. Hence, we conclude that completion rates in CMU2220 cannot be increased by lowering the eligibility cutoff in a CAM to below 40%.

The total number of sets of marks (*FEM* and *CAM*) that fall into a bin in a *CAM* decides the precision of the construction of the corresponding relative frequency polygon in a *FEM*. This could be increased by increasing the width of a bin. However, increasing bin width increases the uncertainty in a *CAM*, as described above. Three bins used in the calculation had 43, 35 and 35 sets of marks. More precise results could have been obtained if we had a larger population.

In this study, we implicitly assumed that any other parameters, such as motivation, which affects completion rates, do not change with the lowering of the eligibility cutoff in a *CAM*. However, this may not be so. For example, motivation may diminish if one substantially lowers the eligibility cutoff. However, such a change will only lead to a reduction the completion rate.

CONCLUSIONS/RECOMMENDATIONS

The continuous assessment in the CMU2220 course has enhanced the learning of students indicating that it has fulfilled its formative role. However, only a very small fraction (1.5%) of students attained a FEM larger than their CAM.

It is highly unlikely that one can increase the completion rate in the CMU2220 course by reducing the eligibility cutoff of the CAM to below 40%.

Although we have specifically studied students of the CMU2220 course, the methodology developed here is general and may be applicable to other courses with a substantial correlation between the *FEM* and the *CAM*.

REFERENCES

Taras, M., & Davies, M. S. (2012). Perceptions and realities in the functions and processes of assessment. *Active Learning in Higher Education 14(1)*: 51-61.

Fester, E. (2012). Implementation of a continuous assessment strategy for determining learners' terminal attainment in higher education. *Paradigms 17*: 113-122.

Tripathi, P., & Fozdar, B. I. (2007). Learner perceptions of continuous assessment in the bachelor degree programme of IGNOU. *Indian Journal of Open Learning 16(2)*: 113 – 128.

Open University of UK. (2014). Assessment Handbook. UK: The, Milton Keynes.
Borg, W. R., & Gall, M. (1983). *Educational Research: An Introduction*. New York: Longman Inc.

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