Shaping Medical Minds: The Power Of Formative Assessments And Feedback

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ABSTRACT

INTRODUCTION: *Formative assessment refers to tools that identify misconceptions, struggles, and learning gaps along the way and assess how to close those gaps. In education, the term assessment refers to the wide variety of methods or tools that educators use to evaluate, measure, and document the academic readiness, learning progress, skill acquisition, or educational needs of students.*

OBJECTIVES: *To Evaluate the effectiveness of different modes of formative assessment like MCQ, Assignment and Reflection writing, with feedback on students' perception.*

METHODOLOGY: *This was a Prospective, cross over study conducted among Phase 2 medical undergraduate students in department of Pharmacology. Sample size of around 105 students were recruited after considering drop outs and selection criteria. The students were grouped into 3 batches and they were explained about the different modes of formative assessments and cross over procedure. Data was entered and analysed using SPSS software version 23.0.*

RESULT: *When comparing the mark percentage of MCQ, Reflection writing and assignment there is statistically significant difference (P=0.0001) with respect to all the topics (GP, ANS and CVS). The students scored better in Assignment and reflection writing when compared to MCQ. But, the scoring of the regular internal assessment marks has improved in all the topics when compared with MCQ mode of formative assessment. Even though the marks obtained by students in MCQ was less, 68.4% (n=73) of students preferred MCQ's as the optimal assessment technique.*

DISCUSSION: *It was observed that MCQ's as a formative assessment technique was preferred by majority of the students in this study, but their performance in MCQs was less as compared to assignment and reflection writing. They preferred MCQs as it would help them training themselves in future competitive examinations. But for facing the summative theory examinations, they preferred assignment. There is also an improvement in the internal assessment marks of students who took MCQs as the mode of formative assessment.*

CONCLUSION: *Even though MCQ can be considered as an optimal tool of formative assessment, assignment and reflection writing should also be given equal standing. The introduction of formative assessment by the NMC in medical education regulations marks a progressive step and help students identify their strengths and areas for improvement. We conclude that, students who are assessed formatively during the process have more motivation and they feel more comfortable for the summative and competitive exams. This supports the idea that formative assessment strategies will help students achieve better in summative assessment.*

Key words: *Formative assessment, MCQ, Assignment and Reflection writing*

INTRODUCTION

The term "assessment" in education refers to the range of techniques and resources teachers employ to gauge, record, and assess students' academic preparedness, learning progress, skill development, and educational requirements. In 1967, Michael Scriven coined the phrases formative and summative assessment, emphasizing the differences in their objectives and applications of the data collected. In his 1968 book "Learning for Mastery," Benjamin Bloom delves more into formative assessment and highlights how it might improve the teaching-learning process.[1]

Every form of evaluation, whether formative or summative, has pros and cons. Teachers may not be able to effectively judge a student's overall strengths and weaknesses based on a single evaluation, which can only give a glimpse of the student's performance at one particular moment in time. Some educators argue that formative assessments might cause disruptions to their lessons, forcing them to cover material quickly in order to make time for assessments. Formative assessments are continuous and may be viewed by students as less important than summative assessments, which are scheduled and affect final marks. This could result in less serious attempts and biased outcomes.[2]

Summative assessments have come under fire for restricting teachers' creativity and promoting a limited focus on "teaching to the test," which can lead to pupils spending too much time on monotonous tasks

instead of participating in interesting and varied activities. Despite these difficulties, summative and formative evaluations offer different approaches to evaluate students' development and improve learning.[3]

Formative assessment involves tools that identify misconceptions, struggles, and learning gaps, providing insights on how to address them. These tools can help shape learning and encourage students to take ownership of their education by understanding that the goal is improvement, not merely grading (Trumbull and Lash, 2013). Formative assessments can include self-assessments, peer assessments, instructor feedback, quizzes, conversations, and other interactive methods. [3,4]

Regarding one-minute reflections, both students and teachers benefit significantly from this quick and easy practice, and students generally view the one-minute paper positively. However, overuse can lead to declining response rates over multiple lecture series.[5]

Weekly tests encourage review and practice, giving pupils regular feedback and improving their study habits. Excessive testing, according to some, might impede learning by frustrating nervous pupils and preventing in-depth study of longer teaching units.[6] It has been demonstrated that homework assignments improve student achievement, leading to higher test scores, grades, and college enrollment rates. Additionally, they support learning and foster the development of positive study habits and life skills. On the other hand, students who have too much homework may become stressed.[7]

The National Medical Commission (NMC) of India has introduced the new Competency-Based Medical Education (CBME) from 2019 onwards. CBME is an outcome-based approach which integrates knowledge, skills, attitude and Ethics in medical education for undergraduates and post graduates. [8]

Assessment plays a vital role in implementation of competency-based education. The traditional form of assessment is largely based on the recall of factual information, for which summative assessment is conducted at the end of the professional year.[2] The new CBME curriculum emphasises on Competency-Based Assessment (CBA) which should be a continuous process conducted throughout the professional year.[9] This can be achieved only through formative assessment. According to NMC, formative assessment is defined as assessment conducted during teaching to provide feedback to improve learning. Feedback is the basis of assessment design and is related to deep learning aimed at discovering knowledge about health culture and knowledge demonstration. It provides students and teachers with an adequate teaching perspective.[10] Various strategies and techniques can be used depending on the situation.[11, 12]

In summary, formative assessment is integrated throughout a class or course to enhance student achievement by addressing specific needs. This study aims to Assess the appropriate Formative assessment technique for improvement in the learning process among Medical undergraduate students.

MATERIALS AND METHODS

Medical undergraduate students 105 Phase 2 from a tertiary care teaching hospital in Puducherry participated in this prospective, cross-over study in the department of pharmacology. The students consented to complete the evaluations as part of the study. The study was carried out between March 2023 and September 2023, a period of six months. The study's goals were to compare and analyze the feedback received from students based on their perceptions of various formative assessment methods, such as multiple-choice questions, reflection writing, and assignments, in order to determine how effective they are. After taking dropouts into account, a sample size of about 105 students was gathered using the universal sampling technique. Students who did not attend two consecutive assessments and did not provide their consent were not included. The study was approved by the institutional research committee and Institutional Ethics committee (No:09/SVMCH/IEC-CERT/MAR22).

Data Collection Procedure

1. The students were grouped into 3 batches (A, B and C batch) as per their routine practical schedule during the afternoon session between 2.00-4.30 pm.

2. They were explained about the different modes of formative assessments and the eligibility criteria to participate in this study after obtaining their written informed consent. Confidentiality was maintained throughout the study procedure.

3. The students were explained about the cross over procedure. The portions for the different formative assessment were selected on the following topics like General Pharmacology (GP), Autonomic Nervous System (ANS) and Cardiovascular System (CVS) as per the regular teaching schedule. The table 1 explains the same;

4. The percentage of marks obtained in each formative assessment (MCQ, Assignment and Reflective writing) by the students in different groups were assessed using the standard answer keys prepared by the investigator. These marks were compared with that of the regular internal assessment conducted in the department.

5. At the end of the study feedback was obtained regarding students' perception from all the groups, about the different formative assessment techniques in improving the learning process.

Statistical Analysis

Data was entered and analysed using SPSS software version 21.0. Mark percentage was expressed in mean + SD. Independent student t test and two-way ANOVA followed by Tukey post hoc test was used to compare within and between the groups. P value <0.05 was considered to be statistically significant.

RESULTS

Demographics:

Number of students who responded = 105; Male = 50 and Female =55

Table 2 shows that there is a statistically significant increase in scoring [assignment (63.2) and reflective writing (56.8)] as compared to the regular internal assessment on General pharmacology (41.2, 40.7) conducted by the department. Though there is no statistical significance observed in the MCQ with regular IA mark (36.1) when compared with MCQ mode of formative assessment (32.1). The scoring of the regular internal assessment mark was on the higher range with MCQ.

When comparing the scores of MCQ (32.1), Reflection writing (56.8) and assignment (63.2) there is a statistically significant difference (P=0.0001) in the marks obtained by the students with respect to different modes of formative assessment. The students scored better in Assignment and reflection writing when compared to MCQ as shown in table 2.

Assessing the ANS pharmacology scores as shown in table 3 shows that there is a statistically significant increase in scoring [assignment (62.6) and reflective writing (57.5)] as compared to the regular internal assessment (51.1, 44.7) conducted by the department. There is a statistical significance observed in the MCQ with regular IA mark (46.6) when compared with MCQ mode of formative assessment (29). The scoring of the regular internal assessment mark has improved when compared with MCQ mode of formative assessment.

When comparing the scores of MCQ (29), Reflection writing (57.5) and assignment (62.6) there is a statistically significant difference (P=0.0001) in the marks obtained by the students with respect to different modes of formative assessment. The students scored better in Assignment and reflection writing when compared to MCQ as shown in table 3.

Assessing the CVS pharmacology scores as shown in table 4 shows that there is a statistically significant increase in scoring [assignment (61.4) and reflective writing (60.8)] as compared to the regular internal assessment (45.4, 45.3) conducted by the department. There is a statistical significance observed in the MCQ with regular IA mark (43.1) when compared with MCQ mode of formative assessment (30.1). The scoring of the regular internal assessment mark has improved when compared with MCQ mode of formative assessment.

When comparing the scores of MCQ (30.1), Reflection writing (60.8) and assignment (61.4) there is a statistically significant difference (P=0.0001) in the marks obtained by the students with respect to different modes of formative assessment. The students scored better in Assignment and reflection writing when compared to MCQ as shown in table 4.

The scoring of the regular internal assessment marks has improved in all the topics (GP, ANS and CVS) when compared with MCQ mode of formative assessment as shown in figure 1.

FEEDBACK ANALYSIS on students' perception of Formative Assessment:

1. The optimal mode of formative assessment technique:

Even though the marks obtained by students in MCQ was less, 68.4%(n=73) of students preferred MCQ's as the optimal assessment technique compared to that of assignment (27.8%, n=29) and reflection writing (3.8%, n=5) as depicted in figure 2.

The following table 5, table 6 and table 7 shows the reasons mentioned by the students (n=73) for preferring various modes of formative assessments like MCQ, Assignments and Reflection writing respectively.

2. As described in figure 3, more than 98% of students agreed that the assessments aligned with the goals, objectives and activities of the learning program.

3. Also, more than 96% of students agreed that the assessment tasks feature real life situations that are relevant to the learner (figure 4).

4. The students were consulted and informed about the forms of assessment tasks being employed and more than 96% of students agreed on the same in their feedback (figure 5).

5. More than 97% agreed that the Purposes and forms of assessment tasks were well defined and clear to the learner as depicted in figure 6.

6. Figure 7 explains that, 97% of students agreed that they had an equal chance at completing the given assessment tasks.

DISCUSSION

The study highlights several key findings regarding the effectiveness of various formative assessment techniques. Firstly, it reveals a clear preference among students for MCQs as a formative assessment method. This preference is largely due to the perception that MCQs offer valuable practice for future competitive exams, which often utilize this format. The familiarity and straightforward nature of MCQs make them appealing to students aiming to hone their test-taking skills.

Despite this preference, the study indicates that students' actual performance in MCQs was lower compared to assignments and reflection writing. This discrepancy suggests that while MCQs may be favoured for their perceived benefits, they might not fully capture the depth of understanding or critical thinking skills that assignments and reflection writing can elicit. Assignments often require students to engage more deeply with the material, demonstrating their knowledge through detailed responses and analysis. Similarly, reflection writing encourages introspection and a deeper grasp of the subject matter.

Additionally, the study indicates that students' internal assessment scores improved when they used multiple-choice questions as their formative assessment approach. This result emphasizes how beneficial multiple-choice questions are for strengthening knowledge and enhancing exam readiness, but it also emphasizes how crucial a fair assessment strategy is.

Assignments were more convenient for pupils when it came to summative theory exams. According to this inclination, tasks that require students to synthesize material and explain their ideas in an organized way may better prepare them for thorough evaluations. Because assignments frequently require more sophisticated problem-solving and critical thinking skills, they can also give a more realistic picture of a student's aptitudes.

The evaluation of different formative assessment tools provides valuable insights into their respective strengths and weaknesses. MCQs are effective for reinforcing factual knowledge and preparing for standardized tests, but they may fall short in assessing higher-order thinking skills. On the other hand, assignments and reflection writing foster deeper engagement with the material and enhance critical thinking, but they may be more time-consuming and challenging to grade consistently.[6,7]

Therefore, a range of formative assessment techniques should be included in a thorough assessment methodology. By addressing both the quick recollection of knowledge through multiple-choice questions (MCQs) and the deeper cognitive skills displayed in assignments and reflections, this well-rounded approach enables instructors to obtain a comprehensive view of student performance [13]. Giving pupils constructive criticism is essential to this process because it helps them identify their areas of strength and growth as they progress through their learning process.

Teachers can have a better understanding of each student's progress in relation to their classmates, overall educational goals, and learning objectives by integrating various assessment techniques and offering thorough feedback. Research indicates that when medical schools incorporate formative evaluations into their curricula, a framework must be established whereby assessments are an essential component.[14]

According to another study, students thought the student-generated formative tests were feasible, helpful, and offered a demanding chance to go deeper into the material, create questions, and hone exam-taking and critical-thinking abilities.[15]

The introduction of this formative assessment by the NMC in medical education regulations marks a progressive step towards creating a more dynamic, responsive, and effective learning environment. It has emphasised on more of small group discussions and formative assessments with feedbacks in the recent 2023 regulations, when compared to the old version which had more of Self-directed learning and summative assessments, which was followed up to 2022. It aims to produce well-rounded, competent medical professionals who are better equipped to meet the demands of modern healthcare.[9] [16]

This holistic approach to assessment not only enhances student learning outcomes but also ensures that students are well-prepared for both formative and summative evaluations, ultimately supporting their academic success, professional growth and ultimately will have its impact on health status of the patients and communities [17].

CONCLUSION

The study concludes that students who undergo formative assessment during their studies are more motivated and feel more prepared for summative and competitive exams. This finding supports the notion that formative assessment strategies enhance students' performance in summative assessments. The benefits of formative assessment extend beyond mere preparation for tests. By providing continuous feedback, formative assessments help students identify their strengths and areas for improvement, fostering a growth mindset. This ongoing process of self-reflection and adjustment can lead to increased confidence and a deeper understanding of the material. The introduction of this formative assessment by the Indian NMC in medical education regulations marks a progressive step towards it.

Moreover, formative assessments often involve a variety of assessment techniques, such as quizzes, peer reviews, and interactive activities, which can make learning more engaging and less stressful. This variety can cater to different learning styles, ensuring that all students have the opportunity to demonstrate their understanding in ways that suit them best. In summary, the implementation of formative assessment strategies not only prepares students for summative assessments but also contributes to their overall academic development. By fostering motivation, reducing anxiety, and providing continuous feedback, formative assessments help students achieve better outcomes in summative assessments and beyond. The positive impact on both students and educators underscores the importance of integrating formative assessment into educational practices.

Table 1: Grouping and cross over procedure:

TOPIC / Formative Assessment	MCQ	Assignment	Reflection writing
General Pharmacology	A batch	B batch	C batch
Autonomic Nervous System	B batch	C batch	A batch
Cardiovascular System	C batch	A batch	B batch

Table 2: Comparison of Mark percentage obtained in General Pharmacology (Formative Assessment Vs Internal Assessment):

Sl. NO	GROUP	N	Mode of Formative Assessment	Mark % obtained in Formative Assessment (Mean + SD)	Mark % obtained in Internal Assessment (Mean + SD)	P value
1	Group A	38	MCQ	32.1 + 8.59	36.1 + 13.35	0.1246
2	Group B	25	Assignment	63.2 + 17.14	41.2 + 16.24	0.0001*
3	Group C	42	Reflection writing	56.8 + 20.82	40.7 + 14.55	0.0001*
P value				0.0001#	0.2716#	

* Data was analysed using Independent Sample t test and # two-way ANOVA.

Table 3: Comparison of Mark percentage obtained in ANS Pharmacology (Formative Assessment Vs Internal Assessment):

Sl. NO	GROUP	N	Mode of Formative Assessment	Mark % obtained in Formative Assessment (Mean + SD)	Mark % obtained in Internal Assessment (Mean + SD)	P value

1	Group A	38	Reflection writing	57.5 + 15.71	44.7 + 15.14	0.0005*
2	Group B	25	MCQ	29.0 + 14.49	46.6 + 14.03	0.0001*
3	Group C	42	Assignment	62.6 + 10.76	51.1 + 14.50	0.0001*
P value				0.0001#	0.1400#	

* Data was analysed using Independent Sample t test and # two-way ANOVA.

Table 4: Comparison of Mark percentage obtained in CVS Pharmacology (Formative Assessment Vs Internal Assessment):

Sl. NO	GROUP	N	Mode of Formative Assessment	Mark % obtained in Formative Assessment (Mean + SD)	Mark % obtained in Internal Assessment (Mean + SD)	P value
1	Group A	38	Assignment	61.4 + 21.93	45.4 + 16.14	0.0005*
2	Group B	25	Reflection writing	60.8 + 19.32	45.3 + 14.48	0.002*
3	Group C	42	MCQ	30.1 + 8.12	43.1 + 16.71	0.0001*
P value				0.0001#	0.7780#	

* Data was analysed using Independent Sample t test and # two-way ANOVA.
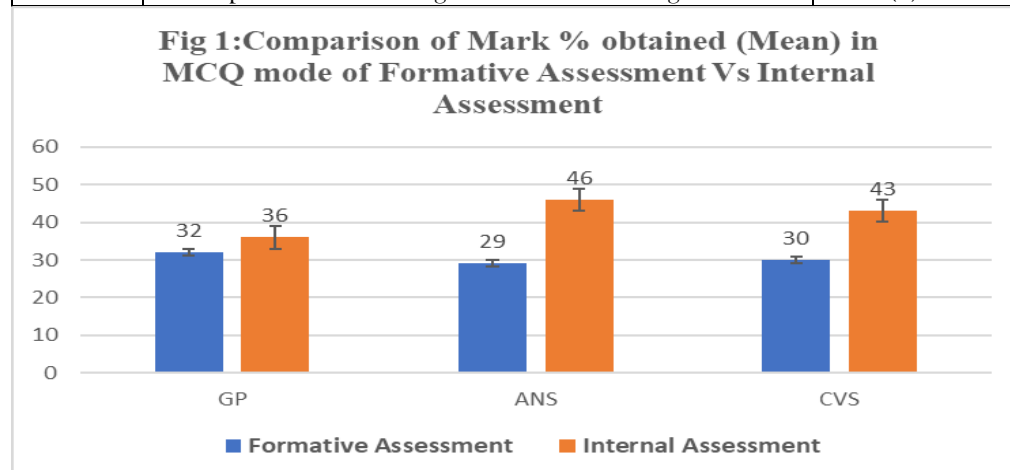
Table 5: Student's perception on MCQ mode of assessment:

Sl.NO	Student's perception on MCQ	Percentage (n=73)
1.	Helpful in preparing for Competitive Exams	48% (35)
2.	Easy	13% (10)
3.	Improves knowledge	13% (10)
4.	Covers entire chapter	11% (8)
5.	Useful for university examinations	11% (8)
6.	Others	4% (2)

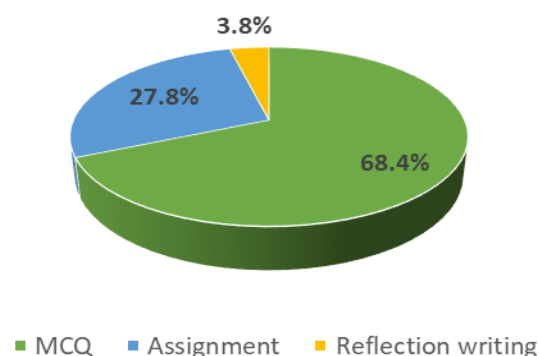Table 6: Student's perception on Assignment mode of assessment(n=29):

Sl.NO	Student's perception on Assignment	Percentage (n=29)
1.	Useful for preparing notes	48% (14)
2.	Deep knowledge of the subject	17% (5)
3.	Gives a Practise for summative exams	22% (6)
4.	Helps to read and write the concepts better	13% (4)

Table 7: Student's perception on Reflection writing mode of assessment(n=5):
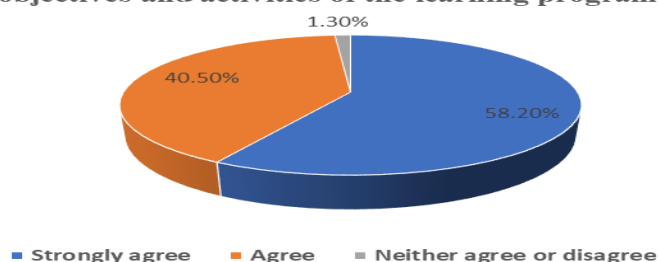
Sl.NO	Student's perception on Reflection writing	Percentage (n=5)
1.	Helps to check our remembrance	60% (3)
2.	To improve our listening skills and knowledge	40% (2)

Fig 1: Comparison of Mark % obtained (Mean) in MCQ mode of Formative Assessment Vs Internal Assessment

Fig 2:Optimal mode of Formative Assessment

3.8%
27.8%
68.4%

■ MCQ ■ Assignment ■ Reflection writing

Fig 3: Assessment tasks align with the goals, objectives and activities of the learning program

1.30%
40.50%
58.20%

■ Strongly agree ■ Agree ■ Neither agree or disagree

Fig 4:Assessment tasks feature real life situations

2.00% 1.80%
45.60%
50.60%

■ Strongly agree ■ Agree ■ Neither agree or disagree ■ Disagree
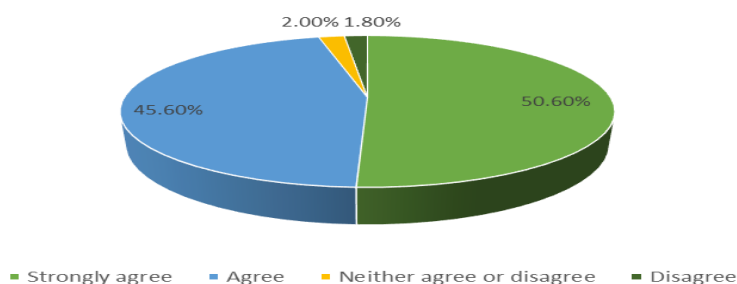
Fig 7: The students had an equal chance at completing assessment tasks

2.50%
44.30%
53.20%

■ Strongly agree ■ Agree ■ Neither agree or disagree
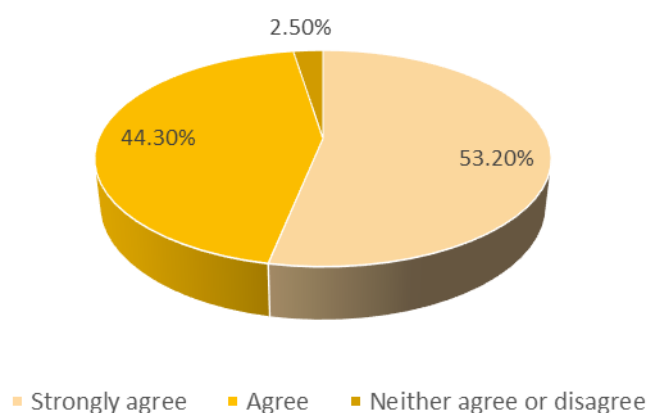
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