RESEARCH

The Impact of Preceptor and Student Learning Styles on Experiential Performance Measures

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Objectives. To identify preceptors' and students' learning styles to determine how these impact students' performance on pharmacy practice experience assessments.

Methods. Students and preceptors were asked to complete a validated Pharmacist's Inventory of Learning Styles (PILS) questionnaire to identify dominant and secondary learning styles. The significance of "matched" and "unmatched" learning styles between students and preceptors was evaluated based on performance on both subjective and objective practice experience assessments.

Results. Sixty-one percent of 67 preceptors and 57% of 72 students who participated reported "assimilator" as their dominant learning style. No differences were found between student and preceptor performance on evaluations, regardless of learning style match.

Conclusion. Determination of learning styles may encourage preceptors to use teaching methods to challenge students during pharmacy practice experiences; however, this does not appear to impact student or preceptor performance.

Keywords: learning styles, experiential education, preceptor, pharmacy practice experience, assessment

INTRODUCTION

The diversity of learning types among students in pharmacy classrooms, laboratories, and practice experience sites presents challenges for pharmacy educators. Different educational backgrounds, life experiences, cultures, generations, and personal and professional interests vary with students. Learning environments are equally diverse and create additional struggles. Three examples of challenges pharmacy educators face are increases in classroom technology, increases in class size, and incorporation of distance learning to deliver curriculums. To address these challenges, it may be appropriate to assess both student and educator learning styles.

Although, defined in a number of ways, a well-accepted definition of learning styles is "characteristic cognitive, effective, and psychosocial behaviors that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment."¹ These have been evaluated in the literature by several different disciplines including engineering, pharmacy, nursing, allied health, and others.²⁻¹⁷ Learning style instruments include the Kolb Learning Style

Inventory,¹⁸ Honey and Mumford's Learning Style Questionnaire,¹⁹ and the commonly used Myers-Briggs Type Indicator.²⁰

Of the instruments available, few have been validated or based on sound educational theory.²¹ The Kolb Learning Style Inventory, has been studied in health professions students and categorizes learners by the way they prefer to acquire knowledge.²² Based on this model, Austin worked with 40 pharmacists from varying disciplines to develop the Pharmacists Inventory of Learning Styles (PILS), a 17-item questionnaire specific to pharmacy.²³ Focus group workshops reviewed descriptors for learning styles that further identified 2 axes resulting in the foundation of the instrument. One axis is focused on *unstructured* vs. *structured* learning. Environments where the learning expectations and/or process are determined by the individual and not externally are *unstructured*, while environments where these expectations are defined externally are termed *structured*. The second axis focused on either doing or reflecting. Some individuals learn by trial and error and thus are the *doers*, while those who prefer to observe others and then practice to learn are termed *reflectors*. Based on these 2 axes, 4 categories of learning styles have been developed: assimilator, diverger, accommodator, and converger (Table 1). One unique aspect of the instrument is that it allows the determination of both dominant and secondary learning styles.

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Table 1. The Pharmacists' Inventory of Learning Styles With Associated Characteristics and Preferred Teaching Styles^a

PILS (Kolb's ^b) Learning Style	Characteristics	Preferred Teaching Style
Enactors (Accommodator)	Opportunistic, intuitive, goal-oriented, active, down-to-earth	Wants to know reason for learning, wants to be given resources for learning
Producers (Assimilator)	Organized, attention to details, rule-oriented, patient, fair-minded	Lectures (by experts), individual homework, limited group work
Directors (Converger)	Practical, leaders, action-oriented, purposeful, networkers	Group work (with purpose), competitions, practice by doing
Creators (Diverger)	Creative, peace-makers, people-oriented, open-minded, free-spirited	Group work (no time pressure), unstructured activities, creative games

^a Adapted with permission from Zubin Austin, PhD, and the *American Journal of Pharmaceutical Education*.²³

^b The Pharmacists' Inventory of Learning Styles, developed by Austin, was based on Kolb's Learning Style Inventory.¹⁸

Forty-eight pharmacists evaluated the reliability and validity of PILS. Although the number of participants was small, Austin suggested the instrument possessed adequate reliability and validity to be used in discussion of pharmacy teaching processes. Austin also encouraged use of PILS in pharmacy education to further validate the instrument and increase discussion between preceptors and students.

Another interesting debate has been whether there needs to be alignment or "matching" between student and teacher when it comes to learning styles. Some evidence suggests that students may become disengaged or bored if their preferred learning style is not addressed.² Others argue that exposing students to learning styles with which they are not comfortable will challenge their learning and lead to a more productive educational experience.²⁴ Some educators/researchers contend that it should be the students' responsibility to adapt their learning style to their instructor's teaching style. Critics have suggested students are not prepared to adjust and may spend more time trying to manipulate or interpret the information rather than actually learning and applying it.²⁵

To our knowledge, no published studies exist that examine learning styles in experiential learning and the effect this relationship may have on student or preceptor performance during pharmacy practice experiences. To better define this relationship, we identified and then evaluated the impact of learning styles on the performance of pharmacy preceptors and students during the third-year introductory pharmacy practice experiences (IPPE) and fourth-year advanced pharmacy practice experiences (APPE) at Texas Tech University Health Sciences Center School of Pharmacy. At the Texas Tech University Health Sciences Center School of Pharmacy, the third year consists of four 6-week IPPE's in institutional, community, inpatient, and ambulatory clinical skills. The fourth year consists of eight 6-week APPE's in rural community, hospital or health-system pharmacy, geriatrics, pediatrics, adult medicine, and primary care, and 2 elective APPEs.

METHODS

This study was conducted in 2 phases during the 2008-2009 academic year at the Texas Tech University Health Sciences Center School of Pharmacy. Phase 1 focused on determining learning styles of preceptors (including adjunct and full-time faculty members) and third- and fourth-year students using the PILS instrument.²³ Phase 2 evaluated the impact on student learning during pharmacy practice experiences of students and preceptors having "matched" or "unmatched" learning styles. The study was approved by the Human Subjects Institutional Review Board of Texas Tech University Health Sciences Center.

Determination of Learning Styles

From May to December 2008, third- and fourth-year pharmacy students and preceptors (adjunct and full-time faculty members) were contacted via e-mail, phone, or in-person to determine interest in participating in the study. All interested parties were then provided details regarding the study and asked to sign a consent acknowledging their willingness to participate. A link to an online survey instrument containing the PILS instrument was developed within the Vovici Company (Herndon, VA) software program. The survey link was provided to all individuals who agreed to participate.²³ Prior to answering questions on the survey instrument, participants were asked to recall a scenario in which they learned something new. After completing the survey instrument, participants were able to determine their dominant and secondary learning styles. Each learning style had a description to provide further explanation of the results. Participants were also required to provide their name, gender, and student or preceptor status. Students were asked whether their class standing was third or fourth year and preceptors were asked the number of years of teaching experience. All information was stored on a secure server to maintain confidentiality.

Impact of Learning Styles on Preceptor and/or Student Performance

Following completion of the survey instruments, one of the investigators, whose administrative position provided access to preceptor and student performance information, cross-referenced student and preceptor survey instruments. A list of practice experiences for which the student and preceptor had completed the survey instrument was generated. Each student could be included in the data set more than once if more than one of their preceptors had completed the survey instrument. Likewise, preceptors could be included more than once if more than one of their students had completed the survey instrument. All student and preceptor practice experiences finished by the date the survey instrument was completed were included in the analysis. Once the list had been generated, the investigator determined whether learning styles matched between preceptor and student for each individual practice experience. Three categories were considered: (1) matched dominant learning style, (2) matched dominant and/or secondary learning style, and (3) multiple learning styles.

In addition to determining matched or unmatched learning styles, the investigator also provided student performance data for each practice experience, as well as average evaluation scores for the preceptor for that practice experience. All IPPEs and APPEs final competency and course grades were included as subjective evaluations. For practice experiences in which a final examination was administered, these grades were included as objective evaluations. Although each IPPE and APPE had its own distinct criteria, all experiences used a competency assessment tool as the primary evaluative component to assess student's skills, attitudes, and abilities. Some practice experiences had additional rubric-driven forms (eg, SOAP notes [subjective, objective, assessment, and plan], drug information questions) that further assessed students' clinical skills. Objective final examinations evaluated students' core disease knowledge in 4 of the APPE's (geriatrics, pediatrics, primary care, and adult medicine) and 2 of the IPPE's (community and hospital). Final course grades were determined based on a combination of the subjective and objective evaluations described above. At the completion of all experiences, students were required to complete a 13-question form to evaluate their preceptor (on a 5-point Likert-scale). The median scores of these evaluations were used to assess overall preceptor performance. Prior to involvement of other investigators, all preceptor and student's names were removed from the data to protect confidentiality.

Data were evaluated with the Excel statistics add-on package Analyze-it, v 2.07 (Analyze-it Software, Ltd., Leeds, England, United Kingdom). The continuous data

were evaluated with the Shapiro-Wilk test for normality and the majority were non-parametric; therefore, all central tendencies are presented as medians $\pm$ at least 95% confidence intervals. The 95% confidence intervals of the medians were calculated by the binomial method. For all unpaired comparisons, the Mann-Whitney U test and Kruskal-Wallis test were used. For all non-parametric paired data, the Wilcoxon sign rank and Wilcoxon rank sum tests were used. The alpha was set at <0.05 .

RESULTS

Seventy-two students and 67 preceptors participated in the study. Fifty-seven percent of students and preceptors were female. Of the 72 students, there was an equal number of third- and fourth-year students ($n=36$). This represented a response rate of 40% in both year classes. Of the 67 preceptors, 25 were adjunct faculty members and 42 were full-time faculty members or residents. This represented 65% of all full-time faculty and residents at the school and 12% of all adjunct faculty members. Sixty-one percent of preceptors had been teaching on clinical practice experiences for 6 years or less. Four students and 4 preceptors who completed the survey instrument had not yet completed a pharmacy practice experience and thus were not included in the performance analysis.

Students were most likely to report assimilator as their dominant learning style (61%), with converger being the second most common (29%) (Table 2). There were no significant differences in dominant learning styles between third- and fourth-year students. Preceptors were also more likely to report assimilator as their dominant learning style (57%) with converger being the second most common (32%) (Table 3). Although differences were not significant, 70% of preceptors who had taught for 6 years or less were assimilators and 25% were convergers, while 38% of those precepting for more than 6 years were assimilators and 42% were convergers.

Two hundred fifty-five introductory and advanced pharmacy practice experiences were included in the performance analysis. Seventy-five of these practice experiences involved third-year students and 180 involved fourth-year students, all of whom were matched with their preceptor. For each student included in the analysis, the number of student practice experiences in which they had participated that was included in the study ranged from 1 to 7. For preceptors, the number of practice experiences ranged from 1 to 19. For 39% of practice experiences, the preceptor's and student's primary learning style matched, and for 95% of practice experiences, the preceptor's and student's primary and/or secondary learning styles matched. For 2% of practice experiences, neither the primary or secondary learning styles matched (Table 4)

Table 2. Dominant Learning Styles of Students According to the Pharmacist's Inventory of Learning Styles

Learning Style	Third-Year Students, n=36, No. (%)	Fourth-Year Students, n=36, No. (%)	Combined Students, n=72, No. (%)
Accommodator	2 (5)	1 (3)	3 (4)
Assimilator	20 (56)	24 (67)	44 (61)
Converger	11 (31)	10 (28)	21 (29)
Diverger	2 (5)	0	2 (3)
Multiple styles ^a	1 (3)	1 (3)	2 (3)

^a Students scoring equally in 2 or more of the learning style categories.

There were no significant differences related to learning style matching in student performance on objective or subjective evaluations. Students completed a final examination for 117 of the 255 pharmacy practice experiences. The median grades for these examinations were 82% in the matched groups and 81% in the unmatched groups, respectively (Table 5). The median competency score was 94% in both the matched and unmatched groups. The median final course grades were 93% in both groups. For all outcomes, there was not enough data to do comparisons of individual experiences within each specific group. Looking at student evaluations of preceptors, there were also no differences between matched and unmatched groups, the mean scores were 4.6 and 4.7 (on a 5 point Likert-scale), respectively. Based on these data, there was not a clear correlation between student or preceptor performance and status of learning styles.

DISCUSSION

Kolb's LSI and the PILS instrument have been commonly used to assess learning styles in pharmacy education.^{3,6,7,12,14} Garvey and colleagues examined 501 pharmacy students enrolled during their first through fourth years of 2 different pharmacy programs. Using the Kolb's LSI, they discovered that the most common type of learning style among students was converger.⁶ Pungente studied first-year pharmacy students enrolled in a 2-semester undergraduate course in the Faculty of Pharmaceutical Sciences at the University of British Columbia with Kolb's LSI. Thirty-six percent were classified as accommodators, with remaining participants equally divided

between assimilators, convergers, and divergers.¹² In a study of 182 APPE students enrolled in their final year of the masters of science pharmacy program at Uppsala University in Sweden, 38% of students were identified as accommodators and 33% as assimilators.¹⁴ Poirier described a student orientation program that was implemented at Southern Illinois University Edwardsville to develop skills in first-year students to prepare them for a community of learning. A component of this orientation program was the PILS. Of the 82 students who completed this instrument, more than 55% of them were identified as assimilators.¹³

Austin administered the Kolb's LSI and the PILS to 176 pharmacists at a pharmacist-training workshop related to learning styles of undergraduate pharmacy students, and 166 (95%) participants strongly agreed or agreed that the results accurately identified their learning style.³ The predominant learning style identified was assimilator followed by converger, at 33.8% and 32.7% respectively. Similarly, in our study, the majority of pharmacy students and preceptors were either assimilators or convergers according to results from the PILS questionnaire. In fact, more than 95% of preceptors and students shared either the same dominant or secondary learning style or both.

As described above, multiple studies have identified a diversity of preferences for learning styles among pharmacy students in a variety of learning environments. Assimilators prefer to work alone and at their own pace. They also like to observe others before performing a task and want things to be done right the first time. They prefer an

Table 3. Dominant Learning Styles of Preceptors According to the Pharmacist's Inventory of Learning Styles

Learning Style	Adjunct Preceptors, n=25, No. (%)	Faculty Preceptors, n=42, No. (%)	Combined Preceptors, n=67, No. (%)
Accommodator	2 (8)	0	2 (3)
Assimilator	13 (52)	25 (60)	38 (57)
Converger	8 (32)	13 (30)	21 (32)
Diverger	1 (4)	2 (5)	3 (4)
Multiple styles ^a	1 (4)	2 (5)	3 (4)

^a Preceptors scoring equally in 2 or more of the learning style categories.

Table 4. Student and Preceptor Matched Learning Styles

	No. of Third-Year Students/No. of Preceptors (%)	No. of Fourth-Year Students/No. of Preceptors (%)	No. of Total Students /No. of Total Preceptors (%)
Matched Dominant Learning Style, No. (%)	29/75 (39)	71/180 (39)	100/255 (39)
Matched Dominant and/or Secondary Learning Style, No. (%)	74/75 (99)	167/180 (93)	241/255 (95)

organized learning environment and are always striving to do their best. Grades are also important to them. On the other hand, convergers tend to be practical and to the point. They prefer a fast-paced environment and want to get things done as soon as possible rather than mulling over a tough decision. They tend to be leaders and do not mind being the center of attention. Accommodators value efficiency, sometimes at the expense of the quality of their work. They prefer purpose-driven work and want immediate access to the resources they need to get the job done. Divergers put a significant value on relationships and are especially concerned with others' perception of them. They enjoy opportunities to be creative and function best when there are no time constraints.²³

As many preceptors are instructing more than 1 student at a time in a pharmacy practice experience, understanding these differences in learning styles could be helpful. In a practice experience, a preceptor should know that assimilators prefer to do individual assignments, favor preceptor-led disease state discussions, and like to receive a lot of feedback on their performance. Convergers prefer to work in small groups, enjoy competitions, and like to be responsible for their own learning. Divergers also prefer working in groups, but only when they are involved in activities not pressured by time. Finally, accommodators like active-learning strategies as long as they are given the instruments to complete the tasks. The sandwich method for feedback works best for assimilators and

Table 5. Student and Preceptor Assessments Based on Learning Styles

	Matched Dominant Learning Style, Median Score (95% CI)	Unmatched Dominant Learning Style, Score (95% CI)	<i>P</i> ^a
Student competency assessment scores (<i>subjective</i>)	94 (92-95)	94 (93-95)	0.23
Student final examination scores (<i>objective</i>)	82 (77-86)	81 (76-84)	0.85
Student final course grades	93 (91-94)	93 (92-94)	0.33
Preceptor practice experience evaluation ^b	5 (4.9-5.0)	5 (4.8-5.0)	0.89
	Matched Both Dominant AND Secondary Learning Style, Median Score (95% CI)	No Matched Primary OR Secondary Learning Style, Median Score (95% CI)	<i>P</i> ^a
Student competency assessment scores (<i>subjective</i>)	94 (91-96)	94 (93-95)	0.32
Student final examination scores (<i>objective</i>)	80.5 (64-89)	82 (80-84)	0.89
Student final course grades	93 (88-94)	93 (92-94)	0.37
Preceptor practice experience evaluation ^b	4.9 (4.6-5)	5 (4.9-5)	0.25
	Matched Either Dominant OR Secondary Learning Style, Median Score (95% CI)	No Matched Primary OR Secondary Learning Style, Median Score (95% CI)	<i>P</i> ^a
Student competency assessment scores (<i>subjective</i>)	94 (93-95)	94 (90-96)	0.45
Student final examination scores (<i>objective</i>)	81 (77-84)	85 (70-90)	0.38
Student final course grades	93 (92-94)	93.5 (88-94)	0.50
Preceptor practice experience evaluation ^b	5 (4.9-5)	5 (4.3-5)	0.17

^a *P* value < 0.05 is considered significant.

^b Preceptor scores based on a 5-point Likert Scale with a score of 5 being outstanding.

divergers. Feedback is also important for convergers and accommodators; however, they would prefer the preceptor “cut to the chase” rather than trying to balance the good against the bad. The preceptor could modify the way an orientation is designed, the way feedback is given, and the overall structure of a practice experience to accommodate the students’ learning styles. What may be viewed as optimal for one student may be challenging and distracting to another. Preceptors must remember that no student or practice experience is ever the same.

Aside from understanding individual learning preferences, we sought to determine whether this had any impact on student or preceptor performance during pharmacy practice experiences. To do this, we compared preceptor and student practice experiences where learning styles were the same (matched) or different (unmatched). For each of these categories, we did not find that student and preceptor having or not having matching learning style preferences affected outcomes. No differences were found between student performance on subjective or objective evaluations or between preceptor’s student evaluations. We acknowledge that the small sample size and commonly accepted grade inflation on pharmacy practice experiences (median >90% for IPPEs and APPEs in 2008-2009) may have limited our ability to detect meaningful differences.

Learning styles are not fixed personality traits, but individuals do have a preference for one style over another.¹⁸ Preferences may change based upon learning environment (problem-based learning vs. classroom lecture vs. pharmacy practice experience). In addition, learning preferences tend to change over time. In one study involving problem-based learning, students’ learning style preferences changed during the course of a single semester.¹¹ While each style may suggest a certain preference for a specific learning strategy, a learning style is not all encompassing. For example, people may prefer to learn by action, but that does not mean they cannot also learn by reading. Most individuals use multiple learning methods depending on the situation.

The awareness of different learning styles could help educators develop teaching approaches that better fit their students’ needs. In fact, there is evidence that simply knowing a student’s learning style improves student learning, independent of the teaching method used.¹¹ Learning style inventories, like PILS, could be used by students and preceptors to initiate discussions about learning. It should not be used as a predictor of success, but rather to make each other aware of the ways they like to teach and learn. Student and teacher learning styles do not have to match for the student-teacher relationship to be successful, as evidenced by findings in our study. In fact, it may be more beneficial to students if their learning style does not match that of their teacher.

Colleges and schools of pharmacy are encouraged to include a discussion of learning styles in their preceptor training programs. Doing so will help to promote self-reflection by students and preceptors, which is an important component of the continuing professional development process. In addition, consideration should be given to developing toolkits for preceptors and students to assist them in adopting learning strategies or teaching methods focused on their learning preferences. Preceptor development is critical, for if preceptors start using a diversity of teaching methods to account for different learning styles without appropriate training, it could prove detrimental to the students’ learning experience.

CONCLUSION

Challenges exist to assessing and accommodating the different learning styles of large classes of students. In experiential practice setting, however, with lower student-to-preceptor ratios, accommodating different learning styles is more practical. Determination of learning styles may encourage preceptors to use teaching methods to challenge students during pharmacy practice experiences; however, doing so does not appear to impact student or preceptor performance. Larger trials of pharmacy students in a diversity of practice environments should be performed to further assess the usefulness of the PILS instrument.

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REFERENCES

1. Keefe JW. Learning style: an overview. In NASSP’s *Student Learning Styles: Diagnosing and Prescribing Programs*. Reston, VA. National Association of Secondary School Principals;1979: 1-17.
2. Felder RM, Silverman LK. Learning and teaching styles in engineering education. *Engr Educ*. 1988;78(7):674-681.
3. Austin Z. Learning styles of pharmacists: impact on career decisions, practice patterns and teaching method preferences. *Pharm Educ*. 2004;4(1):13-22.
4. Frankel A. Nurses’ learning styles: promoting better integration of theory into practice. *Nurs Times*. 2009;105(2):24-27.
5. Hauer P, Straub C, Wolf S. Learning styles of allied health students using Kolb’s LSI-IIa. *J Allied Health*. 2005;34(3): 177-182.
6. Garvey M, Bootman JL, McGhan WF, Meredith K. An assessment of learning styles among pharmacy students. *Am J Pharm Educ*. 1984;48:134-140.
7. Gardner SF, Monaghan MS. Comparison of learning styles between traditional and nontraditional pharmacy students in a doctor of pharmacy program. *J Pharm Teach*. 1996;5(4):31-39.
8. Engels PT, de Gara C. Learning styles of medical students, general surgery residents, and general surgeons: implications for surgical education. *BMC Med Educ*. 2010;10:51.

9. Vaughn L, Baker R. Teaching in the medical setting: balancing teaching styles, learning styles and teaching methods. *Med Teach*. 2001;23(6):610-612.
10. Sharif S, Gifford LA, Morris GA, Barber J. The relationship between learning styles, attendance, and academic performance of pharmacy undergraduates. *Pharm Educ*. 2010;10(2):138-143.
11. Novak S, Shah S, Wilson JP, et al. Pharmacy students' learning styles before and after a problem-based learning experience. *Am J Pharm Educ*. 2006;70(4):Article 74.
12. Pungente MD, Wasan KM, Moffet C. Using learning styles to evaluate first-year pharmacy students' preferences toward different activities associated with the problem-based learning approach. *Am J Pharm Educ*. 2003;66:199-124.
13. Poirier TI, Santanello CR, Gupchup GV. A student orientation program to build a community of learners. *Am J Pharm Educ*. 2007;71(1):Article 13.
14. Wallman A, Lindblad AK, Gustavsson M, Ring L. Factors associated with reflection among students after an advanced pharmacy practice experience (APPE) in Sweden. *Am J Pharm Educ*. 2009;73(6):Article 107.
15. Langlois J, Thach S. Teaching and learning styles in the clinical setting. *Fam Med*. 2001;33(5):344-346.
16. Teevan CJ, Li M, Schlesselman LS. Index of learning styles in a US school of pharmacy. *Pharm Pract*. 2011;9(2):82-87.
17. Zoghi M, Brown T, Williams B, et al. Learning style preferences of Australian health science students. *J Allied Health*. 2010;39(2): 95-103.
18. Kolb DA. *Learning Style Inventory*. Boston, MA: McBer and Co; 1985.
19. Honey P, Mumford A. *The Manual of Learning Styles, 3rd Edition*. Maidenhead: Peter Honey Publications Ltd;1992.
20. Myers IB, McCaulley MH. *Manual: A Guide to the Development and Use of the Myers-Briggs Type Indicator*. Palo Alto, CA: Consulting Psychologists Press; 1998.
21. Coffield F, Moseley D, Hall E, Eccestone, K. *Should We Be Using Learning Styles? What Research Has to Say to Practice*. London: Learning and Skills Research Centre; 2004.
22. Mainemelis C, Boyatzis RE, Kolb DA. Learning styles and adaptive flexibility: testing experiential learning theory. *Manage Learn*. 2002;33(1):5-33.
23. Austin Z. Development and validation of the Pharmacists' Inventory of Learning Styles (PILS). *Am J Pharm Educ*. 2004; 68(2):Article 37.
24. Felder RM. Reaching the second tier: learning and teaching styles in college science education. *J Coll Sci Teach*. 1993;23(5):286-290.
25. Romanelli F, Bird E, Ryan M. Learning styles: a review of theory, application, and best practices. *Am J Pharm Educ*. 2009; 73(1):Article 9.