

Correlation Between The Learning Approaches Of First Year Medical Students And Their Performance In Multiple Choice Questions In Physiology

Navin Rajaratnam*, Suzanne Maria D'cruz**, Chandrasekhar M***

*Associate Professor, Department of Physiology, Meenakshi Medical College Hospital and Research Institute, Kanchipuram,

**Associate Professor, Department of Physiology, Sri Muthukumaran Medical College Hospital and Research Institute, Chennai,

***Professor and HOD, Department of Physiology, Meenakshi Medical College Hospital and Research Institute, Kanchipuram.

Abstract: Background: Students generally choose either a surface learning approach that focuses on rote learning or a deep approach that focuses on understanding. While selection for postgraduate medical courses is based on Multiple Choice Questions (MCQs), only some medical colleges in Tamil Nadu, India, use MCQs for assessing undergraduate students. Aims and Objectives: The aim of this study was to determine the relationship between the learning approaches of first year medical students using the Revised Two Factor Study Process Questionnaire (R-SPQ-2F) and their performance in Multiple Choice Questions in Physiology. Materials and Methods: The Revised Two Factor Study Process Questionnaire (R-SPQ-2F) was administered to 142 first year medical students of a private medical college in Tamil Nadu after the internal assessment examination in Physiology that included 20 MCQs. Pearson product-moment correlation coefficient was determined using SPSS 17 software, to find the relationship between the deep and surface learning approach scores with the performance in the MCQ examination. Results: The majority of our students (73%) preferred a deep approach while learning Physiology. There was a positive correlation between deep approach scores and MCQ marks ($r=0.226$, $p=0.007$, $n=142$) and a negative correlation between surface approach scores and MCQ marks ($r=-0.258$, $p=0.002$, $n=142$). Conclusion: The majority of our first year medical students exposed to a didactic-non Problem Based Learning curriculum in which assessment included MCQs in Physiology preferred a deep learning approach which was positively correlated with MCQ marks. [Rajaratnam N et al NJIRM 2013; 4(5) : 43-48]

Key Words: Learning Approaches, Medical students, Multiple Choice Questions, R-SPQ-2F.

Author for correspondence: Dr. Navin Rajaratnam, Associate Professor, Department of Physiology, Meenakshi Medical College Hospital and Research Institute, Enathur, Kanchipuram 631552, Tamil Nadu.

E- mail: drnavin@ymail.com

Introduction: Students learn in different ways, choosing to either adopt a surface learning approach that focuses on rote learning or a deep approach that focuses on understanding. The concept of learning approaches was first described by Marton and Saljo in 1976 on the basis of how students perceived a reading task and then learnt it¹. Bigg's Study Process Questionnaire (SPQ) and the Revised Two Factor Study process Questionnaire (R-SPQ-2F) are used to determine students' learning approaches². The SPQ scores give information on student's preferred, ongoing and contextual approaches to learning and provide a good idea about the presage, process and product levels of Bigg's "Presage-Process-Product (3P) model"³ of the learning process, since they describe how each student differs within a particular teaching context; how he/she handles a specific task; and how teaching contexts differ from each other⁴. The Students' Approaches to Learning (SAL) model considers learning as occurring within the teaching/learning-context unlike the Information Processing model which considers learning to occur within the student³.

Learning approaches describe the relationship between student, task and context and therefore are not each student's individual stable trait⁴.

The Study Process Questionnaire (SPQ) had three approach scores but was subsequently revised to yield a simple, short, two factor version - the Revised Two Factor Study process Questionnaire (R-SPQ-2F), which had just surface and deep approaches and a motive and strategy score for each⁴. Students who adopt a surface approach memorize facts without understanding and generally have an extrinsic motivation to learn; while students with a deep approach have an intrinsic motivation to learn and focus on understanding study material⁵. Generally, the aim of instruction should be to encourage students to adopt a deep approach to subjects that are vital for their development⁵.

In addition to research on curriculum, competence and student assessment and evaluation, there is a recent trend in medical education research to focus on determining student characteristics⁶.

Mattick et al found that medical students had higher scores on the deep approach when compared to other students in higher education⁷. Newble and Gordon studied the learning approaches of first, third and final year medical students and found that first year medical students had low scores on the deep approach and had preferences more similar to science students than to arts students⁸. Salamonson et al compared the learning approaches of first year medical, nursing, engineering, health science and medicinal chemistry students and found that while there was no statistically significant difference in their use of surface learning approaches, their use of deep learning approach varied widely⁹.

Research on the relationship between learning approaches and academic performance, measured qualitatively and quantitatively has yielded different insights. Trigwell and Prosser proved that there was a relationship between learning approach and learning outcomes in first year nursing students¹⁰ and Zeegers found that there was a consistent positive correlation between the deep approach and assessment outcomes in science students¹¹. Mattick et al found that academic scores were higher in medical students who had a deep learning approach⁷. May et al showed that there was a relationship between learning approaches of medical students and their performance on a high stakes clinical examination, as the scores on the top two quartiles were significantly higher on the deep approach while the scores in the bottom quartile was significantly higher on the surface approach¹². Salamonson et al also found that both the deep and surface learning approaches were independent and significant predictors of academic performance⁹. Gurlen et al however found that there was no correlation between academic achievement and a surface approach¹³.

Learning approaches of students are influenced by many factors. Abraham et al compared the learning approaches to Physiology in students following a partially Problem Based Learning (PBL)-oriented curriculum and those following a non-PBL curriculum and found that the implementation of PBL promoted a deep approach¹⁴. Reid et al however showed that while medical students had high scores for deep and strategic approaches to

learning and lower scores for a surface approach; there was little significant change in these scores (apart from a tendency for the surface approach to lessen) after reforms intended to promote a deep approach¹⁵. Balasooriya et al found that attempts to shift medical students towards a more deep learning approach by using a new Integrated Medicine Program surprisingly resulted in a significant number of students moving in the opposite direction and adopting a more surface approach; although a proportion of students did change towards a deep approach¹⁶.

Gijbels and Dochy studied the relationship between students' assessment preferences and learning approaches and investigated if students' learning approaches changed after formative assessment (involving feedback)¹⁷. Although they found significant correlations between a deep approach to learning and a preference for higher-order thinking tasks, they surprisingly also found that the students' learning approaches changed towards a more surface approach to learning after formative assessment and proposed that students' perceived workload and problems in the learning environment, could be the possible explanations¹⁷. Lizzio et al found that while perceptions of heavy workload and inappropriate assessment pushed students towards a surface learning approach; perceptions of good teaching influenced them towards a deep approach¹⁸.

Students perform better in MCQs than in uncued essays¹⁹, or long essays²⁰, or short essay questions in Physiology²¹. Gijbels et al found no relationship between students' approaches to learning and performance in MCQs that tested different aspects of problem solving and proposed that the method of assessment (MCQs); the students' perception of the method of assessment; and the content and method of teaching had more influence on their learning approach, than the actual wording of the questions²². Yonker studied the relationship between the learning approaches of psychology students aged 18–52 years and their performance in MCQs and found that while younger students used a surface approach; when age was statistically controlled, the surface learning approach had more of a negative influence on performance than a deep learning approach benefitted performance²³. Reid et al found that performance of second year

medical students in modified essays and MCQs correlated positively with deep learning approaches and negatively with surface approaches²⁴. Watkins found that students were encouraged to use a deep approach when assessed by essays rather than by MCQs²⁵. Scouller found that students perceived MCQs as being knowledge based and as assessing lower levels of cognitive processing and were therefore likely to use surface learning approaches while preparing for their MCQ examination²⁶.

While selection for postgraduate medical courses is based on MCQs, not all medical colleges in Tamil Nadu, India, use MCQs for assessing undergraduate medical students. In their first year of study, undergraduate medical students learn Anatomy and Biochemistry in addition to Physiology, and their written assessment generally consists only of essays, short notes and short answers. MCQs however are routinely used to assess first year medical students in Physiology in the medical college in which this study was conducted, which employs a didactic, non-problem based learning curriculum. Medical education in India is now at a stage where many curricular reforms are being proposed and gradually being implemented. We were therefore interested in determining the learning approaches that our first year medical students used while studying Physiology and in investigating if there was any correlation between their learning approaches and their academic performance in Multiple Choice Questions, especially in view of the inconsistent findings of other researchers.

The aim of this study was therefore to determine the relationship between the learning approaches of first year medical students using the Revised Two Factor Study Process Questionnaire (R-SPQ-2F) and their performance in Multiple Choice Questions (MCQs) in Physiology.

Materials and Methods: This cross-sectional study involving first year medical students of the 2012-13 batch, was conducted in the Department of Physiology of Meenakshi Medical College & Hospital in Kanchipuram, Tamil Nadu, India, after obtaining ethical clearance from the Institutional Ethical Committee. A didactic non-PBL curriculum is followed in this medical college and first year

medical students are assessed in Anatomy, Physiology and Biochemistry using Multiple Choice Questions (MCQs) in addition to essays, short notes and short answers. After obtaining consent, the Revised Two Factor Study Process Questionnaire (R-SPQ-2F)⁴ was administered to 142 first year medical students (60 males and 82 females) at the end of their Physiology internal assessment examination that included 20 Multiple Choice Questions (MCQs) in the single, best-response type format with 4 options and 0.5 marks being awarded for each right answer.

The Revised Two Factor Study Process Questionnaire (R-SPQ-2F)⁴, which was chosen for this study to determine the students' learning approaches, has 20 questions about the students' usual way of studying. The students were asked to be honest and to choose the single best response which described their way of studying Physiology. Scoring was done according to the instructions of the R-SPQ-2F. Deep approach and surface approach main scores were calculated. In addition, the motive and strategy subscales were determined for each of the main scales.

Means and standard deviations for the two main scales and four subscales of the R-SPQ-2F and the marks obtained in the MCQ examination (maximum = 10), were calculated for all 142 students. SPSS 17 was used for statistical analysis. Pearson product-moment correlation coefficient was determined to find the relationship between the deep and surface approach scores and subscale scores with the marks obtained in the MCQ examination. In addition, gender-wise analysis of learning approaches was also done using the Z-test of two proportions and the unpaired Student t-test.

Results: In this study done to determine the relationship between the learning approaches of first year medical students and their performance in Multiple Choice Questions (MCQs) in Physiology, it was found that out of the 142 first year medical students who participated in the study, 104 students (73%) preferred a deep approach while learning Physiology; 34 students (24%) preferred a surface approach and 4 students (3%) had equal scores on both deep and surface scales.

There was a positive correlation between deep approach scores and MCQ marks ($r = 0.226$, $p = 0.007$, $n = 142$) and a negative correlation between surface approach scores and MCQ marks ($r = -0.258$, $p = 0.002$, $n = 142$) (**Table 1**).

Although 60% of males and 82.9% of females preferred a deep approach and the difference was significant ($p = 0.002$) (**Table 2**); there was no significant difference ($p = 0.674$) between the deep approach scores of males (30.93 ± 6.68) and females (31.38 ± 5.84) (**Table 3**). A significant difference ($p = 0.000$) was found between the surface approach scores of males (28.02 ± 7.95) and females (22.94 ± 5.98) (**Table 3**).

Table 1: Correlation between the learning approaches of first year medical students and their performance in Multiple Choice Questions in Physiology.

S No.	Parameter	Pearson correlation	p value
1.	DA vs MCQ	0.226	0.007*
2.	SA vs MCQ	-0.258	0.002*
3.	DM vs MCQ	0.289	0.000*
4.	DS vs MCQ	0.093	0.270
5.	SM vs MCQ	-0.299	0.000*
6.	SS vs MCQ	-0.156	0.064

Results expressed as Pearson product-moment correlation coefficient (Pearson Correlation) for scores obtained by the first year medical students in the Deep Approach (DA) main scale; Surface Approach (SA) main scale; Deep Motive (DM) subscale; Deep Strategy (DS) subscale; Surface Motive (SM) subscale and Surface Strategy (SS) subscale of the Revised Two Factor Study Process Questionnaire (R-SPQ-2F) versus their marks obtained in the Multiple Choice Questions (MCQ) in Physiology; * p value of <0.05 being taken as significant.

Learning approaches of male and female first year medical students expressed as the number and the percentage (in brackets) of male and female first year medical students who had a deep or surface learning approach and those who had equal scores on deep and surface learning approaches,

determined using the Revised Two Factor Study Process Questionnaire (R-SPQ-2F); Z-scores calculated using Z-test for two proportions; *p value of <0.05 being taken as significant

Table 2: Comparison of the learning approaches of male and female first year medical students.

Learning Approach	Males n = 60	Females n = 82	Z-score	p value
Deep	36 (60%)	68 (82.9%)	-3.0483	0.002*
Surface	24 (40%)	10 (12.2%)	3.8353	0.000*
Equal	0 (0%)	4 (4.9%)	-1.7354	0.081

Table 3: Comparison of the learning approach scores of male and female first year medical students.

	Males n = 60	Females n = 82	t	df	p value
DA	30.93 ± 6.68	31.38 ± 5.84	-0.422	140	0.674
SA	28.02 ± 7.95	22.94 ± 5.98	4.344	140	0.000*
DM	15.27 ± 3.99	15.87 ± 3.63	-0.931	140	0.353
DS	15.67 ± 3.55	15.51 ± 3.12	0.275	140	0.784
SM	12.80 ± 4.61	10.09 ± 3.48	4.002	140	0.000*
SS	15.22 ± 4.22	12.85 ± 3.61	3.586	140	0.000*

Learning approach scores of male and female first year medical students expressed as the means and standard deviations of Deep Approach (DA) and Surface Approach (SA) main scores and the Deep Motive (DM), Deep Strategy (DS), Surface Motive (SM) and Surface Strategy (SS) subscale scores obtained using the Revised Two Factor Study Process Questionnaire (R-SPQ-2F); with corresponding t values and degrees of freedom; *p value of <0.05 being taken as significant.

Discussion: The majority of our first year medical students (73%) used a deep learning approach while studying Physiology. This is in agreement with the findings of Mattick et al⁷, but differs from Newble and Gordon's finding that first year

medical students had low deep approach scores⁸. Physiology is a subject where basic concepts and principles have to be understood and applied. Teachers of Physiology therefore encourage a deep learning approach, as advised by Felder and Brent⁵, since such students would focus on understanding and relating new to previously learnt material.

We found that there was a significant positive correlation between students' deep approach scores and MCQ marks. While Trigwell and Prosser proved the relationship between learning approach and quality of learning outcomes¹⁰, Zeegers¹¹, Mattick et al⁷ and May et al¹² found that there was a positive correlation between deep approach scores and actual academic scores. Reid et al too found that MCQ marks correlated positively with deep learning approaches, although their study involved second year medical students and included modified essay questions also²⁴.

Unlike us, Gijbels et al however found no relationship between learning approaches and marks in MCQS categorized as testing different components of problem solving and attributed this to factors like students' perception of the assessment method and teaching method²³. We did not methodically categorize MCQs as Gijbels et al did (although we used questions that test understanding and application in addition to recall) and we follow a didactic non-PBL curriculum while they used PBL. Significant correlations between a deep approach to learning and students' preference for higher-order thinking tasks have been demonstrated by Gijbels and Dochy¹⁷. Scouller however found that students perceived MCQs as merely assessing lower order thinking skills and therefore were likely to use surface learning approaches²⁶. This does not seem to be the way our students perceive MCQS, although we could have confirmed it by actually eliciting their perceptions and preferences.

Unlike Gurlen et al, who found that there was no correlation between academic achievement and a surface approach¹³, we found a significant negative correlation between surface approach scores and MCQ marks like Reid et al did²⁴. We also found significant correlations between the motive subscales (positive for deep and negative for surface) and MCQ marks with no correlation for

the strategy subscales, which probably confirmed the influence of motives on performance. There was no significant difference between deep approach scores of male and female students although there was a significant difference in the surface approach scores, with the scores of males being higher. A significantly greater percentage of female students preferred a deep learning approach. As undergraduate medical students who were assessed using MCQs, in this medical college that used a didactic-non PBL curriculum, still preferred a deep learning approach while studying Physiology (which was positively correlated with performance), other medical colleges too can consider using MCQs to assess undergraduates. Limitations of this study include failure to take into consideration the effect of factors like gender; students' preferences of assessment methods and perceptions of workload. Further studies can be done to address these issues.

Conclusion: The majority of our first year medical students exposed to a didactic-non PBL curriculum in which assessment included MCQs in Physiology preferred a deep learning approach which was positively correlated with MCQ marks.

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Conflict of interest: None
Funding: None