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Original Work

One-Minute Paper: A thinking centered assessment tool

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ABSTRACT: A versatile assessment technique used in classroom for quick and simple feedback is 'One-Minute paper'. It provides real-time feedback from class and enables the teacher to find out if students have recognized the main points in a class session. The objectives of the study were to employ one-minute paper for post-graduate students during a continuous medical education (CME) program lecture, to assess its effectiveness for achievement of objectives and learning ability of the students, to analyze the questioning pattern of the students for the topic and to obtain feedback on participant's perception on use of 'one-minute paper'. The study was employed for one-hour lecture in CME program for post-graduate students. One-Minute paper was employed for the topic 'Phenylketonuria'. The lecture was sub-divided into five components and the response sheet was designed accordingly. The delivery time for each component varied between 8 to 12 minutes. At the end of each component, 2 minutes was given for the participants to respond to two questions - what was the most important thing they learnt during this session and what important question remains unanswered? Analysis of response was carried out to know achievement of objectives, association of learning ability and questioning pattern. Response to the learning ability showed that 80 to 90% of the participants responded satisfactorily to all the components. Questioning pattern was least for component 3 of the lecture. Questioning skills showed that most questions were in stage 1, 4 and 5. Participants reflected that the use of 'one-minute paper' was thinking centered, engaged them throughout the topic and provided liberty for them to ask questions. One-minute paper is inexpensive, easy to use, and an instant assessment means, which reflects the achievement of learning objectives. It is a thinking centered assessment tool, which gives ample opportunity to the learner for active learning.

KEY WORDS: *One-Minute paper; Questioning pattern; Questioning skills; Thinking centered*

INTRODUCTION

After completion of a teaching session, two important questions, which any teacher would be curious to know and evaluate, are:

1. What did students learn from my lecture?
2. How can I help my students learn better from my lecture?

There are several different techniques that the teachers can adapt to gauge student learning. The usual techniques followed by the teacher during the lecture include: eliciting responses by asking questions, soliciting or raising questions from students, brainstorming, buzz groups and mini-assessment techniques. More commonly, assessment tools employed are the standardized objective type tests like multiple choice, true false, fill in the blanks; but they provide limited information regarding understanding and evaluating student performance.¹ The main reason for this is that these techniques primarily deal with factual information, rote memory and critical thinking. The aim of every teacher while teaching in a classroom is to strive for improved

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understanding of the topic(s) covered in a lecture. Thus, there is a need to apply assessment techniques, which provide information regarding student learning during the lecture as well as providing an opportunity to ask their queries and addressing them, which makes learning better.

'One-Minute paper' (OMP) is one such versatile multi-dimensional easily employable assessment technique used in the classroom for quick, simple and effective feedback. A "one-minute paper" may be defined as a very short, in-class writing activity, taking one-minute or less to complete. The response is to an instructor-posed question, usually at the end of the session, which prompts students to reflect on the day's lesson, which provides the instructor with useful feedback.² It is one of the simple strategies opted for measuring learning, student engagement and program effectiveness.

A professor of physics at the University of California, Berkeley, originally developed this strategy. 'One-Minute Paper' was first developed by Weaver and Cottrell³, later modified by Wilson⁴ in the year 1983 and then popularized by Cross & Angelo in 1988. Minute paper requires no technology, and only a small investment of time and effort. It is a natural form of formative evaluation, which gives a snapshot of learning at any particular point and allows for necessary adjustments. Use of OMP serves two purposes:

1. It investigates how well students understand important concepts presented during a class period.
2. Provides an insight towards improvement in instruction in the succeeding class by modifications in the presentation.

The general process of use of minute paper is that, the teacher stops the class for two to three minutes, between the talk or towards the end and asks each student to respond briefly to some variation on the following two questions:^{5,6}

1. What was the most important thing you learned during this session or class?
 2. What important question remains unanswered?
- Ideally, students then write their responses on index cards or half-sheets of scrap paper and hand them to the teacher. Following collection of response sheets, the teacher reviews the responses, clarifies the answers for the questions raised and ideally responds to them in the next class, or privately on an individual basis. This process makes a student think and respond along the lines of objectives set by the teacher during the course of a lecture class.

The advantage of minute paper is that it gives provision for manageable amounts of opportunity to self assess, think and reflect for the minimal amount of time spent. Teacher cannot only check how well the students are learning, but also what they are teaching. The benefits derived from OMP appear sizeable and 'dual' both for teachers themselves and students.⁷ Generally perception of

OMP is favorable when employed, both in small group as well as large group teaching.

The characteristics of OMP itself make it a useful learning tool for instructors and students across a wide range of disciplines. It encourages 'active learning' that is recognized as best teaching practice. It is applied especially for a large group of students in a didactic lecture wherein it is daunting for a teacher to pay individual attention, to easily interact with students and to monitor their attentiveness. From OMP, replies to the first question focus on an important element of adult learning style, in which it tests the student's ability to think, rank the relative importance of what they have heard and understood, encouraging active listening during the class. The second OMP question prompts another higher order cognitive skill - giving an easy and anonymous opportunity for the student to ask questions freely.⁸ Responses not only reflect the behavior and learning attitude of the students in the class, but also make assessment an integrative task.

Many practitioners across a wide variety of disciplines have described minute paper as 'invaluable'⁹ with 'outstanding benefits'¹⁰ and the pedagogical innovation that 'swamped all others'.⁷ Although use of OMP is convenient and simple, yet its application is not very popular. This is mainly due to lack of awareness of its existence and because of the belief that it would be too time-consuming to analyze and to address students' replies.¹¹

With this background, a study on employing OMP was carried out in a lecture during an academic program attended by post-graduate students.

METHODOLOGY

The study was designed and structured for a University sponsored Continuation of Medical Education (CME) program for post-graduate students at P. E. S. Institute of Medical Sciences and Research, Kuppam, Andhra Pradesh, India. Minute paper was employed for one of the lecture topics after giving specific instructions before the start of the talk by the speaker regarding as to how exactly one needs to respond to the questions.

The topic of presentation was 'Phenylketonuria' and the duration of lecture was for about an hour. Minute paper response sheet administered was designed based on the specific learning objectives. The objectives of the lecture were based on the following five components:

1. Main pathway for phenylalanine metabolism
2. Chemistry and genetics of phenylalanine hydroxylase
3. Significance of minor pathways in phenylketonuria
4. Clinical features of phenylketonuria
5. Diagnosis and management of phenylketonuria

The delivery time for each component was scheduled to be 10-15 minutes. At the end of each component, 2 minutes time was given for the participants to respond to two questions:

1. What was the most important thing you learned during this session?
2. What important question remains unanswered?

The footer of minute paper had the provision for students to provide their name, the institution they represent and their e-mail address. The ethical clearance for the study was obtained by the 'Institutional Ethics Committee' of Sri Devaraj Urs Medical College.

Thirty-eight post-graduate students from four medical institutions, who attended the CME program, responded promptly to the minute paper administered. All the minute papers were collected for analysis of response at the end of the lecture session. Checking the responses for achievement of objectives assessed the learning process. The proportion of responses was categorized, as objectives achieved being complete or incomplete. The proportion of respondents who raised questions was also looked into. Questioning pattern for each component and skill of questioning were analyzed.

Analysis of skill of questioning was carried out by tabulating as per 'Questioning Rubric'¹². To know the usefulness and perception of the technique, a feedback form on OMP was administered towards the end and its analysis was also carried out.

RESULT

The response of 38 minute papers were analyzed and the nature of the response were noted. **Table 1** shows the learning ability for the various components of the topic presented. Complete response to all the components were given by 80 to 90% of participants. **Figure 1** and **2** shows the questioning pattern and questioning skills of the participants. Majority of questions could be categorized under stage 4 and stage 5, wherein they used the 'seven servants' with relevant key words and/or phrases. **Table 2** and **3** depicts the participants feedback and perception of the technique employed for the learning activity. The responses indicate the appreciation of the technique and their comfort of learning.

Table 1: Response showing the learning ability for the various components (n = 38)

Component	Achievement of objectives		
	Complete n (%)	Incomplete n (%)	No response n (%)
Phenylalanine metabolism – Main pathway	32 (84.2)	1 (2.6)	5 (13.2)
Phenylalanine hydroxylase – Chemistry and genetics	34 (89.4)	2 (5.3)	2 (5.3)
Minor pathways in phenylketonuria – Significance	25 (65.7)	8 (21.1)	5 (13.2)
Phenylketonuria – Clinical features	35 (92.1)	2 (5.3)	1 (2.6)
Phenylketonuria – Diagnosis and management	37 (97.4)	0 (0)	1 (2.6)

Table 2: Feedback on One Minute Paper (n = 20)

Questions	Responses				
	Nicely done	Fairly done	Neutral	Satisfactorily done	Not done well
Specified Objectives	18 (90%)	2 (10%)	0 (0%)	0 (0%)	0 (0%)
Division of components	15 (75%)	3 (15%)	2 (10%)	0 (0%)	0 (0%)
Time for response	Much more than required 0 (0%)	More than required 0 (0%)	Adequate 19 (95%)	Less than required 1 (5%)	Much less than required 0 (0%)
Understanding of content	Extremely good 14 (70%)	Good 6 (30%)	Neutral 0 (0%)	Bad 0 (0%)	Extremely bad 0 (0%)
Learning by 1-minute paper	Extremely good 17 (85%)	Good 1 (5%)	Neutral 2 (10%)	Bad 0 (0%)	Extremely bad 0 (0%)
Answers provided for questions raised	Extremely helpful 19 (95%)	Helpful 1 (5%)	Neutral 0 (0%)	Somewhat helpful 0 (0%)	Not helpful 0 (0%)

Table 3: Participants’ perception of use of ‘One Minute Paper’ (n=57)

Options	Number of responses
Lerner centred	6 (10.5%)
Thinking centred	16 (28%)
Engages throughout the topic	12 (21%)
Liberty to ask questions	11 (19.2%)
Better understanding of the topic	9 (15.7%)
Mutually bebeficial	3 (5.2%)

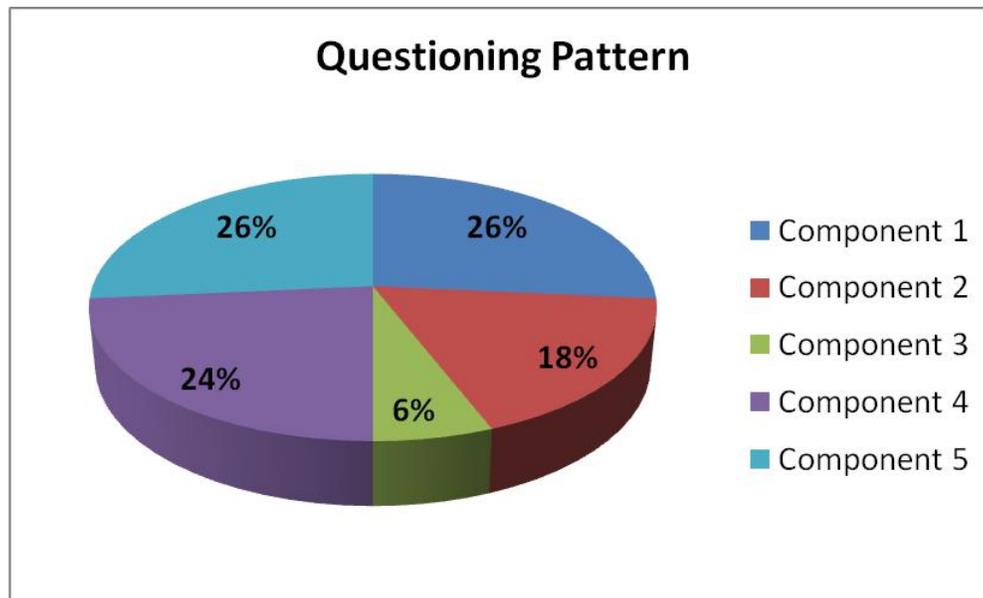


Figure 1: Proportion of questioning pattern for various components

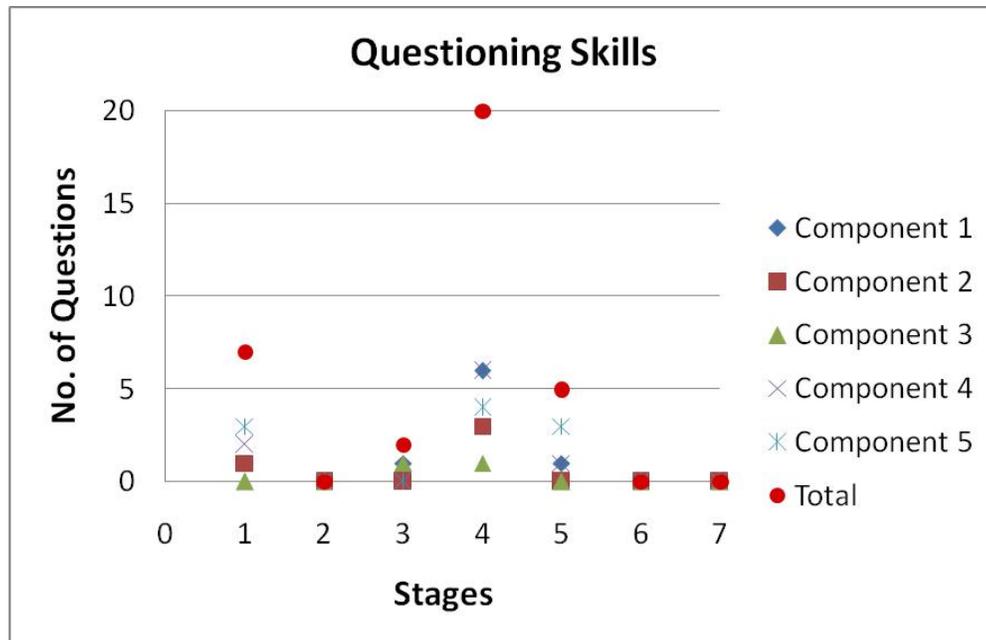


Figure 2: Pattern of questioning skills for various components

DISCUSSION

Effective assessment techniques can improve an instructor's understanding of student needs and cater to a learner-centered classroom. In the Harvard Assessment Seminars, 'first report' as detailed by Richard Light states that one-minute paper was the single most successful innovation that the teachers had applied in their classrooms.¹³ Use of OMP is one of the most common and admired method used for classroom assessment. Minute papers provide a "conceptual bridge" between successive topics in the class. It is considered an ideal one for use in large group discussions like lectures. It is one such a unique tool having following advantages:

1. Reaction - Instant feedback of the topic covered in a lecture
2. Attitude - Keeps the listener alert as he/she needs to respond at appropriate times
3. Response - Makes the listener think and respond accordingly
4. Environment - Provides a uniform platform for the clarification of doubts

Due to above-mentioned benefits, it can be considered the right tool for review and reflection after a lecture. John F Chizmar and Anthony L Ostrosky, two professors of economics at Illinois State University, have experimented with OMP for quite some time⁷. They share their experience as they are convinced that using the one-minute paper has improved student learning in their classes. They believe that it works in the following three ways:

1. Provides detailed feedback concerning what students are learning and how well they are learning it,

2. Provides feedback on a regular basis, and
3. Information of students who have genuine input and better control based on the premise.

Minute paper stages an effective way of involving all students in class simultaneously ensuring equal participation of each and every class member, including anyone who may be too shy or fearful to participate orally. In the present study, 38 post-graduate participants responded to the minute paper on the topic 'Phenylketonuria'. Assessment of response to the learning ability reflected that 80 to 90% of the participants responded completely to the components of the topic namely: Phenylalanine metabolism – main pathway, Phenylalanine hydroxylase – chemistry and genetics, Clinical features, diagnosis & management of phenylketonuria. However, only during the mid part of the lecture on the component 'Significance of minor pathways of phenylketonuria' showed modest response of 65%. The exact figures highlighting the learning ability are shown in **Table 1**. OMP thus provides a chance for the students to reflect on the content they have learnt. A minute paper is a shorter, more focused, writing-to-learn assignment that promotes greater reflection and deeper thinking in the classroom. Harwood describes OMP as a communication tool for a large lecture class⁸. He describes OMP as a teaching strategy used to encourage active learning by students as well as provide effective feedback to teachers. He suggests that the use of OMP enables the professor to establish rapport with a large class of students and provides the professor with an insight into student difficulties and perceptions of the lecture material⁸.

Analysis of questioning pattern as represented in **Figure 1** shows that majority of questions asked were on main pathway of phenylalanine metabolism, diagnosis and management of phenylketonuria. Questions asked on significance of minor pathways in phenylketonuria were least in number. The provision to express their queries by OMP reveals what the students desire to know more on the topic. **Figure 2** illustrates the questioning skills of the participants. Since the majority of questions were under stage 4 and stage 5 categories, it depicts the thought process among the students for those components and interest to know in depth about them.

In a publication by Choinski et al, the researchers value it as a tool, which was useful, easy to use and fulfilled their objectives¹⁴. They recommend that development of OMP provides one more weapon for the outcomes assessment arsenal.

The purpose of this exercise was to encourage students to actively participate, think and reflect on the presentation, and review and synthesize what they learnt during and before they leave the class¹⁵. Such exercises help them multi-dimensionally to summarize and synthesize the concepts in their own words, review and focus upon important ideas covered, practice writing across the curriculum, articulation of what they have not understood and helps them identify areas for further study and review, all these using a nonverbal approach.

The feedback on this exercise as presented in **Table 2** clearly reflected that use of OMP during the lecture helped the learner to understand and learn better. Also, 95% of the participants agreed that the time given for response was adequate. All the queries were answered systematically, component-wise, citing proper references and were communicated to all the participants via e-mail in the week following the CME program. The participants also showed immense appreciation towards the explanations provided for their questions raised. Thus, it proves that, in the technique used, there was learning during the course of lecture, aided thinking to learn more and continuation of learning after the lecture was done. Moreover, it requires no technology or preparation to employ, and takes only a minute of each student's time. It benefits the teacher in determining the depth of understanding of concepts, identification of problems or grey areas in the topic, opening of a line of communication between them and students. Teachers get to know their students better and responding to students personalizes the process of their teaching. Vonderwell described the minute paper as a classroom assessment strategy and technique, which can help instructors, close the communications gap that can impede effective teaching and learning¹⁶. A good number of participants perceived that use of OMP was

thinking centered, engages one throughout the topic and provides liberty to ask questions, which has been shown in **Table 3**.

CONCLUSION

One-minute paper is an inexpensive, mutually beneficial, formative, easy to use and instant assessment means which unambiguously reflects the achievement of learning objectives. It is a thinking centered assessment tool which gives ample opportunity and flexibility to the learner for dynamic participation in the process of 'active learning'. It provides the right platform for the learner to think and evolve, asking questions during the course and at the end of learning process. From the teacher's point of view, it gives feedback on what the learner has learnt, how far the objectives were achieved and a chance to interact with the learners by addressing their queries, taking the learner to a complete understanding of the topic.

Limitations and Recommendations

The present study was employed only for a small group of students at a higher level (post-graduates), whose learning abilities grossly differ from that of students at a lower level (under-graduates). Also, the study did not use any tool to assess the extent of learning which happened during the session, but assessed only the response during the session.

Due to several advantages in this technique, it can be easily employed during the learning process, particularly for didactic lectures, and can be considered for administration at any level for effective learning.

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