RESEARCH

Comparison of Learning Styles of Pharmacy Students and Faculty Members

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Objectives. To compare dominant learning styles of pharmacy students and faculty members and between faculty members in different tracks.

Methods. Gregorc Style Delineator (GSD) and Zubin's Pharmacists' Inventory of Learning Styles (PILS) were administered to students and faculty members at an urban, Midwestern college of pharmacy.

Results. Based on responses from 299 students (classes of 2008, 2009, and 2010) and 59 faculty members, GSD styles were concrete sequential (48%), abstract sequential (18%), abstract random (13%), concrete random (13%), and multimodal (8%). With PILS, dominant styles were assimilator (47%) and converger (30%). There were no significant differences between faculty members and student learning styles nor across pharmacy student class years ($p > 0.05$). Learning styles differed between men and women across both instruments ($p < 0.01$), and between faculty members in tenure and clinical tracks for the GSD styles ($p = 0.01$).

Conclusion. Learning styles differed among respondents based on gender and faculty track.

Keywords: learning preferences, learning styles, teaching, learning, pharmacy students, faculty

INTRODUCTION

Faculty members in colleges and schools of pharmacy engage in a myriad of methods to help students develop into knowledgeable practitioners, critical thinkers, problem solvers, and better communicators. Learning styles are defined as the "... manner in which individuals choose to or are inclined to approach a learning situation," ie, the behaviors and processes people use to acquire new knowledge.¹ Although learning styles have been addressed in a variety of disciplines and domains, the specific definitions, models, and construct measures vary. Cognitive, affective, psychomotor, and situational learning preferences can impact successful outcomes of the student's learning experience.²⁻⁴ Consideration of the diversity of student learning styles may take on greater importance in pharmacy education considering the larger class sizes, disparate backgrounds of entry-level students, increased cultural interactions, technological advances, and growing use of distance education.^{3,5}

Typologies are helpful in characterizing how people respond to various learning stimuli. Numerous tools have been developed to assess learning-style preferences.

Comparative summaries and evaluative comments provide succinct descriptions of some of the major or popular learning-assessment instruments, details of which are published elsewhere.^{1,4,6} Despite widespread use of learning-style constructs and assessments, some scholars have suggested that insufficient or equivocal evidence exists regarding the theoretical underpinnings, psychometric properties, and efficacy of models.^{1,4,6-8} While additional research is warranted, the potential benefits of assessing learning styles are generally well accepted, including enhanced student awareness of a variety of techniques for learning and faculty cognizance of the utility of different teaching strategies.³ Two commercially available learning-style instruments and 1 freely available pharmacy-specific instrument are briefly described, as they are germane to this study, either through direct application or background.

The Gregorc Style Delineator (GSD) analyzes seemingly fixed learning-style preferences in situational classroom experiences.⁷ The GSD is designed for self-assessment of 2 learning dimensions: perception (abstract concrete, which refers to abilities in comprehending intangible vs tangible information) and ordering (random, ie, simultaneous or unstructured information processing, or sequential, ie, systematic or stepwise information processing). The GSD uses 4 descriptors to categorize dominant perspectives, although learners may have orientations toward other learning styles.⁷ Concrete sequential learners tend to desire clear objectives and concrete

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examples rather than theories and abstractions. They prefer actual rather than contrived or simulated experiences. Abstract sequential learners prefer more intellectual, analytical, and theoretical learning styles and are inclined toward learning techniques that are sequential, substantive, logical, rational, and structured. Abstract random learners are more affective and imaginative and value relationship building. Individuals with this dominant learning style read body language, assess emotional states, and empathize. Finally, concrete random learners are more intuitive and use insight to avoid details and to discover the “big picture.” These learners function well in unstructured, open-ended activities and thrive in situations that provide choice, chance, challenge, and change.

Among the more extensively used instruments is the Kolb Learning Style Inventory (LSI), which assesses a continuum of experiences across 2 learning dimensions: perception in how people take in information (abstract/concrete) and information processing (active/reflective).^{9,10} Kolb’s characterizations should not be considered mutually exclusive and may occur in a cyclical fashion. Predominant learning categories in the Kolb LSI are diverger, assimilator, converger, and accommodator. Divergers are focused, imaginative, people-oriented, and affective learners who view situations from different perspectives and appreciate idea generation in problem solving. They reason based on specific, concrete experience, and reflective observation. Assimilators are self-paced learners who value organization and attentiveness to detail and prefer to learn on their own in a logical manner based on reflective observation and abstract conceptualization. Convergers show strong technical and deductive abilities, with less inclination toward social interaction. These learners are able to solve problems, make decisions, and derive practical applications from theories and ideas based on abstract conceptualization and active experimentation. Preferring active experimentation and concrete experience, accommodators are efficient, adaptable, social learners who prefer hands-on or new experiences and active involvement rather than traditional lecture formats.¹⁰ The earliest identified study of pharmacy student learning styles found that 50.7% were convergers, based on the Kolb LSI.¹¹

Austin developed and validated the Pharmacists’ Inventory of Learning Styles (PILS) to measure dominant and secondary learning styles.^{12,13} Adapted primarily from aspects of the Kolb LSI, the PILS was the first pharmacy-specific instrument to assess learning styles. The modified version of PILS includes learning-style descriptors with definitions that essentially overlap those of the Kolb LSI. A survey of Canadian pharmacists using the modified PILS identified the dominant learner types

as assimilators (33.7%), convergers (32.5%), divergers (21.1%), and accommodators (12.1%).¹³

Our literature search identified few articles published on learning styles among pharmacy students over the past 3 decades.^{9,11,14-19} The literature has recommended tailored *teaching* styles in pharmacy education to better mesh with diverse *learning*-style preferences among students, although some have argued that incongruence may better challenge students’ minds and lead to increased learning.^{3,12,16,20} We investigated from a different approach – the similarity between *learning*-style preferences of pharmacy students and the *learning* styles of their corresponding faculty members. To our knowledge, only 1 previous study has investigated learning styles among pharmacy students and faculty members. The Kolb LSI was administered to bachelor of science pharmacy students in West Virginia, pharmacy faculty members who attended a graduate seminar, graduate students, pharmacy school applicants, and pharmacy practitioners, with results showing that faculty members and students differed on abstract conceptualization and active experimentation learning modes.¹⁵

Studies comparing faculty and student learning styles were identified in the health sciences literature outside of pharmacy. Differences were found in Kolb LSI learning styles between students and faculty members in dietetics.²¹ Student responses were fairly evenly distributed across learning-style categories although their learning styles were uncorrelated with their stated career interests. Conversely, learning-style preferences among dietetics faculty members were associated with disciplinary areas of expertise. Clinical nutrition faculty members scored primarily as assimilators and convergers, management faculty members were more likely to be convergers, and faculty in community or dietetics education were mainly accommodators.²¹ A study using the GSD tool in dentistry education showed no differences in learning styles among clinical dental faculty members and students.²² In nursing education, no differences were found among learning styles between baccalaureate nursing students, nursing school faculty members, and others.²³ Engels and de Gara, however, reported differences in learning styles between undergraduate medical students and medical faculty members but did not discuss the potential implications of this difference.²⁴ Nationwide, the pharmacy curriculum has changed since the 1980s when the initial study comparing learning styles between undergraduate pharmacy students and their faculty members was conducted,¹⁵ and we believed another study of learning styles among pharmacy students and faculty members was warranted. The curriculum has evolved from the baccalaureate to the universal doctor of pharmacy degree, including more clinically

focused and experiential education. The objectives of our study were to compare dominant learning styles between pharmacy students and faculty members and learning styles between faculty members in different tracks.

METHODS

This project was approved by the institutional review board of the University of Illinois at Chicago. In the spring semester 2008, time was set aside in core pharmacy curriculum courses to administer the survey instrument to the graduating pharmacy classes of 2008, 2009, and 2010. The faculty survey instruments were administered at a faculty meeting during spring 2008. Students and faculty members had the option to complete or refuse to complete the survey instruments. For those who participated, demographic student and faculty data were collected prior to administering the 2 learning-styles assessment instruments. Student and faculty demographic questions differed.

Participants were administered both the GSD, a widely used general instrument, and the PILS, a pharmacy-specific instrument. The procedure for completion of both instruments was provided by the faculty principal investigator. Only 3 minutes were allotted for completion of each survey instrument to secure more instinctual answers to the assessment questions. Both tools use ipsative measures (forced-choice responses that order items into grouped sets) to assess dominant learning styles and preferences based on how respondents rank order their response sets. Once the survey instruments were completed, participants calculated their individual scores. Dominant learning styles were determined based on instructions for score interpretation that were provided with the assessment instruments. In case of tied scores (or other inability to determine 1 dominant style), the learning styles were coded as multimodal.

The investigators coded the data using a numbering system to differentiate different student classes and faculty members. Incomplete survey instruments were removed from the analysis. Results were analyzed using SPSS Windows Version 19 (IBM, Armonk, NY). Chi-square tests were performed with an *a priori* significance level of 0.05.

RESULTS

Student responses were received from 299 of 482, for an overall response rate of 62%. The usable sample included students from the class of 2008 (111 of 159 = 69.8%), class of 2009 (71 of 160 = 44.3%), and class of 2010 (117 of 163 = 71.8%). Fifty-nine of 112 (52.7%) faculty members provided responses. One faculty respondent did not report a specific faculty track. Based on the

full sample of 358, outcomes for the GSD learning styles were concrete sequential ($n=170$, 47.5%), abstract sequential ($n=67$, 18.7%), abstract random ($n=48$, 13.4%), concrete random ($n=46$, 12.8%), and bimodal or trimodal ($n=27$, 7.5%). Table 1 lists group frequencies based on the GSD. Responses demonstrating multimodal learning styles were excluded from further analyses. There were no differences in the proportional learning styles between pharmacy students (overall) and faculty members ($p=0.371$). Similarly, no differences were found among pharmacy students across the 3 class years ($p=0.390$). Significant differences were found between GSD learning styles based on gender and faculty track. For gender analyses, responses from students and faculty members were combined. Men and women differed in their preferred learning styles ($p<0.0001$). Analysis of adjusted residuals comparing expected and observed cell frequencies showed a greater-than-expected representation of men whose preferred learning styles were abstract sequential and concrete random (adjusted residuals, 2.7 and 2.3, respectively; both greater than z value of 1.96) and women whose dominant style was abstract random (adjusted residual, 3.3). Findings for the GSD instrument also showed differences in learning-style preferences between tenure-track and clinical-track faculty members ($p=0.01$). Residual analysis showed higher-than-expected cell frequencies for tenure-track faculty members, whose dominant style was abstract sequential (adjusted residual, 2.3), and clinical-track faculty members, whose dominant style was concrete sequential (adjusted residual, 2.0).

For PILS, predominant learning styles were assimilator ($n=162$, 45.3%), converger ($n=114$, 31.8%), diverger ($n=19$, 5.3%), accommodator ($n=8$, 2.2%), and multimodal ($n=55$, 15.4%). Categorical frequency results from the PILS are listed in Table 2. As with the findings from the GSD instrument, there were no significant differences in the proportional learning styles between pharmacy students and faculty members (when student responses were combined, $p=0.971$), nor across pharmacy student class years ($p=0.987$). When comparing tenure-track and clinical-track faculty members, accommodator and diverger cells were combined because of small cell frequencies. Unlike the GSD, the PILS instrument showed no significant differences in learning styles between faculty members in tenure-track and clinical-track ($p=0.761$). Analyses were rerun, comparing only the top 2 predominant styles of assimilators and convergers across faculty tracks, with stable findings of no difference ($p=0.976$). As with the GSD, significant gender differences were found among PILS learning styles ($p=0.003$). Residual analysis showed greater-than-expected frequencies among women

Table 1. Assessment of Learning Styles Using Gregorc Style Delineator (GSD)

GSD Learners	Concrete Sequential, No. (%)	Abstract Sequential, No. (%)	Abstract Random, No. (%)	Concrete Random, No. (%)	Multimodal, No. (%)
Students (N=299)	142 (47.5)	56 (18.7)	42 (14.0)	34 (11.4)	25 (8.4)
Class of 2008 (n=111)	58 (52.3)	21 (18.9)	13 (11.7)	10 (9.0)	9 (8.1)
Class of 2009 (n=71)	36 (50.7)	12 (16.9)	8 (11.3)	12 (16.9)	3 (4.2)
Class of 2010 (n=117)	48 (41.0)	23 (19.7)	21 (17.9)	12 (10.3)	13 (11.1)
Gender (N=349)					
Men (n=118)	51 (43.2)	31 (26.3)	6 (5.1)	22 (18.6)	8 (6.8)
Women (n=231)	116 (50.2)	33 (14.3)	41 (17.7)	23 (10.0)	18 (7.8)
Faculty (N=59)	28 (47.5)	11 (18.6)	6 (10.2)	12 (20.3)	2 (3.4)
Tenure track (n=19)	6 (31.6)	7 (36.8)	0	6 (31.6)	0
Clinical track (n=39)	22 (56.4)	4 (10.3)	6 (15.4)	5 (12.8)	2 (3.4)

as assimilators (adjusted residual 3.4) and greater representation among men as divergers (adjusted residual 2.3).

DISCUSSION

Awareness of various learning styles can be used to assess and design educational curricula and strategies to accommodate different types. The learning-style preferences of faculty members may influence their teaching styles, student learning, and levels of student interaction during classroom instruction, problem-based learning, and experiential teaching activities.²⁵ A balanced approach in teaching strategies is recommended.^{3,20} Using the scoring mechanism for the GSD and PILS instruments, student and faculty respondents were able to identify their individual learning styles in our study. As found in Austin's study of practicing pharmacists, the 2 most dominant learner categories for our sample were assimilators and convergers, based on the PILS instrument.¹³ One study using the PILS instrument in 2008 found that the majority of third- and fourth-year pharmacy students and their experiential faculty preceptors at a Texas university were assimilators, with convergers being the second most-common learning-style category.²⁶ Our results

found concordance between the learning styles of students and faculty members in pharmacy, no differences across 3 pharmacy student class years, gender differences, and mixed results (depending on the instrument used) between clinical-track and tenure-track pharmacy faculty members. It is not known whether these findings reflect an institutional effect or disciplinary characteristics in pharmacy education. At the University of Illinois at Chicago, clinical-track faculty members are appointed only in the Department of Pharmacy Practice, whereas all 4 college departments include tenure-track faculty. The curriculum at the study institution includes more application (eg, case-based recitations) in the second and third years and in the experiential education courses (introductory and advanced pharmacy practice experiences). Thus, clinical faculty members who are more involved at these points in instruction demonstrate a learning style that is more concrete sequential (per the GSD tool), while a greater proportion in the tenure track portray a predominantly abstract sequential learning style, involving more theoretical concepts and analytical approaches. Concrete sequential individuals prefer more practical, usable, down-to-earth information.⁷ Our results, which show clinical

Table 2. Assessment of Learning Styles Using Pharmacists' Inventory of Learning Styles (PILS)

PILS Learners	Accommodator	Assimilator	Converger	Diverger	Multimodal
Students (N=299)	7 (2.3)	136 (45.5)	95 (31.8)	16 (5.4)	45 (15.1)
Class of 2008 (n=111)	1 (0.9)	53 (47.7)	34 (30.6)	7 (6.3)	16 (14.4)
Class of 2009 (n=71)	2 (2.8)	32 (45.1)	23 (32.4)	4 (5.6)	10 (14.1)
Class of 2010 (n=117)	4 (3.4)	51 (43.6)	38 (32.5)	5 (4.3)	19 (16.2)
Gender (N=349)					
Men (n=118)	4 (3.4)	41 (34.7)	45 (38.1)	11 (9.3)	17 (14.4)
Women (n=231)	3 (1.3)	121 (52.4)	65 (28.1)	8 (3.5)	34 (14.7)
Faculty (N=59)	1 (1.7)	26 (44.1)	19 (32.2)	3 (5.1)	10 (16.9)
Tenure track (n=19)	1 (5.3)	8 (42.1)	6 (31.6)	1 (5.3)	3 (15.8)
Clinical track (n=39)	0	17 (43.6)	13 (33.3)	2 (5.1)	7 (17.9)

pharmacy faculty members displaying a dominant learning style of concrete sequential, corroborate those of Berlocher and Hendricson, which showed that clinical faculty members in dentistry also preferred a concrete sequential learning style.²²

Using different measurements, previous studies found varied results in similarities and differences between genders in learning styles.^{11,16,27-29} Our results differed from a finding of nonsignificant gender difference in learning preferences among Canadian pharmacists using the PILS survey instrument.¹³ In our study, results from the GSD and PILS demonstrated a gender difference. A possible implication for this finding is that faculty members should be sensitive to possible differences in learning styles when instructing students of the opposite sex. For example, male instructors who teach from an abstract sequential point of view (eg, logical, analytical) might confuse students with an abstract random point of view (eg, imaginative, appreciation of stimulus-rich environments with varied learning approaches), which is demonstrated more often by female students. Alternatively, female faculty members who teach from an abstract random point of view might cause confusion for the concrete random male student who transcends details in attempts to discover the larger meaning of a situation. While it is not our intent to stereotype learning styles based on gender, when students struggle with instruction by a faculty member of the opposite sex, learning style differences could be at the root of the problem.

There continues to be a need to study learning styles among pharmacy students and faculty members. Learning-style preferences and behaviors may change as students matriculate through the doctor of pharmacy program as a result of individual maturation, professional socialization, and institutional culture.^{1,13,30} It would be valuable to determine students' learning styles early in the first year of their pharmacy education and to assess their progress through the classroom and experiential portions of the curriculum. Further, it would be valuable to know if students' discovered learning styles coincided with their belief of how they learn optimally. Knowing a student's learning style could guide faculty advisors in helping students resolve learning difficulties encountered in varying curricular learning situations.

Identification of learning style by faculty members could also benefit them personally and in their teaching. Specifically, faculty members could determine if their assessed learning style matched their perceptions of their learning style. This was the first administration of a learning-styles instrument at this institution as part of a formal research process, but it is unknown whether a learning-styles instrument had been administered previously to

individual faculty members in this sample. Future research could examine whether knowing their individual learning style altered faculty members' methods of teaching students and/or developed in them a sensitivity enabling them to recognize that students might learn differently from their own style. A recommendation would be to implement a process for faculty members to discover their own learning styles through faculty development programs for the purpose of guiding their teaching strategies.

Results should be interpreted in consideration of study design and limitations. The scale of this study was circumscribed to provide insight on differences in learning styles among pharmacy students and faculty members at 1 college of pharmacy. It was not a goal to establish psychometric properties of the instruments, and investigation of learning styles in helping achieve intended educational outcomes was beyond the scope of this research. One limitation of the study was the low number of tenure-track faculty members who completed the learning-styles inventories. Thus, the possibility of nonresponse bias should be considered in interpreting results based on faculty tracks. Another limitation of this study was a less-than-optimal response rate among students, especially from the class of 2009. The lower response may have been associated with the influence that a fire at our college had upon class attendance when the survey instruments were administered early in the spring semester 2008. During this time, the college was closed for 1 week and classes in the ensuing weeks were relocated.

Experience tells us that some students learn in unexpected ways. For example, some benefit from learning success while others learn best from failure.³¹ A central goal of faculty is to promote learning. However, the methods used may benefit some students and actually hinder others from learning. As educators, if we decide to use only techniques we prefer and/or are most accomplished in, it is likely we will leave some students floundering and others frustrated and attempting to learn on their own.

CONCLUSION

Learning styles of faculty members and students at the study institution were congruent, but dissonance was shown in dominant learning styles between the genders and different faculty tracks. Pharmacy educators should realize that students may present with a variety of learning styles differing from their own. Thus, faculty members are challenged to use a number of teaching methods, some of which might be counter to their own preferred learning style, to foster students' success with learning and development of performance-based abilities, such as

communication, problem solving, critical thinking, and interpersonal skills.

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