LESSONS LEARNED FROM THE PERFORMANCE OF STUDENTS OF PHARMACOLOGY IN SELF CODED SURPRISE TEST WITH NEGATIVE MARKING

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ABSTRACT

Introduction: The present study aims to find the effect of instruction of negative marking in a self-coded MCQ examination on the performance of students in the subject of Pharmacology concerning the raw score, correct score and negative score. **Methodology:** This longitudinal study was conducted in the Department of Pharmacology. The Second MBBS students were exposed to a self-coded MCQ test twice by surprise. The first test (T1) was given without instructions of negative marking, while during the second test (T2) instructions for negative marking were given. The parameters of the raw score, negative score, corrected score and number of students who did not attempt respective MCQs was calculated. The number of students passing with modified Minimum Passing Level was calculated was compared with conventional Minimum Passing Level. **Results:** Sixty-seven students participated in the study. There was a statistically significant decrease in the raw score in the T2, while an increase in the negative score when compared with T1. The number of non-attempted questions was increased in T2. There was a statistically significant difference in the number of students passed concerning raw score in T1 and T2, while no such difference was seen concerning Negative score and Corrected score. **Conclusion:** The Corrected score and Negative score are not affected by the minimum passing level, indicating a better parameter of scoring than the raw score. Hence, the use of Negative score or Corrected score should be encouraged rather than the use of conventional Raw score.

Keywords: Minimum Passing Level; Negative Marking; MCQ; Corrected score; Pharmacology; Formative assessment; Surprise test; Self-coded test.

INTRODUCTION

Formative assessment can be defined as one form of self -assessment by the student, which intends to provide feedback to both the teacher and the student [1]. Ideally, during a formative assessment, stress due to the evaluation process, if absent proves to be a positive experience by reducing anxiety [2]. The stress of evaluation by self-coded evaluation may affect the performance, in which only the student knows his result by self decoding. There were no studies found in the literature regarding the effect of self-coded test. Surprise test improves performance in the theory as well as in the practical marks [3].

Multiple choice questions (MCQ) is a common method of assessment for a large group of student. It is not only objective and faster to assess, but also highly reliable and valid concerning content and construct [4]. But MCQs pose a problem because a student has a chance to obtain marks when answered by guessing. Therefore, guessing should neither be rewarded nor encouraged. Guessing also has a negative impact on the reliability of MCQs [5-7]. Varied scoring methods are available to accommodate for guessing [8,9].

Negative marking is the commonest method which discourages guessing by a penalty for wrong answers. This has also shown to improve test reliability [10,11]. Currently, the 'rights minus wrongs' correcting of scores is commonly implemented [12]. Another method of penalty is to subtract $1/(n-1)$ marks for each wrong answer, where n is several choices [13]. There is no certainty over the amount of penalty to be given for wrong answers.

The present study aims to find out the effect of a surprise test, and negative marking instruction in a self-coded MCQ examination on the performance of students concerning he raw score corrected score and negative score.

MATERIAL AND METHODOLOGY

Study design: This was a longitudinal study

Study place: Undertaken in the Department of Pharmacology, Rural Medical College, Loni, Ahmednagar, Maharashtra.

Participants: The second year MBBS students were the study population.

Ethics approval: The study was initiated after the approval obtained from the Institutional Ethics Committee.

Inclusion criteria: Students, who had their teaching completed in the General Pharmacology, Autonomic Nervous System, Cardiovascular System, Endocrine

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system and Chemotherapy were included in the study

Methodology: Inclusion criteria filled students were subjected to a surprise test (T1) with 20 MCQ questions consisting off our questions of each respective systems. The students were asked to write a unique code, consisting of a maximum of eight alphabetical/ numerical characters, which could be identified only by the individual student. They were asked to remember their unique code to identify their test results when displayed on the notice board. Another surprise test was conducted with the same unique code and same MCQ paper, but during this second test (T2), the students were given instructions regarding negative marking. The MCQ papers of both surprise tests had four versions to discourage copying from adjacent students. The students were given 20 minutes to solve the MCQ paper during both the tests.

The data obtained was compiled and subjected to the calculation of total score, negative score and corrected score. The frequency of ones, zeros and not attempted for each question was also compiled.

The negative score was calculated by adding one mark for each correct answer and subtracting one mark for each wrong answer. Marks were neither subtracted not added for a non-attempted question. The corrected score was calculated by adding one mark for each correct answer and subtracting 1/3 marks (i.e. 1/number of options-1) for each wrong answer. Marks were neither subtracted not added for a non-attempted question [14]. The corrected score was thus calculated as

$$Corrected\ score = Raw\ score - \frac{Number\ of\ wrong\ answers}{(n-1)}$$

Where n= Number of options for MCQ.

A novel method of calculating Minimum Passing Level was proposed, named as Modified Minimum Passing Level. For calculating this parameter, Modified Acceptability Index (MAI) for each question was calculated by the following formula:

$$MAI = \frac{H + L}{N}$$

Where H and L are the numbers of students in high score group and low score group respectively, who answered the respective MCQ correctly, N the total number of students in high and low score group, for calculation of H and L, the students are arranged in descending order of their score and the upper and lower one-third of the students is considered for analysis, respectively.

The modified minimum passing score is calculated by the sum of MAI of individual questions. The number of students passing with modified Minimum Passing Level was calculated was compared with conventional Minimum Passing Level.

Statistical analysis: Paired t test was applied for comparison of Raw score, Negative score and Corrected score between T1 and T2. Wilcoxon matched-pairs signed-ranks test was used to compare the Raw scores of T1 and T2 with respect to various systems. The number of students passed with modified MPL and Conventional MPL were compared by using Fisher's Exact Test. All tests were analyzed using Graphpad instat Software.

RESULTS

Sixty-seven students participated in the study. The numerical code was most commonly used (48) followed by Alpha-numerical code (17) and Alphabetical code (2). All except one student used all eight cells for coding.

Figure no. 1 depicts MCQ question wise number of students who did not attempt the question. The total number of attempts for each student in each test was 20. Hence, for a given test, the number of attempts for 67 students was 1340. The sum of several students who did not attempt for all questions was high in T2 (262 out of 1340, 19.55%) as compared to T1 (19 out of 1340, 1.41%). Question number 18 was attempted by all, while question number 16 was the most non attempted question of all.

The Raw score, Negative score and Corrected score were calculated and compiled, as shown in Table no. 1. The Mean Raw score, Negative score of T1 were significantly different when compared with corresponding values of T2. However, there was an increase in Negative score and Corrected score while a decrease in Raw score of T2 as compared with T1. There was no significant difference between the corrected scores of T1 and T2.

Table no. 2 represents the performance of students in systems of Pharmacology during T1 and T2. The total number of questions in each system was four. There was a significant decrease in the overall score during T2 with respect to General Pharmacology, Cardiovascular System and Endocrine system. The overall score in both T1 and T2 was lowest in the endocrine system while highest in Chemotherapy.

The modified Minimum Passing Level of the students was 11.84, which was rounded off to 12 marks. Table no. 3 represent the number of students passed with MPL calculated by MAI and conventional MPL (50% of maximum marks). On statistical analysis, it was found that there was a significant difference in the number of students passed when the MPL calculated by MAI (i.e., 12) was compared with Conventional MPL (i.e., 10) concerning the raw score in both the tests. However, there was no statistically significant difference in the number of students passed when the same groups, when compared concerning Negative score and Corrected score.

DISCUSSION

The aim of the present study was to compare the

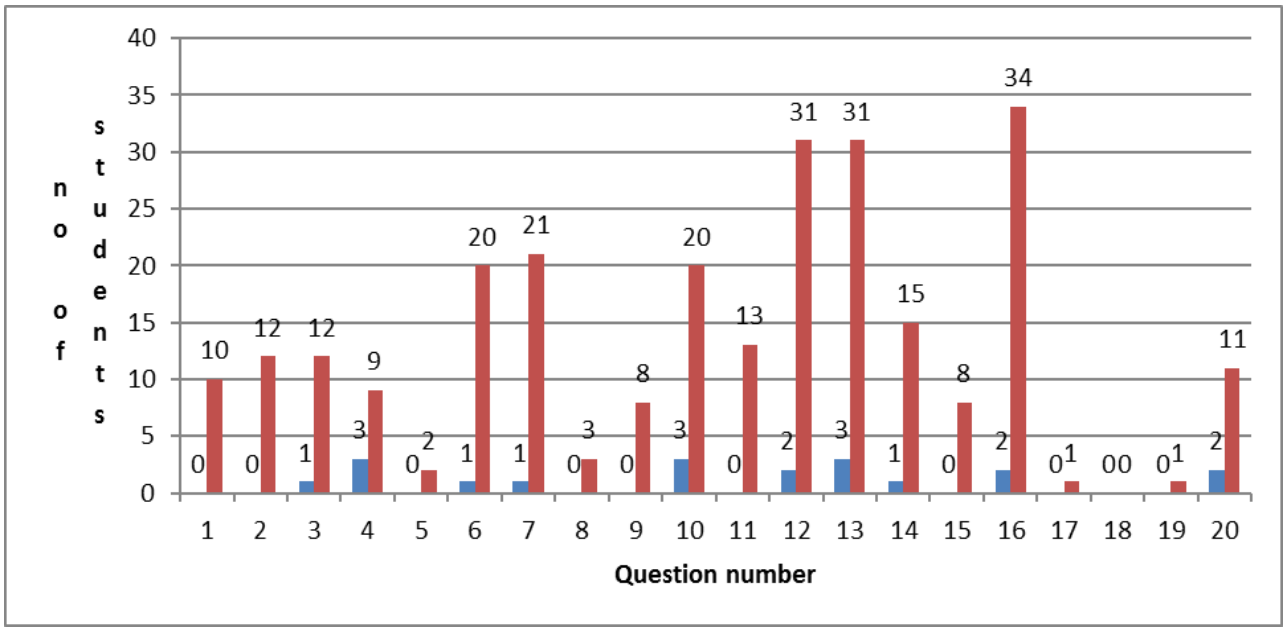

Fig 1. MCQ question wise number of Students who did not attempt the question.

Conventional – T1, Negative marking – T2

Table 1. Mean Raw score, Negative score and Corrected score of T1 and T2.

	Raw score		Negative Score		Corrected Score	
	T1	T2	T1	T2	T1	T2
MEAN	12.5	11.7*	5.2	7.4**	10.1	10.3$
SD	3.2	3.1	6.2	5.1	4.2	3.6

*P= 0.0049 vs Raw score T1, **P= < 0.0001 vs Negative score T1, $P= < 0.4412 vs Corrected score T1 (Paired t test)

Table no. 2. Performance of students (Mean score) in systems of Pharmacology during T1 and T2.

Systems	GP	CVS	CNS	ENDO	CHEMO
Raw Score					
T1 (n=67)	2.61±1.06	2.40±1.09	2.43±1.21	1.84±0.77	3.19±0.86
T2 (n=67)	2.42±1.06*	2.13±1.25*	2.25±1.31	1.61±0.74*	3.31±0.80
Number of non attempted questions					
T1 (n=67)	4	2	5	6	2
T2 (n=67)	43	46	72	88	13

GP- General Pharmacology, CVS- Cardiovascular system, ENDO-Endocrine system, Chemo- Chemotherapy
*P<0.05 vs T1 (Wilcoxon matched-pairs signed-ranks test)

Table 3. Number of students passed with Modified MPL and Conventional MPL.

	Modified MPL (12 marks)		Conventional MPL (10 marks)	
Type of score	No of students passed	No of students failed	No of students passed	No of students failed
Raw T1	40	27	55.0*	12.0
Raw T2	33	34	53.0**	14.0
Negative T1	12	55	18.0^{NS}	49.0
Negative T2	15	52	20.0 ^{NS}	47.0
Corrected T1	26	41	37.0 ^{NS}	30.0
Corrected T2	24	43	36.0 ^{NS}	31.0

performance of students during a surprise test with and without instructions regarding negative marking. Precise instructions related tothe marking system in MCQs is essential and affects the behaviour and performance of students[15-17]. The four versions of MCQs were used to discourage copying. The self-coded system was implemented to uninhibit students regarding disclosure of their performance. No studies were found regarding the self-coded system of examination for self-evaluation; while the use of surprise tests in medical literature were scarce [3]. The student chose to use numerical code (48, 71.64%) more often than the alphanumerical and alphabetical code, suggesting the popularity of numerical codes.

As shown in Figure no. 1, students attempted less number of questions when negative marking was introduced. Our findings agree with studies done by Burton FR [5], Bereby-Meyer Y [6] and Kubinger KD [7], which also found the negative impact of negative marking on the students.

The increase in Negative score while a decrease in Raw score of T2 as compared with T1 was statistically significant (Table no. 1). The raw score was decreased, which parallels with the number of non-attempted questions. Thus, the increases in non attempted questions lead to decrease in raw score. Similarly, the Negative score increased due to more number of non attempted questions in the T2. However, the corrected score were not statistically different. Thus, corrected score presents the true score irrespective of the conventional exam or an exam with negative marking. The Scores with negative marking are lower as compared to the non-negative marking scheme [18,19]. A more stringent penalty of -1 mark for an incorrect answer is vital whenever accurateness is needed to avoid the terrible outcome, more so in the medical field [20, 21]. However, it would be more pleasing to adopt a fair penalty to discourage intimidation of students [22,23].

On comparing the number of students passed depending on the Minimum passing level of 50% marks and the modified MPL (Table no. 3), number of students passed with the MPL of 50% marks concerning raw score in both T1 and T2. No such difference was found when the Negative, as well as Corrected scores of both T1 and T2, was compared by using the two passing levels. This indicates that Negative and Corrected scoring are not affected by the criteria of Minimum passing level, irrespective of the type of test (T1 and T2). A study done by Plake suggests the method for Minimum Passing Level to be aggregating minimum pass levels across the MCQs in a test [24]. In our study the modified MPL showed no difference when negative marking and the corrected score was considered.

As shown in Table no. 2, the MCQs were distributed according to the respective systems. The highest score was obtained in students in the Chemotherapy, while the lowest score was obtained in the Endocrine system, in both T1 and T2. This represents the overall difference of understanding of the subject by the students. As feedback, this data is useful for improvement in teaching.

As shown in Table no. 2, there was a significant reduction in T2 raw score concerning General Pharmacology, Cardiovascular system and Endocrine system. On the contrary, the raw score of the Chemotherapy increased, but without statistical significance. Also, the number of non attempted questions in the chemotherapy was considerably lower as compared to those of other systems. This indicates that the students were more prepared with chemotherapy. The teaching of chemotherapy before the conduct of the surprise test may be a confounding factor in this case.

The validity of questions is directly proportional to the number of questions increases [5, 17,18]. Hence, a shortcoming of the present study was the small number of MCQs. Also, the feedback of experience by students would have been a good addition.

CONCLUSION

Students prefer using numerical for self coding. The instruction of negative marking discourages the guessing behaviour of students. The MCQ scoring may be used as a feedback to improve teaching and learning process. The corrected score is not affected by the instructions of negative marking. The Corrected score and Negative score are not affected by the minimum passing level, indicating a better parameter of scoring than the raw score. Hence, the use of Negative score or Corrected score should be encouraged than the use of conventional raw score.

Conflict of interest: We are thankful to the MBBS Students for their active participation in the study.

REFERENCES

[1] Rolfe I, McPherson J. Formative assessment: how am I doing? Lancet. 1995;345:837-9.

[2] Schutz PA, Davis HA. Emotions and self-regulation during test taking. Educational Psychologist. 2000; 35:243-56.

[3] Balachandra N, Poonam D N, B R Ramesh. Surprise Test as an Informal Formative Assessment Tool for Improving Student Performance. 2015;14(12):108-9.

[4] Haladyna TM. Developing and validating multiple-choice test items. 3rd ed. New York: Routledge; 2004.

[5] Burton RF. Quantifying the Effects of Chance in Multiple Choice and True/False Tests: Question selection and guessing of answers. Assess Eval High Educ. 2001; 26: 41-50.

[6] Bereby-Meyer Y, Meyer J, Flascher OM. Prospect Theory Analysis of Guessing in Multiple Choice Tests. J BehavDecisMak. 2002; 15: 313-327.

[7] Kubinger KD, Holocher-Ertl S, Reif M, Hohensinn C, Frebort M. On minimizing guessing effects on multiple- choice items: Superiority of a two solutions and three distractors item format to a one solution and five distractors item format. Int J Sel Assess. 2010; 18.

[8] Lesage E, Valcke M, Sabbe E. Scoring methods for multiple choice assessment in higher education is it still a matter of number right scoring or negative marking? Studies in Educational Evaluation. 2013;39(3):188-93.

[9] Ng a WY, Chan a HS. Different Methods of Multiple-Choice Test: Implications and Design for Further Research. Imecs 2009: International Multi-Conference of Engineers and Computer Scientists, Vols I and II. Hong Kong; 2009. pp. 1958-63.

[10] Burton RF. Multiple choice and true/false tests: Reliability measures and some implications of negative marking. Assess Eval High Educ. 2004; 29: 585-95.

[11] Muijtjens AM, Mameren H V, Hoogenboom RJ, Evers JL, van der Vleuten CP. The effect of a 'don't know' option on test scores: number-right and formula scoring compared. Med Educ. 1999; 33: 267-75.

[12] Kurz, T. B. (1999). A review of scoring algorithms for multiple-choice tests. Paper presented at the annual meeting of the Southwest Educational Research Association, San Antonio, TX.

[13] Karandikar R L. On multiple choice tests and negative marking. Current Science. 2006;99(8), 1042–5.

[14] Guilbert, Jean-Jacques & World Health Organization. (1998). Educational handbook for health personnel / J.-J. Guilbert, 6th ed. rev. and updated 1998. WHO. https://apps.who.int/iris/handle/10665/42118

[15] Betts LR, Elder TJ, Hartley J. &Trueman, M. Does correction for guessing reduce students' performance on multiple-choice examinations? Yes? No? Sometimes? Assessment & Evaluation in Higher Education. 2009;34(1): 1–15.

[16] Frary RB. Partial-credit scoring methods for multiple-choice tests. Applied Measurement in Education. 1989; 2(1), 79–96.

[17] Burton RF. Misinformation, partial knowledge and guessing in true/false tests. Medical education. 2002;36:805–11.

[18] Lesage E, Valcke M, Sabbe E. Scoring methods for multiple choice assessment in higher education – Is it still a matter of number right or negative marking? Stud Educ Eval. 2013; 39:188 –93.

[19] A. Elizabeth Bond, Owen Bodger, David O. F. Skibinski, D. Hugh Jones, Colin J. Restall, Edward Dudley, and Geertje van Keulen. Negatively-Marked MCQ Assessments That Reward Partial Knowledge Do Not Introduce Gender Bias Yet Increase Student Performance and Satisfaction and Reduce Anxiety. PLoS One. 2013; 8(2): e55956. doi: 10.1371/journal.pone.0055956.

[20] Bradbard DA, Parker DF, Stone GL. An alternate multiple-choice scoring procedure in a macroeconomics course. Decision Sciences Journal of Innovative Education. 2004;2(1):11–26.

[21] Jennings S, Bush M. A comparison of conventional and liberal (free-choice) multiple-choice tests. Practical Assessment, Research & Evaluation. 2006;11(8).

[22] Woodford K, Bancroft P. Multiple choice questions not considered harmful. ACM International Conference Proceeding Series; Vol. 106 Proceedings of the 7th Australasian conference on computing education-Volume 42. Newcastle, NSW, Australia. 2005;106:109–116.

[23] Holt A. An analysis of negative marking in multiple-choice assessment. Available at: www.citrenz.ac.nz/conferences/2006/papers/115.pdf. Accessed September 4, 2018.

[24] Plake B. Comparison of Methods for Combining the Minimum Passing Levels for Individual Items into a Passing Score for a Test. Journal of Educational Measurement. 2005;28:249-56.