

Impact of Feedback on Continuous Cumulative Evaluation System for Learning in Physiology

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ABSTRACT

Introduction: Effective feedback helps students to realize their error and confirm most appropriate response posed by them which moreover, magnifies their conceptual understanding. Implementation of the innovative feedback on formative assessment of Continuous Cumulative Evaluation System (CCES) at our institute primes the untrained minds towards better understanding of the assessed content.

Aim: To determine the impact of feedback on CCES process in medical students on learning physiology.

Materials and Methods: Non-randomized, purposive, survey questionnaire based study for 150 students enrolled in 2015 to 2016 for medical program of SBKSMIRC, Sumandeep Vidyapeeth University were considered. Three focus group discussions were conducted with eight students in each group

after completion of session. Pre and post-test was conducted to assess learning outcome of students by feedback methodology. Data was collected, and analyzed statistically using paired t-test and correlation analysis for gender variability for perception.

Results: Pre and post-test showed statistical significance ($p < 0.001$) for learning outcome. Significant correlation for gender variation was observed for some of the survey questions. Focus Group Discussion (FGD) and survey results implied that students improved in the process of learning after receiving feedback.

Conclusion: In depth understanding of the core context of the topic was achieved after receiving feedback with new approach for the formative assessment. This feedback method also showed good peer interaction and better compatibility with the instructor. However, majority disapproved applying the feedback to their future exams.

Keywords: Continuous assessment, Group discussion, Learning outcome, Questionnaire

INTRODUCTION

Assessment system is constructed so that students performance is analyzed based on which they are stamped to move ahead or with held till they reach up to the standards as per council norms. Have we ever questioned why those backed students are lacking; is it because their approach towards the medical field is not up to the mark? May be "Yes", but may be "No". Some of us might have provided them an insight of their flaws but was it enough or we need to work more over it. Every student has right to know how they are doing. Student centered approach has been proved to have enhancement in attaining knowledge and appropriate skills [1,2].

Test enhanced learning gives an idea to a teacher for the output of their teaching tool. In medical education, tests are primarily used for assessment, thus permitting teachers to assess the efficacy of their curriculum and to assign grades.

As a teacher, it is our duty to check that learner understands the content of the feedback we provide them, so that they are encouraged to imbibe rather than misunderstanding the content of feedback [3]. Well planned assessment practice conducted with planned feedback will lead to effective learning facilitated in day to day learning activity [4]. In absence of corrective feedback from an experienced advisor, drive to learning would be a complicated and dangerous endeavour [5]. Effective feedback provides opportunities to bridge the gap between current and desired performance, delivering high-quality information to students about their learning which may depend on the type of school (public and private) [6,7].

In Indian medical institutes first internal assessment for first year student is after six months of their joining (first semester exam). A CCES has been incorporated to assess students of Smt. B.K. Shah Medical Institute and Research Center (SBKSMIRC), on everyday

basis to improve their learning process. The term 'Continuous' implies learners evaluation spread over the entire span of educational endeavor [8], while "Cumulative' means accumulation or the addition of successive parts or elements whereas, 'Evaluation' means judgment about the amount, number, or value of something; in this case assessment. CCES has a wider array of objectives allowing instructors of different courses to evaluate students performance as per the learning objectives of the lecture. This assessment tool not only improved attendance for the lecture but also attentiveness and alertness within the class. This assessment method enhanced their understanding and consequently improved their academic score which is reflected by cumulative increase in internal assessment grades.

In spite of various obstacles, continuous assessment system makes a positive impact on students by making them self-sufficient by repeated and continuous testing thus encouraging students to put effort into studies. The taught and assessed topics are retested during their first semester formative exam which improves retention of taught subject [9-11].

A new feedback approach has been developed by the author as per the internal assessment. Feedback is provided to students after responding to CCES based Multiple Choice Questions (MCQ's) thus, focusing on the concept clarification underlining the question. Priming the untrained minds for different patterns of MCQ to have point to point response to questions thus, providing them explanations about the key response as well as importance of distractors. This feedback also prepares students for upcoming competitive exams which determine their future goals.

The aim of this study is to determine the impact of feedback on CCES process in medical students on learning physiology.

Objectives

- To provide corrective feedback for the MCQs given after every lecture.
- To determine the perception of feedback methodology after completion of the topics in the department of physiology.
- To assess gender variation regarding perception of feedback methodology used.
- To assess the learning outcome after the feedback process.

MATERIALS AND METHODS

Non-randomized, purposive, questionnaire and interview based study started after approval from Sumandeep Vidyapeeth Institution Ethics Committee (SVIEC). All the students of first MBBS (150) for the academic year 2015 to 2016 batch were enrolled in the study while repeater students were excluded from the data collection and analysis of the study.

An innovative internal assessment method, CCES in addition to traditional method has been in cooperated in Sumandeep Vidyapeeth University. After every lecture faculty uploads five MCQ's on the newly developed CCES online server from the taught topic which students have to attempt them within 10 minutes of time frame on their tablets using their institutional ID and password. Questions and its options presented to students are shuffled thus, chance of copying decreases. After completion of test students know their grade but cannot identify the correct answer for the posed question.

For the present study, the author provided feedback for CCES questions, 20 topics related to cardiovascular system, four related to regional circulation and nine linked to higher functions of central nervous system in the physiology department lecture hall. Feedback was provided on alternate weeks for five to six lecture topics designed for CCES program (25-30 questions per feedback session).

Pre and post-test was conducted for all the six feedback sessions to assess the learning outcome. Perception for the feedback process on CCES was collected after validating questionnaire by subject experts using five point Likert scale. Focus group discussion in three groups having eight students per group was also conducted to reconfirm our findings under the facilitation of three different instructors to minimize a biased approach.

| Feedback Session | Pre-test Mean±SD | Post-test Mean±SD | Correlation | p-value |
|------------------|------------------|-------------------|-------------|---------|
| Feedback-1 (115) | 3.05±1.44 | 4.77±1.50 | 0.185 | 0.047 |
| Feedback-2 (115) | 2.96±1.3 | 4.93±1.41 | 0.142 | 0.131 |
| Feedback-3 (120) | 1.85±1.26 | 4.50±0.83 | 0.242 | 0.008 |
| Feedback-4 (124) | 2.93±1.47 | 5.51±1.78 | 0.173 | 0.050 |
| Feedback-5 (115) | 3.017±1.49 | 5.15±1.67 | 0.034 | 0.716 |
| Feedback-6 (124) | 2.75±1.63 | 5.95±1.77 | 0.143 | 0.014 |

[Table/Fig-1]: Descriptive analysis for overall pre and post-test for learning outcome.

| No. | Feedback Session | Paired Differences | | | | | | | |
|--------|--------------------------|--------------------|---------|-----------------|-------------------------------------------|-------|--------|-----|-----------------|
| | | Mean | Mean±SD | Std. Error Mean | 95% Confidence Interval of the Difference | | t | Df | Sig. (2-tailed) |
| | | | | | Lower | Upper | | | |
| Pair 1 | Pre-test-1 - Post-test-1 | -1.71 | 1.87 | 0.18 | -2.06 | -1.37 | -9.81 | 114 | p<0.001 |
| Pair 2 | Pre-test-2 - Post-test-2 | -1.98 | 1.78 | 0.17 | -2.30 | -1.65 | -11.90 | 114 | p<0.001 |
| Pair 3 | Pre-test-3 - Post-test-3 | -2.65 | 1.33 | 0.12 | -2.89 | -2.41 | -21.89 | 119 | p<0.001 |
| Pair 4 | Pre-test-4 - Post-test-4 | -2.58 | 2.10 | 0.19 | -2.95 | -2.21 | -13.66 | 123 | p<0.001 |
| Pair 5 | Pre-test-5 - Post test-5 | -2.13 | 2.20 | 0.21 | -2.54 | -1.72 | -10.39 | 114 | p<0.001 |
| Pair 6 | Pre-test-6 - Post test-6 | -3.20 | 2.23 | 0.20 | -3.60 | -2.81 | -16.01 | 123 | p<0.001 |

[Table/Fig-2]: Pre and post-test for learning outcome. Test Applied: Significant t-test

| S. No. | Questions | Frequency in Percentage for Survey questionnaire about feedback for CCES questions. | | | | | Mean±SD |
|--------|----------------------------------------------------------------|-------------------------------------------------------------------------------------|----------|-------------|-------|----------------|-----------|
| | | Strongly Disagree | Disagree | Indifferent | Agree | Strongly Agree | |
| 1 | I could identify my mistake | 4.9 | 10.7 | 9.8 | 50 | 24.6 | 3.79±1.09 |
| 2 | Had better understanding of asked questions | 1.6 | 4.9 | 10.7 | 58.2 | 24.6 | 3.99±.84 |
| 3 | Better reasoning for key answers | 3.3 | 5.7 | 17.2 | 57.4 | 16.4 | 3.78±.91 |
| 4 | Clarified our doubts | 4.9 | 8.2 | 11.5 | 46.7 | 28.7 | 3.86±1.08 |
| 5 | Difficulty in understanding explanation for the correct answer | 9.8 | 36.1 | 27 | 18.9 | 8.2 | 2.80±1.11 |
| 6 | Gave us extra-load | 17.2 | 36.1 | 13.9 | 17.2 | 15.6 | 2.78±1.35 |
| 7 | Failing to understand reason for giving the feedback | 16.4 | 39.3 | 18.9 | 13.9 | 11.5 | 2.65±1.24 |
| 8 | Helped us study seriously and with focus | 2.5 | 12.3 | 13.1 | 52.5 | 19.7 | 3.75±.99 |
| 9 | Helped us increase our internal grades | 4.1 | 9 | 21.3 | 45.1 | 20.5 | 3.69±1.03 |
| 10 | Difficulty in applying feedback to future exams | 10.7 | 35.2 | 32 | 18 | 4.1 | 2.70±1.02 |
| 11 | Motivated me to work more for the course | 6.6 | 6.6 | 18 | 49.2 | 19.7 | 3.69±1.07 |
| 12 | Improved my self-planning for other topics | 4.1 | 5.7 | 17.2 | 50.8 | 22.1 | 3.81±.98 |
| 13 | Enhanced my learning skills | 4.1 | 6.6 | 18.9 | 58.6 | 13.9 | 3.70±.94 |
| 14 | Enough time was not allotted to discuss wrong answers | 12.3 | 26.2 | 22.1 | 26.2 | 13.1 | 3.02±1.25 |
| 15 | Enjoyed small group feedback method | 4.9 | 9.8 | 16.4 | 50.8 | 18 | 3.67±1.04 |
| 16 | Session build up on my previous learning | 5.7 | 8.2 | 18 | 54.1 | 13.9 | 3.62±1.02 |
| 17 | Facilitator explained me the answer with clear reasoning | 4.9 | 4.9 | 16.4 | 46.7 | 27 | 3.86±1.03 |
| 18 | This was informal and relaxed way of learning | 4.9 | 4.1 | 18 | 53.3 | 19.7 | 3.79±.97 |
| 19 | Session was interactive and had supportive environment | 4.1 | 15.6 | 9 | 48.4 | 23 | 3.70±1.11 |
| 20 | Good compatibility with the instructor | 3.3 | 9 | 15.6 | 46.7 | 25.4 | 3.82±1.02 |
| 21 | Good interaction with peer students | 2.5 | 8.2 | 18.9 | 48.4 | 22.1 | 3.80±.96 |

[Table/Fig-3]: Frequency distribution for survey questionnaire for perception on feedback for CCES questions.

STATISTICAL ANALYSIS

Students paired t-test and descriptive statistical analysis and correlation analysis for gender variation was done using SPSS version 23.0 software. Data analysis allowed us to prepare evaluation matrix up to the level II i.e., we can find reaction as well as learning of the students.

RESULTS

The [Table/Fig-1] shows descriptive analysis for pre and post-test with correlation statistical significance ($p < 0.05$) for feedback session 1,3,4 and 6. [Table/Fig-2] shows significant paired sample t-test significant difference (2-tailed < 0.001) for each feedback session.

Twenty-one questions asked to assess the effect on learning enhancement if feedback is given for CCES question having Cronbach's Alpha value > 0.784 i.e. data for 21 items is reliability statistically. [Table/Fig-3] shows frequency distribution for 21 questions regarding effect of feedback for CCES question for learning enhancement agreement for all the asked question expect for Q5, Q6, Q7, Q10. Which implies that the students felt

| S.No | Questions response with Equal variances assumed | Sig. (2-tailed) | Mean±SD Male/Fe-male | 95% CI of the Difference | |
|------|----------------------------------------------------------------|-----------------|-------------------------|--------------------------|--------|
| | | | | Lower | Upper |
| 1 | I could identify my mistake | 0.319 | 3.69±1.17/ 3.89±0.99 | -0.586 | 0.192 |
| 2 | Had better understanding of asked questions | 0.161 | 3.89±0.92/ 4.1±0.75 | -0.512 | 0.086 |
| 3 | Better reasoning for key answers | 0.012 | 3.57±0.96/ 3.98±0.81 | -0.727 | -0.093 |
| 4 | Clarified our doubts | 0.035 | 3.66±1.14/ 4.07±0.98 | -0.791 | -0.029 |
| 5 | Difficulty in understanding explanation for the correct answer | 0.002 | 3.1±1.12/ 2.49±1.03 | 0.221 | 0.992 |
| 6 | Gave us extra-load | 0.315 | 2.9±1.35/ 2.66±1.34 | -0.236 | 0.728 |
| 7 | Failing to understand reason for giving the feedback | 0.344 | 2.75±1.29/ 2/54±1.19 | -0.231 | 0.658 |
| 8 | Helped us study seriously and with focus | 0.121 | 3.61±1.08/ 3.89±0.88 | -0.632 | 0.075 |
| 9 | Helped us increase our internal grades | 0.022 | 3.48±1.16/ 3.9±0.83 | -0.789 | -0.064 |
| 10 | Difficulty in applying feedback to future exams | 0.184 | 2.82±1.06/ 2.57±0.97 | -0.118 | 0.610 |
| 11 | Motivated me to work more for the course | 0.736 | 3.66±1.11/ 3.72±1.04 | -0.450 | 0.319 |
| 12 | Improved my self-planning for other topics | 0.117 | 3.67±1.03/ 3.95±0.92 | -0.629 | 0.071 |
| 13 | Enhanced my learning skills | 0.923 | 3.69±0.94/ 3.7±0.94 | -0.353 | 0.320 |
| 14 | Enough time was not allotted to discuss wrong answers | 0.003 | 3.34±1.22/ 2.69±1.19 | 0.223 | 1.088 |
| 15 | Enjoyed small group feedback method | 0.298 | 3.57±1.13/ 3.77±0.94 | -0.569 | 0.176 |
| 16 | Session build up on my previous learning | 0.213 | 3.51±1.07/ 3.74±0.95 | -0.593 | 0.134 |
| 17 | Facilitator explained me the answer with clear reasoning | 0.043 | 3.67±1.11/ 4.05±0.92 | -0.742 | -0.012 |
| 18 | This was informal and relaxed way of learning | 0.579 | 3.74±1.0/ 3.84±0.95 | -0.448 | 0.251 |
| 19 | Session was interactive and had supportive environment | 0.627 | 3.66±1.21/ 3.75±1.01 | -0.498 | 0.301 |
| 20 | Good compatibility with the instructor | 0.289 | 3.72±1.11/ 3.92±0.92 | -0.562 | 0.169 |
| 21 | Good interaction with peer students | 0.779 | 3.77±1.04/ 3.82±0.89 | -0.395 | 0.297 |

[Table/Fig-4]: Independent sampling t-test for gender variation.

that there is improvement in the process of learning enhancement by receiving feedback. [Table/Fig-4] shows independent t-test showing significant statistical values for Q3, Q4, Q5, Q9, Q14 and Q17 when comparing male and female were value ($p < 0.05$). Focus group discussion was done among 15 students with three keys question and their comments are stated in [Table/Fig-5].

| How beneficial was feedback for CCES to you? | How can it be improved as per your view point? |
|-------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| • Concepts were clarified. | • Should be only for important topics. |
| • We could identify our mistake. | • Some said it should be for other topics too like endocrine, blood, CNS. |
| • We could reason out our answers. | • Should be after each section. |
| • We understood how to study and revise the concepts. | • Homework is not given thus we do not study for the same. |
| • It was revisit to topic which we couldn't understand. | • Only interested participants should be asked to attend. |
| • Came to know about our lacuna. | • No attendance for that session. |
| • Gained confidence to guess. | • Attendance should be granted to everyone. |
| • Clinical implication was interesting. | • Teacher should randomly choose students from back bench to answer questions with reasons. |
| • We can remember things by discussion. | • It should be made like a quiz within the class to explain with an answer. |
| • We have idea about the type of questions asked during exam. | |
| • Inspired us to listen the lecture keenly to attend CCES session. | |
| • Sometime teacher went out of the topic to clarify concept. | |
| Anything specific? | |
| • Important diagnostic or clinical MCQ's can be added up for explaining questions. | |
| • Twist the framework of questions, extra questions of same pattern for the topic should be provided. | |
| • Other departments should also start this type of feedback. | |
| • If this method is used for every topic then it will be time consuming. | |
| • Topic related videos should be shown. | |

[Table/Fig-5]: FGD result compiled from three groups.

DISCUSSION

Feedback has been the most powerful tool to improve academic performance and students interaction with their instructor. Our study has also shown significant improvement in learning process of students after providing feedback on formative assessment as CCES at our institute. This goes with the study by Rowe and Wood who concluded that the provision of appropriate and timely feedback promoted deep learning in students [12]. Sickinga KT et al., in their study showed that quality of feedback has significant influence on the academic achievement of students [7]. Duffield and Spencer highlighted that maximum respondents in their study expressed desire for the provision of more feedback on performance in assessment in order to guide future learning [13]. In our study, students disagreed or strongly disagreed as per frequency distribution for the difficulty faced with the CCES questions, or time allocation for completion. Students were confident about the answers written by them for the questions asked. Although, 35% of students did feel that the options given were confusing, 65.6% students agreed that feedback increased their internal grades, 69% approved that feedback motivated them to work for the course while 73% granted that it enhanced their self-planning for other topics. Crisp BR found that, a greatest increase in marks was associated with greatest reductions in the number of problem areas which was due to the consistent feedback for assessed work [14]. While Price M et al.,

in his study showed that some students saw a distinction between marks and feedback and disliked feedback that just provided justification of the grades [15]. However, those unsure about the purpose of feedback had adjusted and limited their view to align with the grade justifying feedback they were receiving. Moreover, staff commented in their study that they provided feedback in the hope that it would support students in later stage of the course, although, students saw limited opportunities for feed-forward [15].

In our study, 72.5% students approved that feedback enhanced their learning although 46% students disagreed and 32% had indifferent approach towards applying feedback to their future exam. Although, 68% agreed that feedback built on their previous learning and clarified concepts with reasoning was agreed by 74% of students in our study. Hernander R showed that 63% students suggested that feedback given was applicable to their future assignments [16]. Even a significant number of students reported that the feedback comments received by them were limited and did not suggest how to improve their learning. In Doan L study, 165 students accepted that tutors' feedback was very important for their learning, were majority of them read or acted on tutors feedback [17]. One hundred eighty five students even agreed that feedback helped them to know what they had to achieve and improve in future learning process. Goel K and Ellis B, results revealed that 80.5% students responded for feedback identifying gaps in knowledge, 68.3% said that feedback identifies strengths and encouraged them to do better on future assignment while 73.2% students said that feedback showed their level of achievement against the marked criteria [18]. Study done by Dulloo P and Nazwani N showed that feedback for assessment provided better opportunity for students to improve skill of solving MCQ's and understand the content to be focussed more upon. Even perception of faculty for feedback showed better learning process for students with conceptual understanding of topic, motivates weak students to come forward to communicate [3]. Hepplestone based on online feedback found that students expressed difficulty in feeding understanding and forwarding comments made on their work to future assignments or between modules [19]. Paul O et al., recommended that student's feedback could be linked to 'feed-forward' by making clarity in structural progression and feedback [20].

In our study, 71.4% students found feedback a relaxed way of learning with interactive and supportive environment. 72.1% students accepted that feedback provides good compatibility with instructor, while 70.5% agreed to have good interaction with peer. Weaver MR showed in his study, that large majority of students felt positive feedback to be very important and confirmed that it increased their confidence [21]. Thus, more balanced feedback should be ensured to motivate rather discourage students. Havnes A et al., study found peer students help was more useful than from a teacher [22]. While teachers in their study expressed concern on various aspects including students capability to respond to feedback whether the students were interested or able to follow up feedback they received. Some researchers found feedback a helpful tool to build trust in the instructor other than motivate faculty to write better MCQ's for further assessment [3]. Archer JC study showed that feedback enabled students to make their own revisions through dialogue, helps students to gain new understandings without dictating what these understanding will be [23]. Although, Martens R et al., found no difference in students performance as per the way of feedback provided [24].

Gender difference emerged for some of the perception and preferences, with male and female differing significantly across all measures pertaining to this: female students had strong agreement with the identification of the mistakes from the feedback with better clarification of doubts and better reasoning for key answers. Other than this female student significantly agreed that feedback helped them study seriously and increased their internal grades compared male students. They also enjoyed feedback method and

appreciated facilitator for explaining concept which led to good compatibility with the instructor. It is difficult to compare the present gender findings to previous studies of Rucker ML and Thomson S because of the measurement of different constructs [25]. However, Rowe and Wood did show some of the similarity with our results as far as satisfaction with the amount of feedback or type of feedback are concerned [12].

LIMITATION

A time constraint was the major limitation which forced author to conduct feedback after completion of five to six lecture sessions, rather than after each lecture.

CONCLUSION

The present study illustrates students perceptions about the implementation of newer approach of providing feedback after continuous formative assessment. It shows improvement in student learning outcome and experience. The survey and FGD presented students reflection for the process specifying that concepts were clarified and they were able to identify their mistake which is statistically proven to be significant for the study. The findings highlight the importance of this method since students agreed that they could remember things by discussion and had idea about the type of questions asked during exam.

Way the students perceives the taught context and the way they approach learning affects their learning outcome thus it is important to know the students approach to teaching, learning and feedback methodology. Indian medical institutes are increasingly recognizing feedback as mode to improve their teaching ratings. Future direction for research is to further explore the relationship between student's preferences and approaches to learning. Improving the methodology of feedback in present setup is another promising area of investigation were students are taught skill of self and peer assessment since, it develops the self-regulation skill necessary for using any feedback.

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