Approaches to learning and academic performance in pharmacology among second-year undergraduate medical students

Abordagens de aprendizagem e desempenho acadêmico em farmacologia entre estudantes de medicina do segundo ano

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ABSTRACT

AIMS: To determine the learning approach of second-year undergraduate medical students and whether a surface or deep approach to learning had any correlation with the pharmacology sessional and university examination marks obtained.

METHODS: A cross-sectional study was conducted among second-year medical students in their fifth semester. To determine the students' learning approach, whether superficial or deep, we used the Revised Two Factor Study Process Questionnaire (R-SPQ-2F), which contains 20 items in the form of a five-point Likert scale and is suitable for use in higher education settings. Cronbach's alpha was calculated using the scores obtained from a sample of 20 students to determine the internal consistency. To determine the relationship between the learning approach and examination scores, the average of the individual sessional examination marks and the university examination scores obtained by the students were calculated.

RESULTS: Of the 170 students who participated in the study, 87 (51.2%) were females. The Cronbach's alpha value was considered acceptable for both surface and deep approach. While the academic performance was significantly better in females (U=2571.5; p=0.001), no difference was seen in the learning approach based on gender. Fifty (29.4%) students had a higher score for the surface approach. This group had lower examination scores compared with those with equal scores for surface and deep approach or higher scores for the deep approach. A weak negative correlation was seen between the examination marks and surface approach (τb=-0.167; p=0.002). When analyzed based on gender, the correlation was statistically significant only in females (τb=-0.173; p=0.02).

CONCLUSIONS: A weak negative correlation was seen between the examination marks and surface approach to learning. Although statistically significant, the actual difference between the groups was of a small magnitude. Hence, whether promoting deep learning approach improves academic performance in terms of marks obtained in the examination needs to be confirmed by further studies.

KEYWORDS: learning; pharmacology; academic performance; male; female.

RESUMO

OBJETIVOS: Investigar a abordagem de aprendizagem de estudantes de medicina do segundo ano de graduação e se uma abordagem superficial ou profunda teve alguma correlação com as notas obtidas na disciplina de farmacologia e nos exames universitários.

MÉTODOS: Um estudo transversal foi conduzido entre estudantes do segundo ano de medicina em seu quinto semestre. Para determinar a abordagem de aprendizagem dos alunos, como superficial ou profunda, usamos o questionário *Revised Two Factor Study Process Questionnaire* (*R-SPQ-2F*), que contém 20 itens em forma de uma escala Likert de cinco pontos, sendo o seu uso adequado para ambientes de ensino superior. O alfa de Cronbach foi calculado usando as pontuações obtidas de uma amostra de 20 alunos para determinar a consistência interna. Para determinar a relação entre a abordagem de aprendizagem e as pontuações do exame, calculou-se a média das notas dos exames individuais e as pontuações dos exames universitários obtidas pelos alunos.

RESULTADOS: Dos 170 alunos que participaram do estudo, 87 (51,2%) eram do gênero feminino. O alpha de Cronbach foi considerado bom tanto para a abordagem superficial quanto profunda. Enquanto o desempenho acadêmico foi significativamente melhor em mulheres (U=2571,5; p=0,001), nenhuma diferença baseada no gênero foi observada na abordagem de aprendizagem. Cinquenta (29,4%) estudantes tiveram uma pontuação mais alta para a abordagem superficial. Esse grupo teve escores de exame mais baixos em comparação com aqueles com escores iguais para abordagem superficial e profunda ou escores mais altos para a abordagem profunda. Uma fraca correlação negativa foi observada entre as notas do exame e a abordagem superficial (τb=-0,167; p=0,002). Quando analisada com base no gênero, encontrou-se uma correlação de magnitude fraca e negativa apenas no gênero feminino (τb=-0,173; p=0,02).

CONCLUSÕES: Uma fraca correlação negativa foi observada entre as notas do exame e a abordagem superficial para a aprendizagem. Embora estatisticamente significativa, a diferença real entre os grupos foi de pequena magnitude. Portanto, se a promoção de uma abordagem de aprendizagem profunda melhora o desempenho acadêmico em termos de notas obtidas no exame, isso precisa ser confirmado por outros estudos.

DESCRITORES: aprendizagem; farmacologia; desempenho acadêmico; homem; mulher.

Abbreviation: R-SPQ-2F, Revised Two Factor Study Process Questionnaire.

INTRODUCTION

The medical curriculum is designed to enable students to become basic doctors at the end of the course. The current regulation on undergraduate medical education encourages the use of innovative teaching methods such as integrated teaching, small group discussions, and problem-based learning [1]. The emphasis is on enabling students to integrate and synthesize knowledge rather than just rote learning.

The students' approach to learning is determined by their prior knowledge, ability, and personal preferences as well as by the nature of the content being taught, methods of teaching and assessment, the institutional climate and procedures, etc. [2]. Learning approaches can be defined as "the characteristic cognitive, affective, and psychosocial behaviors that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment" [3]. Unlike the learning style, which is mainly a personal trait, learning approach is not static; it is influenced by a number of factors and, thereby, is liable to change [4]. The learners' perception about the subject and motivation can determine the learning approach; also, the teaching and assessment methods used and the learning environment can influence the learning approach [2]. The approaches to learning could be surface, deep, or strategic. In an individual with surface approach to learning, the primary concern is to pass the examinations, and hence, predominantly depends on rote learning; those with an interest in the subject and a desire to understand the subject matter adopt the deep learning approach; strategic approach involves using a combination of surface and deep approach based on the intrinsic motivation and the nature of work to be accomplished [5, 6].

Recently, significant curricular changes were done in our institution to conform to the updated medical education regulations [1]. These changes in teaching methods were associated with changes in assessment methods. With these changes, we assumed that a majority of the students would adopt a deep learning approach. Identification of students' learning approaches enables educational institutions and teachers to implement suitable instructional formats and/or modify the currently used teaching methods. Hence, this study aimed to know the learning approach of second-year undergraduate medical students using the Revised Two Factor Study Process Questionnaire (R-SPQ-2F) and determine the presence of any correlation between the surface or deep approach to learning, the marks obtained in pharmacology sessional and university examinations, and the presence of any gender difference. The R-SPQ-2F has been shown to be a reliable tool to determine the student learning approaches [7]. We hypothesized that students with a deep learning approach would perform better in the examinations compared with those with a superficial approach.

METHODS

Study design and setting

The present study was a cross-sectional questionnaire-based study conducted among second-year medical students at the Department of Pharmacology, Kasturba Medical College, Mangalore, India. In our institution, pharmacology is taught in three semesters during the second year of the medical course, each semester comprising of six months. The students are taught using the traditional approach, comprising of didactic lectures and practical training. With the recent changes in the Indian medical education regulations emphasizing active learning amongst the students, various changes were introduced in the teaching methods. Some of these changes included one-third of the total teaching hours, being in the form of small group teaching, the rest being didactic lectures; emphasis on active learning during small group teaching in the form of problem-based learning, self-directed learning, case-based learning, etc.; emphasis on acquiring practical skills during the practical teaching hours, such as drug administration techniques using mannequins, use of computer simulations to teach basic pharmacology concepts, etc. The students were formatively assessed during these sessions besides the summative sessional and final University examinations conducted to assess both theory and practical knowledge acquisition. The questions included in the assessment comprised of both those that require the recall of facts as well as knowledge application. The study was initiated after obtaining approval from the Kasturba Medical College Mangalore Institutional Ethics Committee, Communication number 10-16/249.

Study participants

A total of 254 second-year medical students in their fifth semester were invited to participate in the study.

The students were briefly acquainted with the purpose of the study. Information regarding anonymization of data and voluntary participation was explained to the students during the informed consent process, and informed consent was obtained from each participant. Consenting students were provided with the study questionnaire for data collection.

Instrument for data collection

Data on students' approach to learning were obtained using the R-SPQ-2F, developed by Biggs et al. [2]. The R-SPQ-2F contains 20 items with 10 items related to the deep and surface approaches, respectively. Of the 10 items, five items reflect the motives (which refers to why students learn) and five reflect the strategy (which refers to how they learn) for a given learning approach [2]. The questionnaire is answered on a five-point Likert scale. The options to select are: A, this item is never or only rarely true of me; B, this item is sometimes true of me; C, this item is true of me about half the time; D, this item is frequently true of me; E, this item is always or almost always true of me [2]. The students were instructed to choose the single most appropriate response to each of the questions. The responses to the questionnaire were analyzed according to the scoring system, and the results measure whether the students adopted a deep or surface approach. The scores for the deep approach is calculated by summation of deep motive and deep strategy scores and for surface approach by summation of surface motive and surface strategy scores [2]. To evaluate the reliability coefficient of the questionnaire, Cronbach's alpha was calculated, which is a measure of internal consistency. A reliability coefficient of 0.70 or higher is considered "acceptable" in most social science research situations [8]. A pilot test of the questionnaire was conducted among 20 students, and the scores obtained were analyzed to determine the internal consistency.

To determine the relationship between the learning approach and examination scores, the average of the individual sessional examination marks and the university examination scores obtained by the students was calculated.

Data analysis

Data were entered and analyzed using the Statistical Package for the Social Sciences (SPSS) for Windows, Version 11.5 (SPSS Inc., Chicago, IL, USA). The normality of data distribution was determined using the Shapiro-Wilk test. Since the data were not normally distributed (p-values for the surface motive, surface strategy, deep motive, and deep strategy scores were 0.002, 0.047, 0.047, and 0.017, respectively), the comparison of the examination scores and the R-SPQ-2F scores between genders was performed using the Mann-Whitney U test. Correlation between the examination scores and learning approach was determined using Kendall's Tau-b test. A p-value <0.05 was considered statistically significant.

RESULTS

Among the 254 invited students, 170 students agreed to participated in the study, of which 87 (51.2%) were females. The Cronbach's alpha values of the R-SPQ-2F questionnaire for the items denoting superficial and deep learning approach were 0.813 and 0.729, respectively, indicating acceptable reliability of the questionnaire in our study population. Female students obtained higher marks in the pharmacology sessional (p=0.001) as well as university examinations (p=0.001) than male students, and the difference was statistically significant (**Table 1**).

Table 1. Comparison of examination marks in pharmacology and the R-2F-SPQ scores of second-year undergraduate medical students based on gender

Variables	Male (n = 83)	Female (n = 87)
	Median (IQR)	Median (IQR)
Examination marks*	55.74 (47.23-63.19)	63.62 (54.26-70.43)‡
Surface approach score†	25 (22-30)	25 (22-30)
Deep approach score†	31 (26-35)	29 (24-32)

R-2F-SPQ, Revised Two Factor Study Process Questionnaire; IQR, Interquartile Range.
* Average of the pharmacology sessional and university examination marks.
† Combination of surface/deep motivation and surface/deep strategy scores.
‡ p = 0.001.

Among the study sample, 50 (29.4%) students obtained higher scores for surface strategy whereas the rest obtained either equal, or higher scores for the deep learning strategy. No gender difference was seen in the learning approach among the students. We considered a score difference between the learning approaches of more than five to determine the predominant learning approach in the study sample. The results are shown in **Table 2**.

The correlation between the examination scores and the learning approach is shown in **Figure 1**. A weak negative correlation was seen between the surface approach and examination scores for the entire study sample (τb=-0.167, p=0.002). On analyzing the

Table 2. Learning approach pattern in second-year undergraduate medical students

Learning approach	Score difference (Deep approach score − Surface approach score)	Percentage of the study sample (n = 170)
Surface approach	More than -5	15.9%
Surface and Deep approach	Between -5 and +5	39.4%
Deep approach	More than +5	44.7%
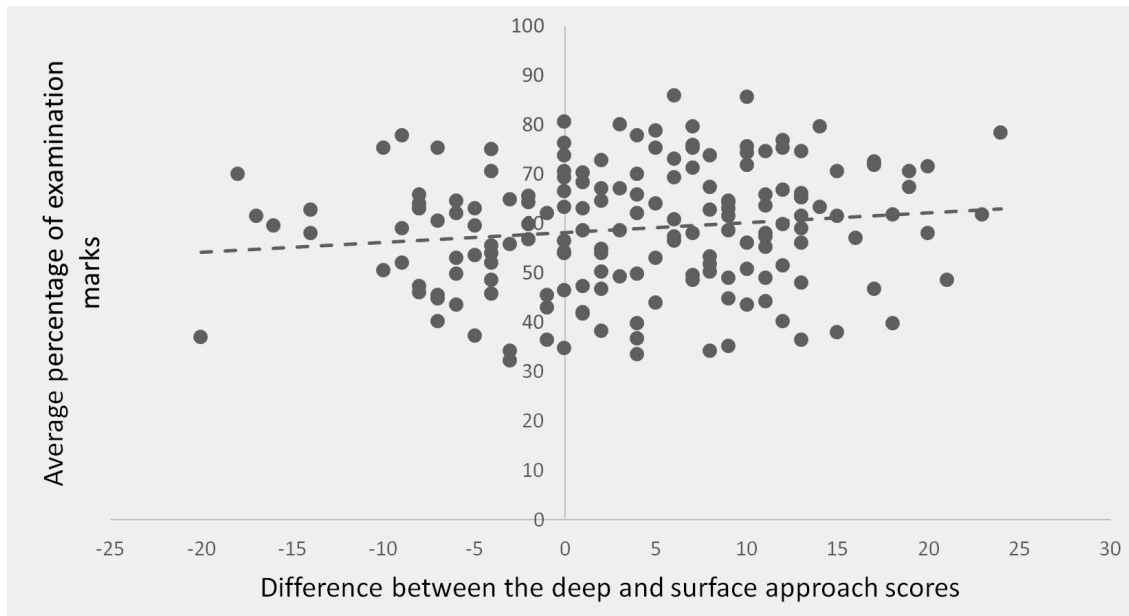
Figure 1. Correlation between the examination marks in pharmacology and the learning approach scores of second-year undergraduate medical students. Points on the positive X-axis represent a higher deep approach score compared with those on the negative X-axis, which denote higher surface approach score. A weak negative correlation is seen between the surface approach and examination scores (τb = -0.167, p = 0.002).

data based on gender, no correlation was seen between the examination scores and deep and surface learning approach in the case of males. No correlation was seen between the examination scores and deep approach (p=0.708), but a weak negative correlation was seen with superficial approach in females (τb=-0.173, p=0.02).

DISCUSSION

Our study tried to determine the learning approach of second-year undergraduate medical students and its correlation with their academic performance in pharmacology subject. We observed a statistically significant but weak negative correlation between the surface approach to learning and the pharmacology examination marks. In particular, the negative correlation was significant in female students.

In our study, most of the students adopted either the deep learning approach or a combined surface and deep learning approach. An assessment method that directly or indirectly promotes rote learning, the teaching environment, and the intrinsic motivation (or lack of) of the students may result in the adoption of a surface learning approach strategy. We expected that, with the recent changes in the teaching and learning methods adopted, a large number of students would have a deep learning approach. Hence, a higher score for the deep learning approach in our study sample is encouraging. This finding is in line with that of earlier studies which have shown a significantly higher deep learning approach among medical students [9-11]. However, changes in curricular delivery may not always result in an apparent change in the student learning approach [12, 13]. It is important to determine how the students perceive the changes in the curriculum, and how these changes affect their academic motivation and quality of life [13]. Moreover, the learning approach may change over time. In a study among health science students, the deep approach scores were found to be significantly lower in second-year medical and dental students compared with those in the first year [9].

The correlation between the learning approach and examination scores based on gender seen in our study has also been seen in earlier studies. A study conducted to determine the effects of progress test on learning approaches and perceived stress among medical students showed that female students with a surface approach to learning scored less than male students, but no difference was seen with respect to deep learning approach [12]. The lack of gender difference with regard to deep approach was also seen in a study comprising of a large sample of first- to third-year medical students [10]. Similar results were obtained in our study, and this issue warrants further study. It has been shown that the surface approach to learning is associated with a higher amount of perceived stress, which may contribute to the poorer performance of these students [12, 14]. Similar to other studies, surface approach to learning was associated with poorer examination performance, independent of the gender effect.

Our study has limitations. It was a single time-point study done among a single cohort of second-year medical students. The effect of teaching methods on the learning approach of students needs to be determined over a period. However, since the study was conducted in the context of the introduction of a revised curriculum, which emphasized on active learning, the findings of our study are of general relevance, albeit with limitations, and important in understanding the effects of curriculum change on student learning approaches. Since we were interested in determining the effect of the learning approach on academic performance in pharmacology subject, our results may not be valid for other subjects since the teaching and assessment methods adopted may be different. Although a statistically significant negative correlation was seen between the surface approach to learning and the average examination marks, the magnitude of difference was small and, hence, requires a larger study to validate the findings. Also, while deep learning approach is encouraged among students, our study, as well as previous studies [12, 15, 16], have not found a significant effect on the academic performance. Hence, this issue requires further research. In this study, a weak negative correlation was seen between the examination marks and surface approach to learning. Although statistically significant, the actual differences between the groups were of a small magnitude. Hence, whether promoting deep learning approach improves academic performance in terms of a significant difference in the marks obtained in the examination needs to be confirmed by further studies.

NOTES

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Conflicts of interest disclosure

The authors declare no competing interests relevant to the content of this study.

Authors' contributions

All the authors declare to have made substantial contributions to the conception, or design, or acquisition, or analysis, or interpretation of data; and drafting the work or revising it critically for important intellectual content; and to approve the version to be published.

Availability of data and responsibility for the results

All the authors declare to have had full access to the available data and they assume full responsibility for the integrity of these results.

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