The effect of learning styles and study behavior on success of preclinical students in pharmacology

Halil Asci, Esin Kulac¹, Mekin Sezik²,³, F. Nihan Cankara, Ekrem Cicek

ABSTRACT

Objectives: To evaluate the effect of learning styles and study behaviors on preclinical medical students’ pharmacology exam scores in a non-Western setting.

Materials and Methods: Grasha–Reichmann Student Learning Study Scale and a modified Study Behavior Inventory were used to assess learning styles and study behaviors of preclinical medical students (n = 87). Logistic regression models were used to evaluate the independent effect of gender, age, learning style, and study behavior on pharmacology success.

Results: Collaborative (40%) and competitive (27%) dominant learning styles were frequent in the cohort. The most common study behavior subcategories were study reading (40%) and general study habits (38%). Adequate listening and note-taking skills were associated with pharmacology success, whereas students with adequate writing skills had lower exam scores. These effects were independent of gender.

Conclusions: Preclinical medical students’ study behaviors are independent predictive factors for short-term pharmacology success.

KEY WORDS: Grasha–Reichmann Student Learning Study Scale, learning style, pharmacology, study behavior

Introduction

Achievement of medical education depends on multifactorial elements such as medical teachers and students, education program, learning environment, study hours, academic infrastructure, institutional climate, and financial issues.¹,² Within these elements, medical students form the essential component of medical education. Therefore, factors affecting the success of medical learners have been the subject of investigation in recent years. In line with these, study behaviors and learning styles of medical students may be critical determinants for predicting success. Pharmacology courses possess a relatively important part of the undergraduate medical curriculum. The key to success in pharmacology courses will depend on proper study behavior combined with the efficient learning style of the students.

Studies have revealed that each student has a dominant learning style and particular study behavior characteristics.²⁻⁴ This is reflected by some students preferring individual learning, whereas others learn better in a competitive environment with principally independent characteristics. In fact, such differences give rise to various learning styles exhibited by the students.¹ The definition of “learning style” varies considerably in the educational literature. Grasha¹ based his definition on personal qualities, interactions with peers, and the teacher and learning experiences. Grasha–Reichmann learning style model centering peer-to-peer and pupil–instructor interaction, defines six different learning styles depending on the active participation of the students.¹ This are summarized in the following sections.

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

Cite this article as: Asci H, Kulac E, Sezik M, Cankara FN, Cicek E. The effect of learning styles and study behavior on success of preclinical students in pharmacology. Indian J Pharmacol 2016;48:15-20.
Independent
These students study what they think important and prefer independent study. They would prefer to work alone, especially in topics they are highly interested in, irrespective of the learning subjects.

Dependent
These students usually do not have any intellectual curiosity and depend on guidance and authority.

Competitive
The main aim of the competitive learners is to receive recognition among others to perform better than their peers and to be rewarded.

Avoidant
This group of students is not willing to cooperate with teachers and other students and is uninterested in the class content, with an overwhelmed feature.

Participant
In contrast to the avoidant style, participant learners attend to class activities, are interested in learning and try to be a "good" student.

Collaborative
These students tend to share knowledge and are cooperative with the peers and teachers.

Medical students require a particular “self-discipline” during the learning process. Engaging the proper study behavior is considered a prerequisite for success. In this process, habits and attitudes of students during studying differ to some extent. While some students draw up efficient study schedules with selective role-taking strategies, others tend to study lecture notes without attending the class and use critical reading skills based on different resources.

The Study Behavior Inventory (SBI) has been developed for identifying student’s learning skills and comprises the following areas related to the student’s academic performance and success: Time management, study reading, general study habits, listening–note-taking, writing, test anxiety/test taking, and faculty relations. Study skills are considered to function as critical tools for learning. Effective study behavior enables students to take advantage of learning opportunities. Hence, the use of learning strategies within a large spectrum is vital for academic competence, especially for preclinical medical learners.

Proper study behaviors assist learners use time efficiently. Although the amount of time spent during studying was reported to have no direct effect on academic performance, motivation and study time were found to interact significantly for acting on academic success. Moreover, using visual learning strategies such as underlining, highlighting in different colors, symbols, flowcharts, and graphs may affect success.

Factors associated with success in medical school such as teaching methods, learning styles, gender, and ethnicity have been emphasized in the previous literature. For example, in an Austrian study evaluating the reliability of the prediction of student success in the Medical University of Vienna, male sex, German native language, performance at school, learning capacity, and learning styles were main determinants. Therefore, both study behavior and learning style seems to be predictive factors for success in medical school. Although some previous publications have analyzed learning styles and study behavior in medical learners, data on the association between these and medical students’ success are limited.

The aim of the current study was to evaluate the effect of learning styles and study behaviors on the exam scores of a specific preclinical course (i.e., pharmacology) in the medical school setting. We hypothesized that learning styles and study behavior would influence pharmacology success, particularly in a non-Western setting.

Materials and Methods
Our medical school utilizes an integrated curriculum within a system-based education program during the first 3 years of study. Pharmacology courses are given in the 3rd year and comprise 17% of the total lecture hours. The 3rd year includes six blocks of 3–6 weeks’ duration. By the end of each thematic block, a multiple-choice examination is performed. At the end of the year, one final examination that integrates all courses, again with multiple-choice questions takes place. The number of questions in the examinations is determined by the weight of each course depending on lecture hours.

Study Design
The current study was subject to approval by the Local Ethics Committee. All of the students at the end of year 3 (preclinical phase) in our medical school were invited to participate. Of the 159 students approached, 87 gave consent resulting in a 54.7% response rate.

Initially, a 10-min briefing was given to all the participants by one of the authors (E.K.) on the topic of study behaviors and learning styles. Then, SBI and Grasha–Reichmann Student Learning Study Scale (GR-SLSS) were distributed as written material. The first part of the survey included demographic data such as gender and age. Race and native language were not specifically asked for.

Instrumentation
In the current study, we used a modified SBI adapted by Baltas into Turkish language. This inventory examines study behaviors in seven subcategories: Time management, study reading, general study habits, listening–note-taking, writing, test anxiety/test taking, and faculty relations. The scale scores outlined in Table 1 determines adequacy in certain behaviors. GR-SLSS was selected to assess the learning style characteristics of the participants. GR-SLSS defines dominant learning styles categorized into independent, dependent, competitive, collaborative, avoidant, and participant. The scale scores were determined using score ranges in Table 1.

Statistical Analyses
Categorical variables were analyzed using Chi-square contingency table analysis and Kruskal–Wallis test. Post-hoc Mann–Whitney U-test was used when significant differences were detected. Logistic regression models were generated to evaluate the independent effect of gender, age, learning styles, and study behaviors on pharmacology success classified as a final examination grade at various cutoffs (50–80). In all analyses, significance was set at $P < 0.05$ at 95% confidence intervals.
Results

Descriptive Data

The reliability (Kuder-Richardson-20) of the scale was found to be 0.81 (range, 0.8-1.0 for each item), revealing an acceptable internal consistency. Descriptive data of the cohort are shown in Table 2. There were 53 females (60.9%) with a female-to-male ratio of 1.56. The mean ± standard deviation age was 21.2 ± 1.0 years, with the majority of the students (45.9%) being 21 years old. Students were most commonly adequate in study reading (40.2%) and general study habits (37.9%), as shown in Table 3. Subcategory distributions (adequate/moderate/inadequate) of study behavior characteristics are given in Figure 1. Collaborative (40%) and competitive (27.1%) dominant learning styles were most frequent among learners [Table 3]. There were no students with “participant” as the dominant style.

The effect of gender on study behavior is summarized in Table 2. The distribution of gender was similar across various facets of study behaviors [Table 2]. Study behavior characteristics and dominant learning styles were also compared, and there were significant differences in subcategory scores of study reading (Kruskal-Wallis Chi-square = 21.8, P = 0.0001) and test anxiety/test taking (Kruskal-Wallis Chi-square = 15.3, P = 0.004). Post hoc analyses revealed that students with avoidant learning style had higher scores (i.e. decreased adequacy) in study reading (Mann-Whitney U-test, z = -3.14, P = 0.002) and test anxiety/test taking (Mann-Whitney U-test, z = -3.29, P = 0.001).

Logistic Regression Models

Gender, age, dominant learning style, and study behaviors were entered as independent variables into logistic regression models. Various cutoff values for final examination mark ranging from 50 to 80 (out of 100 as the full mark) were defined as the dependent variable, and odds ratio for adequacy versus moderate adequacy plus inadequacy were calculated. Table 4 summarizes the main results of the models.

Adequate listening and note-taking skills were independently associated with a final exam grade ≥50, ≥60, and ≥70 out of 100. Students with adequate study reading were 2.6-fold more likely to score ≥50 [Table 4]. On the other hand, students with adequate writing skills had lower pharmacology success in terms of pass marks <60 and <70 [Table 4]. Students with higher (≥80) pharmacology pass mark were about 90% less likely to have a collaborative learning style [Table 4].

Discussion

Study behavior and learning styles are particularly important for student performance. Complex interrelationships exist among student learning experiences and study behavior for influencing academic success in higher education. Recent data on 541 final year university students in Hong Kong indicates that “student perception of the learning experience predicts study behaviour and that study behaviour considerably predicts final exam scores.” In our study, we did not specifically identify student perceptions; however, we included pharmacology students’ learning styles in association with their study behaviors.

Most of the students in our cohort were "adequate" in study reading. This finding emphasizes that learners selective in taking the relevant information are able to use time effectively considering reading habits. With the increasing amount of
medical data, the medical student also faces the difficulty of reading substantial amount of lecture notes, books, journals, and articles. Therefore, effective reading methods such as quick reviewing, reading selectively, and surveying seem to be essential for pharmacology success. Eventually, most medical learners typically improve their reading skills and adapt these techniques to their learning styles. In fact, study behavior characteristics and learning styles are expected to be common determinants of success in a specific learning environment.\textsuperscript{[11]}

Only about 15\% of students in our study group were inadequate in general study habits. Hence, the survey results indicate that most students had improved their abilities as they progressed through medical school using various study techniques for memorizing, making a list of important items, and reviewing important aspects. Moreover, horizontally integrated curriculum in our medical school may assist students, strengthen their previous learning experiences.\textsuperscript{[17]}

We used GR-LSS for determining the learning styles of our cohort. The most frequent dominant learning styles were collaborative and competitive. These findings support previous data from Malaysia\textsuperscript{[18]} (on 545 medical students) and Pakistan\textsuperscript{[19]} (on 230 medical students). However, our study was unique, as we analyzed the correlations across study behaviors and learning styles of medical students. Students with the avoidant dominant learning style had higher scores in study-reading skills. It should be noted that higher scores in the SBI we utilized are associated with inadequacy in a particular skill. Therefore, avoidant learners were probably uninterested in the class and were insufficient to develop proper note-taking strategies. These students may be unwilling to persuade the instructor to slow down or repeat the key topics during the

\begin{table}[h]
\centering
\caption{Descriptive data of the cohort ($n=87$)}
\begin{tabular}{|l|c|}
\hline
Variable & Value \\
\hline
Gender (female/male, \%) & 60.9/39.1 (53/34) \\
Female/male ratio & 1.56/1 \\
Age (years) \% & 21.2±1.0 (19-24) \\
\leq 21 & 69.4 (59) \\
\geq 21 & 30.6 (26) \\
Pharmacology exam score & 64.9±12.8 (28-88) \\
\geq 50 & 89.4 (76) \\
\geq 60 & 72.9 (62) \\
\geq 70 & 27.1 (23) \\
\geq 80 & 12.9 (11) \\
Adequacy in study behavior & \\
Time management & 1.1 (1) \\
General study habits & 37.9 (33) \\
Listening–note-taking & 9.2 (8) \\
Study reading & 40.2 (35) \\
Writing & 12.6 (11) \\
Faculty relations & 10.3 (9) \\
Test anxiety/test taking & 17.2 (15) \\
Dominant learning style & \\
Independent & 4.7 (4) \\
Avoidant & 24.7 (21) \\
Collaborative & 40.0 (34) \\
Dependent & 3.5 (3) \\
Competitive & 27.1 (23) \\
Participant & - \\
\hline
\end{tabular}
\end{table}

\begin{table}[h]
\centering
\caption{Summary of the logistic regression models for a pharmacology pass mark of \textgreater 50, \textgreater 60, \textgreater 70, and \textgreater 80}
\begin{tabular}{|l|l|c|c|c|c|}
\hline
Study behaviors & Pass mark & OR & CI & P \\
\hline
Listening–note-taking & \\
Adequate & - & 13 & 4.4 & 1.4-13.6 & 0.01 \\
Moderate & 7 & 57 & \\
Inadequate & 2 & 6 & \\
Study reading & \\
Adequate & 1 & 32 & 2.6 & 1-1.5-9 & 0.02 \\
Moderate & 7 & 37 & \\
Inadequate & 1 & 7 & \\
Test anxiety/test taking & \\
Adequate & 1 & - & 0.5 & 0.2-0.9 & 0.03 \\
Moderate & 7 & 62 & \\
Inadequate & 1 & 14 & \\
\hline
Listening–note-taking & \\
Adequate & - & 13 & 1.5 & 1.1-2.3 & 0.048 \\
Moderate & 20 & 44 & \\
Inadequate & 3 & 5 & \\
Writing & \\
Adequate & 12 & 27 & 0.7 & 0.5-0.9 & 0.045 \\
Moderate & 10 & 26 & \\
Inadequate & 1 & 9 & \\
\hline
Listening–note-taking & \\
Adequate & 9 & 4 & 1.5 & 1.0-2.2 & 0.076 \\
Moderate & 46 & 18 & \\
Inadequate & 7 & 1 & \\
Writing & \\
Adequate & 26 & 13 & 0.6 & 0.5-0.8 & 0.04 \\
Moderate & 29 & 7 & \\
Inadequate & 7 & 3 & \\
\hline
Collaborative & 18 & 5 & 0.09 & 0.01-0.8 & 0.03 \\
\hline
\end{tabular}
\end{table}

All data are given as mean±SD (range within parentheses) or percentages (frequencies within parentheses). SD=Standard deviation.
Moreover, they can have lapses in reviewing the lecture notes with peers and improving study techniques. To overcome such difficulties, tailored remedial programs for improving learning in low performers may be useful. For example, a study from India found improved confidence and self-esteem in 73 students, who performed poorly in pathology examination following sessions on study skills and counseling concerning their personal problems. Detailed investigations on this issue will be needed.

In our design, we investigated the effect of learning styles and study behaviors on pharmacology success relying on multiple-choice final examination scores. We used logistic regression models to evaluate the independent contribution of these variables, as learning styles and study behaviors are interrelated determinants. Adequacy in listening–note-taking was the most important independent predictor of pharmacology success, especially for a pass mark ≥50, ≥60, and ≥70. Interestingly, over 75% of our cohort was moderately adequate in listening–note-taking skills, while full adequacy was about 10%. It is obvious that identifying main points by not being bogged down in detail and taking adequate notes depending on cues given by the lecturer would contribute to pharmacology success. Learners who attend lectures regularly have more listening and proper note-taking skills. At this point, a characteristic feature of pharmacology courses can be emphasized. Due to excess load of information with time, critical reading with logical consistency seems to be fundamental for relevant pharmacology learning.

We found that students with adequate writing skills were associated with lower examination pharmacology scores. In our cohort, students aiming to learn about a broad subject area using concrete examples and reasoning were not as successful as students that were selective in learning processes such as note-taking and reviewing notes. Obviously, our output variable (final examination grade from the pharmacology course) does not directly assess and evaluate any writing skills. Interestingly, students with collaborative learning styles were less likely to get very high (≥80) pharmacology grades. Collaborative learners were moderately successful, as they probably tend to share their learning materials, knowledge, and details related to pharmacology notion. However, students with dominant collaborative style were not able to get very high grades in our cohort.

Li et al. investigated the effects of case-oriented self-learning and review in 185 3rd-year medical students in pharmacology teaching, using mid-term and final examination performances. Students in the study group had better exam performances compared to those in the traditional lecture-based teaching. These recent data indicate that collaborative learning can improve students' internalization of basic pharmacological principles. Other recent studies also support the significance of methods that support collaborative study in undergraduate pharmacology teaching, especially in small group case-based learning. In line with these studies, our results may also support that we should focus further on methods incorporating collaborative learning in pharmacology teaching.

Gender seems to have no significant effect on associations we encountered in our study group. This finding seems to disagree with several publications that include gender differences in study behaviors in university students. Meyer et al. described an apparently separate female trait considering comprehension learning style and achievement motivation. Another study that included university students in Ethiopia reported significant gender differences in the management of time for routine, recurring tasks, and in overall study behavior. The lack of gender differences in our design may be due to the inclusion of learning styles in the logistic regression models. Therefore, differences between male and female students encountered in previous investigations could originate from gender differences in learning styles, and not the study behaviors. This is supported by recent data demonstrating a correlation between primary learning style and gender in the medical school setting.

There are certain limitations of our study. Our participation rate was relatively low (about 55%). The output variable was the final examination score derived from multiple-choice questions. Therefore, evaluation of pharmacology success was rather limited and did not include various assessment techniques in our design. Another drawback may be that in any classroom, there will be a mix of students with different learning styles, and it is not generally possible to individualize instruction to meet these differences. The differences in the way different subjects are taught may further compound the problem. Moreover, our study design is based on the assumption that pharmacology teaching is a constant process with more of rote memory and uncontextual load of information. Despite these drawbacks, our study is unique, as we have attempted to investigate the independent predictive value of learning styles and study behaviors over pharmacology success in medical students within a single institution.

It is also possible to suggest some practical implications for teaching practice depending on our data. First, there is a need to adapt the pharmacology curriculum and the teaching practice in a flexible manner so that students with different learning backgrounds and styles will be able to overcome difficulties they encounter during the learning process. As suggested above, this requires tailored approaches such as small group case-based learning with identification of avoidant learners and more emphasis on increasing student participation. Second, there is a need to promote collaborative learning, especially in our environment. The medical profession requires interprofessional collaboration in a noncompetitive environment, and the opportunities to implement team-working skills during preclinical years should not be missed. Finally, dominant learning style and study behavior of medical learners are not static and will depend on the learning environment, institutional culture, teaching styles, professionalism issues, and assessment-evaluation tools.

**Conclusion**

Most of the students in our cohort had adequate study-reading skills and were competitive or collaborative learners. Gender had no effect on study behavior. Adequate listening–note-taking skills were positively associated with higher pharmacology exam scores. Following the current results on the relationship between certain study behaviors and pharmacology success, detailed investigations including multiple institutions will be warranted. Moreover, mentoring to improve study behavior of
low performers and incorporation of case-oriented self-learning in small study groups need to be emphasized.

Financial Support and Sponsorship
Nil.

Conflicts of Interest
There are no conflicts of interest.

References
1. Grasha AF. Teaching with Style: A Practical Guide to Enhancing Learning by Understanding Teaching and Learning Styles. 2nd ed. San Barnadino: Alliance Publishers; 2002. p. 167-74.
2. Richardson M, Abraham C. Modeling antecedents of university students’ study behavior and grade point average. J Appl Soc Psychol 2013;43:626-37.
3. Rehman R, Khan R, Akahai MA, Hassan F. Approach of freshly-inducted medical students towards learning at Bahria University Medical & Dental College. J Pak Med Assoc 2013;63:320-3.
4. Samarakoono L, Fernando T, Rodrigo C. Learning styles and approaches to learning among medical undergraduates and postgraduates. BMC Med Educ 2013;13:42.
5. Tinajero C, Lemos SM, Araujo M, Ferraces MJ, Paramo MF. Cognitive style and learning strategies as factors which affect academic achievement of Brazilian University students. Psicol Reflex Crit 2012;25:105-13.
6. Alligan H. Assessment and Evaluation in Education. 4th ed. Ankara: Ani Yayinclip; 2007.
7. Gurpinar E, Guzeliler CO, Alimoglu K, Kulac E. Determining studying behaviours of medical students and psychometric characteristics of study behaviour evaluation inventory. Med J SUD 2011;18:96-9.
8. Baltas A. Outstanding Achievements in Learning and in Exams without Being Squashed Under Stress. 17th ed. Istanbul: Remzi Kitabevi; 1999.
9. Study Behaviour Inventory. Glendale Community College. Available from: http://www.glendale.edu/index.aspx?page=1473. [Last accessed on 2013 May 20].
10. Gettinger M, Seibert JK. Contributions of study skills to academic competence. Sch Psychol Rev 2002;31:350-65.
11. Nonis SA, Hudson GL. Academic performance of college students: Influence of time spent studying and working. J Educ Bus 2006;81:151-8.
12. De Voe PH. Learning strategies for success in medical school a guide for new medical students. Albuquerque, NM, USA: University of New Mexico School of Medicine; 2003. p. 17-24. Available from: http://hsc.unm.edu/community.cnah/archive/docs/handbook_2004.pdf.
13. Ferguson E, James D, Madeley L. Factors associated with success in medical school: Systematic review of the literature. BMJ 2002;324:952-7.
14. Haidinger G, Frischenschlager O, Mitterauer L. Reliability of predictors of study success in medicine. Wien Med Wochenschr 2006;156:416-20.
15. University of Pittsburgh, Assigning Relative-Scale Grades, University of Pittsburgh TA Services. Available from: http://www.cidee.pitt.edu/ta-handbook/evaluation-students/logic-grades/assigning-relative-scale-grades. [Last accessed on 2013 Jan 05].
16. Ning HK, Downing K. The interrelationship between student learning experience and study behaviour. High Educ Res Dev 2011;30:765-78.
17. Vivic B, Welilauf HM. Horizontal and vertical integration of academic disciplines in the medical school curriculum. Clin Anat 2002;15:233-5.
18. Amira R, Jelas ZM. Teaching and learning styles in higher education institutions: Do they match? Procedia Soc Behav Sci 2010;7:680-4.
19. Gujaa AA, Tabassum R. Assessing learning styles of student teachers at federal college of education. Procedia Soc Behav Sci 2011;30:267-71.
20. Uzuntiryaki E. Learning styles and high school students’ chemistry achievement. Sci Educ Int 2007;18:25-37.
21. Mysorekar VV. Need for mentorship to improve learning in low-performers. Natl Med J India 2012;25:291-3.
22. Gysbers V, Johnston J, Hancock D, Denyer G. Why do students still bother coming to lectures, when everything is available online? Int J Innov Sci Math Educ 2011;19:20-36.
23. Li S, Yu B, Yue J. The application of case-oriented self-learning and review in pharmacology teaching. Am J Med Sci 2013;348:52-6. [E-pub].
24. Rao YK, Shenoy GK. Introducing team based learning in undergraduate pharmacology. Indian J Pharmacol 2013;45:102-3.
25. Tayem YI. The impact of small group case-based learning on traditional pharmacology teaching. Sultan Qaboos Univ Med J 2013;13:115-20.
26. Thistlethwaite JE, Davies D, Ekeocha S, Kidd JM, MacDougall C, Matthews P, et al. The effectiveness of case-based learning in health professional education. A BEME systematic review: BEME Guide No 23. Med Teach 2012;34:e421-44.
27. Meyer JH, Dunne TT, Richardson JT. A gender comparison of contextualised study behaviour in higher education. High Educ 1994;27:469-85.
28. Devi PN, Woldetsadik LC. Gender difference in study behaviour among university students in Ethiopia. Natl Mon Refereed J Res Arts Educ 2013;2:37-46.
29. Kulac E, Sezik M, Asci H, Gurpinar E. Learning Styles, Academic Achievement, and Gender in a Medical School Setting. J Clin Anal Med 2015;6: 608-11.