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Assessing Learning Styles of Graduate Entry Nursing Students as a Classroom Research Activity: A quantitative research study

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ABSTRACT

Background: A number of studies across different disciplines have investigated students' learning styles. Differences are known to exist between graduate and baccalaureate nursing students. However, few studies have investigated the learning styles of students in graduate entry nursing programs. .
Objectives: Study objective was to describe graduate entry nursing students' learning styles.
Design/Setting/Participants/Methods: A descriptive design was used for this study. The Index of Learning Styles (ILS) was administered to 202 graduate entry nursing student volunteers at a southwestern university. Descriptive statistics, tests of association, reliability, and validity were performed. Graduate nursing students and faculty participated in data collection, analysis, and dissemination of the results.
Results: Predominant learning styles were: sensing – 82.7%, visual – 78.7%, sequential – 65.8%, and active - 59.9%. Inter-item reliabilities for the postulated subscales were: sensing/intuitive ($\alpha = 0.70$), visual/verbal ($\alpha = 0.694$), sequential/global ($\alpha = 0.599$), and active/reflective ($\alpha = 0.572$). Confirmatory factor analysis for results of validity were: $\chi^2(896) = 1110.25$, $p < 0.001$, CFI = 0.779, TLI = 0.766, WRMR = 1.14, and RMSEA = 0.034.
Conclusions: Predominant learning styles described students as being concrete thinkers oriented toward facts (sensing); preferring pictures, diagrams, flow charts, demonstrations (visual); being linear thinkers (sequencing); and enjoying working in groups and trying things out (active),. The predominant learning styles suggest educators teach concepts through simulation, discussion, and application of knowledge. Multiple studies, including this one, provided similar psychometric results. Similar reliability and validity results for the ILS have been noted in previous studies and therefore provide sufficient evidence to use the ILS with graduate entry nursing students. This study provided faculty with numerous opportunities for actively engaging students in data collection, analysis, and dissemination of results.

1. Introduction

In recent years, nursing programs have revised curricula and teaching/learning strategies to reflect the incorporation of personal learning styles (Tenhunen and Fitzgerald, 2014). An argument can be made for incorporating assessments of students' learning styles into graduate entry prelicensure nursing programs as well. In addition, evidence regarding personal learning styles is now appearing in acute care setting professional in-service training programs (McCrow et al., 2014), with the goal of specifically targeting the learning needs and preferences of practicing nurses. Nursing educators should consider incorporating these assessments into graduate entry prelicensure education to promote balanced content and learning activities.

The incorporation of learning styles into the curriculum is a successful and innovative strategy for graduate student nurse recruitment. The demand for nurses with graduate degrees has increased in recent years as a result of the joint initiative of the Institute of Medicine (IOM) and Robert Wood Johnson Foundation (IOM, 2011), designed to evaluate the nursing profession. This initiative resulted in a report entitled "The Future of Nursing: Leading Change, Advancing Health." Among other recommendations, the report advocated doubling the number of nurses with doctoral degrees by the year 2020. Clearly nursing education must use innovative learning strategies to attract potential candidates. The

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graduate student population is very diverse: differing in ages, experiences, culture, level of preparedness, and learning styles (Meehan-Andrews, 2009). This diversity provides a challenge to academics in motivating and promoting student learning. Incorporating teaching strategies that target differences in student learning styles can be a successful approach. Nursing education has addressed learning styles to some degree with the use of simulation labs, standardized patient actors, and small group projects. However, it may be beneficial for graduate student nurses to have options for completing coursework that appeals to their personal learning styles.

There are over 70 learning style instruments in the literature that have been used to assess graduate students (Hall and Moseley, 2005). While there are many theories of learning styles, relatively few address the learning styles of students in the sciences - health (Cox et al., 2013; Zoghi et al., 2010), medicine (Bhagat et al., 2015; Engels and de Gara, 2010; Nuzhat et al., 2013), and baccalaureate nursing (Andreou et al., 2014; Brown et al., 2014; D'Amore et al., 2012; Fleming et al., 2011; Meehan-Andrews, 2009). Fewer studies investigated learning styles of graduate entry nursing students (Fernandez et al., 2012).

The research question for this study was "What are the predominant learning styles of graduate entry nursing students?" The purpose of this article is to describe a five-year investigation of the learning styles of graduate entry nursing students' enrolled in a southwestern university. In addition, the article describes the evaluation of the factor structure and internal consistency of nursing student responses to the Index of Learning Styles (ILS) to determine the appropriateness of the ILS in further investigation and use in graduate entry nursing education.

2. Background/Literature

A learning style is a particular set of behaviors related to how learners perceive, interact with, and respond to the learning environment. Behaviors have four dimensions:

- Active vs. reflective. Active learners prefer exploring or testing information. Reflective learners are more introspective.
- Sensing vs. intuitive. Sensing learners prefer facts, data, and experimentation. Intuitive learners prefer theories, principles, and innovation.
- Visual vs. verbal. Visual learners perceive information most effectively through pictures and graphs. Verbal learners prefer written or spoken words.
- Sequential vs. global. Sequential learners progress toward learning via linear, ordered steps. Global learners often learn holistically, in large steps (R. M. Felder and Soloman, 2004).

Limited research exists from the United States on learning styles in graduate entry nursing education. Researchers who performed studies with Australian students ($n = 259$) and ($n = 81$) used a Motivated Strategies for Learning Questionnaire (Duncan and McKeachie, 2005) with scales related to: extrinsic goal motivation, help seeking, peer learning, and critical thinking. The highest mean score was for extrinsic goal motivation while the lowest was for peer learning (Everett et al., 2013; Fernandez et al., 2012). Researchers in a study of Australian graduate entry students ($n = 61$) use the VARK (Fleming and Mills, 1992) learning preferences questionnaire that addresses visual, aural/auditory, read/write, and kinesthetic learning modalities). The highest mean scores were for the read/write and aural modalities (Koch et al., 2011). To date, there are no reported studies on the ILS and graduate entry nursing students.

There is more research on the learning styles of students in baccalaureate nursing education, although results demonstrate considerable variation in the predominance of specific learning styles. In bachelor of science in nursing (BSN) students, a review of six studies from 1994 to 2012 using the Kolb Learning Style Inventory (Kolb and Kolb, 2005) revealed diversity of learning styles (Andreou et al., 2014). The Kolb tool differentiates divergent and convergent learning styles. Divergent learners demonstrate a preference for concrete experience over abstract conceptualization and reflective observation over active experimentation. Conversely, convergent learners prefer active experimentation over reflective observation and abstract conceptualization over concrete experience. Predominantly divergent learning styles were reported in Saudi Arabia (Suliman, 2010) and in Korea (Gyeong and Myung, 2008) among samples of 98 and 724 students, respectively. Predominantly convergent learning styles were reported among 281 U.S. students (Fogg et al., 2013). Using the ILS, predominant learning styles in 100 Chinese nursing students were reflective over active, sensing over intuitive, visual over verbal, and global over sequential styles (Zhang and Lambert, 2008).

Some researchers reported learning style differences between baccalaureate students and the graduate entry student population (Everett et al., 2013). Graduate entry students were more likely to identify peer learning, help seeking, and critical thinking as strategies for learning than baccalaureate students. Graduate students were predominantly of a convergent learning style; baccalaureate students were predominantly of a divergent learning style (Suliman, 2006). Fifty percent of both BSN and graduate entry students reported a multimodal (visual, auditory, reading/writing and kinesthetic) preference for learning (Pettigrew et al., 2011).

3. Methods

Protection of participant's rights/research design/data collection/procedures.

This study was approved by the university's institutional review board (IRB). The classroom research activity used the ILS as a teaching strategy to increase engagement and research dissemination among faculty and students. The course comprised several sections of students with respective faculty and student teachers. At one designated weekly session, section faculty offered students from all sections the opportunity to participate in the research. While all students complete the ILS and identified their personal learning style preferences, those interested in research participation scored a duplicate answer sheet and completed consent and demographic forms. Research materials were placed in a closed box in the classroom. Section faculty joined the project as co-investigators. After all nine faculty/PhD student teachers and those 48 students volunteering to assist in the project completed the research ethics certification and were approved by the IRB, faculty announced the project by reading the script, and students coordinated materials and numbered, distributed, and collected the instruments, answer sheets, and demographic and consent forms. Anonymity of participation, security of data and storage was maintained. After collection of relevant forms, students separated the consents from the completed ILS tools and carried consents to a faculty member unconnected with the course for safe storage. Students and faculty met outside of class for a brief two-hour session working on research dissemination: input and analysis of data, writing abstracts, designing graphics and eight posters, summarizing the literature, and authoring sections of the manuscript.

The ILS (Litzinger et al., 2007) was administered to six cohorts of graduate entry nursing students in a southwestern university from 2011 to 2015. After study explanation and consent, 202 of 285 students voluntarily consented to participate in the study.

3.1. Sample size

To generalize results to the graduate entry nursing cohort population of 285 students from the classes of 2012–2017, a sample size of 164 would have been needed to obtain 95% confidence with ± 5% margin of error. The obtained sample size of 202 resulted in a 3.73% margin of error. Computation of sample size and margin of error was performed using the online calculator at http://www.surveysystem.com/sscalc.htm.

3.2. Measures

Detailed rationale prompted the selection of the ILS learning styles instrument among the many instruments available. Extensive psychometric analyses of the instrument were performed by its developer, Richard M. Felder, and others. The ILS was well-suited for use as a classroom activity as it was developed in the classroom with engineering students (Felder, 2010; Felder and Soloman, 2004). Students of engineering, an applied science, were reasoned to be similar to nursing students. The instrument had been used successfully in a study of baccalaureate student nurses (Zhang and Lambert, 2008). The ILS is a popular instrument. It consists of 44 items assessing learning styles in four dimensions. The results are provided on a scale of preferences, which is considered to be fluid and dynamic (Sandman, 2009).

Evidence for internal consistency reliability for the ILS has been reported as a coefficient alpha of 0.48 (Zhang and Lambert, 2008). Reliabilities for the four dimensional scales ranged from 0.41–0.65 (Van Zwanenberg et al., 2000) and 0.55 to 0.77 (Felder and Spurlin, 2005; Hosford and Siders, 2010; Litzinger et al., 2007). Test-retest reliabilities, using Pearson r, comparing first and second administration after three months ranged from 0.684 to 0.856. Cronbach's alphas were reported to range from 0.62 to 0.77 (Cook and Smith, 2006).

As indicated in the prior literature utilizing the ILS (Van Zwanenberg et al., 2000; Zywno, 2003), exploratory factor analysis (EFA) has revealed an obtained 14–16 factor solution (using Kaiser criterion of eigenvalue >1.0), with the items from the hypothesized four constructs exhibiting a substantial amount of cross-loading, as well as a lack of cohesion of the sequential/global items (Romanelli et al., 2009). The instrument developers (Felder and Spurlin, 2005) concluded that active/reflective, sensing/intuitive and visual/verbal scales may be considered independent but the sequential/global dimension shows a moderate degree of association. A principal components factor analysis, with varimax rotation and extraction of four components matching the four dimensions of the ILS, has been reported as accounting for 27.5% of the total variability in item responses (Hosford and Siders, 2010).

The response options to the ILS scales are of a binary nature, each one having a unique textual alternative (e.g., a: "sensible" vs. b: "imaginative"). The instrument originator recommended scoring the items as +1 and −1 respectively. There are 11 items in each scale. The total score on a scale from −11 to +11 shows the preference for the style. The dichotomous nature of the scales makes the use of standard statistical tests difficult (Van Zwanenberg et al., 2000). For this reason, responses were scored by assigning a value of 1 to the (a) items, and 0 to (b) items and adding the score. Learning style preference for active, sensing, visual and sequential scales would be demonstrated by scale scores of 6 through 11. A score of 1 through 5 would indicate a reflective, intuitive, verbal or global learning style.

In addition, scoring can be interpretted based on the strength of the preference. A score of 4, 5, 6 or 7 out of 11 would indicate being fairly well-balanced on the dimensions represented by the scale (e.g. active and reflective, sensing and intuitive, etc.). A score of 2, 3, 8 or 9 indicates a moderate preference for the dimension; a score of 0, 1, 10, or 11 indicates a strong preference for the dimension. Students with a moderate preference for one dimension of the scale will learn more easily in a teaching environment that favors that dimension. Students with a very strong preference for one dimension of the scale may have real difficulty learning in an environment that does not support that preference (Felder and Solomon, 1994).

3.3. Data analysis

Descriptive statistics such as measures of centrality, dispersion, and frequencies/percentages were used in data analysis. Though minimal, all missing data were handled through mean substitution. Given the binary nature of the items, the Kuder Richardson-20 (KR-20) was used to test internal consistency within each of the obtained scales. Although it is generally recommended that EFA and CFA for the same instrument be conducted on separate samples, due to the substantial amount of cross-loading, as well as a lack of cohesion of the sequential/global items reported in the literature, both EFA and CFA were performed.

Initially, for the 44-item ILS, an unrestricted exploratory factor analysis (EFA) was conducted, using both orthogonal and oblique rotation, as well as two different types of extractions: principal component and principal axis factoring. Given the metric of the items, a binary exploratory factor analysis (EFA) was conducted to test the unrestricted model and a confirmatory factory analysis (CFA) was performed to test the postulated (more restricted) 4-factor solution using the Mplus 7.4 software (Muthen and Muthen, 1998-2012). Given that the tool developers have stipulated a 4-factor structure for their instrument (Felder and Spurlin, 2005), a binary CFA was conducted in Mplus. Ultimately, given the reported inconsistencies/lack of stability of the sequential/global items and scale (Romanelli et al., 2009; Van Zwanenberg et al., 2000), a constrained 3-factor solution (sans sequential/global items) was tested.

4. Data/Results

4.1. Demographics

Demographics were collected for 159 of 202 students. Graduate entry students' age range was 21–56 years, with a mean age of 28.93 years (SD 6.48). Students were primarily female (61.9%), Caucasian (60.9%), and experienced an urban or suburban early childhood environment (62.9%) (Table 1). No significant associations were evidenced among demographics and learning style scores.

4.2. Learning Style Scores

Mean scores for the four dimensions across cohorts ranged from 5.97 to 7.37. Scores for sensing ranged from 6.94 to 8.15, visual 6.83 to 7.65, sequential 5.67 to 6.90, and active 5.79 to 6.06 (Table 2). Predominant learning styles among participating students were sensing (82%), visual (80%), sequential (67%), and active (59%) (Table 3). Strength of preferences was fairly well balanced in both dimensions represented by the scales, however scoring demonstrated "very strong preferences" for visual and sensing styles among 20% and 19% of the students, respectively (Table 4).

Table 1
Demographics of the sample ($n = 159$)*.

variable	n	%
Race		
Caucasian	107	67.3
African am/black	6	3.8
Asian/Pacific Islander	22	13.8
Caucasian/Hispanic	16	10.1
More than one race	7	4.4
Asian/Hispanic	1	0.6
Gender		
male	34	21.4
female	125	78.6
Childhood environment		
urban	48	30.2
suburban	79	49.7
Small town	21	13.2
rural	11	6.9

* Demographics not collected for one cohort n = 43.

Table 2
Means, Standard Deviations of Predominant ILS for Graduate Entry Nursing Cohorts.

cohort	Active Score		Sensing Score		Visual Score		Sequential Score	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
2012–2017	5.97	2.21	7.37	2.45	7.27	2.47	6.27	2.30
2012	6.05	2.65	7.13	2.46	7.59	2.78	5.67	2.52
2013	5.95	2.16	7.23	2.34	6.95	2.52	5.90	2.31
2014	6.06	2.04	8.15	2.16	7.65	2.39	6.90	2.24
2015	5.89	1.76	7.78	3.23	7.44	1.74	6.89	2.32
2016	5.79	2.26	6.79	2.32	6.83	2.49	6.17	2.08
2017	5.89	2.19	6.94	2.72	7.00	2.34	6.37	2.12

4.3. ILS Properties

The inter-item reliability for each of the four postulated subscales was: sensing/intuitive– SNSINT ($\alpha = 0.70$), visual/verbal–VISVRB ($\alpha = 0.694$), sequential/global–SEQGLO ($\alpha = 0.599$), and active/reflective–ACTREF ($\alpha = 0.572$).

When the unconstrained/unrestricted model was tested in IBM SPSS Statistics 23 (IBMCorp., 2015) for all 44 items, a 15-factor solution emerged (using the Kaiser criterion of eigenvalue $\lambda \geq 1.0$ for factor extraction) with 60.30% of the variation accounted for and including many cross-loadings. A binary exploratory factor analysis (EFA) was run utilizing the tetrachoric correlation. A similar factorial solution emerged (i.e., 15 factors with $\lambda \geq 1.0$). Subsequently, when testing the constrained 4 factor solution in EFA using SPSS, 27.51% of the variation was accounted for. Convergence was attained using 100 iterations. A binary EFA was run utilizing the tetrachoric correlation. The following result was obtained: $\chi^2(776) = 895.59$ $p < 0.001$, CFI = 0.876, TLI = 0.849 SRMR = 0.099, and RMSEA = 0.028. Using the very constrained solution (3 factors and no sequential items), 26.36% of the variance was accounted for. Out of 11 items, ten items obtained factor loadings >0.30 for active and sensing scales and 9 items obtaining factor loadings >0.30 for the visual scale. The results were: $\chi^2(432) = 544.536$ $p < 0.0002$, CFI = 0.857, TLI = 0.825 SRMR = 0.104, and RMSEA = 0.036 (Table 5). There is no single standard for interpreting the magnitudes of structures coefficients in EFA, but one rule of thumb is that absolute structure coefficients >0.30 indicate minimum consideration level and > 0.40 indicate appreciable indicator-factor correspondence (Thompson, 2004).

For the binary four factor confirmatory factor analysis (CFA), the results were: $\chi^2(896) = 1110.25$, $p < 0.001$, CFI = 0.779, TLI = 0.766, WRMR = 1.14, and RMSEA = 0.034. Using the very constrained solution (3 factors and no sequential items) using binary CFA the results were: $\chi^2(492) = 670.49$ $p < 0.001$, CFI = 0.773, TLI = 0.757, WRMR = 1.17, and RMSEA = 0.042. In CFA, generally, one desires a non-significant chi-square statistic, Bentler's Comparative Fit Indexes and Tucker-Lewis Indexes (CFI, TLI) larger than 0.95, weighted root mean square residuals (WRMR) less than or equal to 1.00, standardized root mean square residual (SRMR) and the Root Mean Square Error of Approximation (RMSEA) <0.05.(Hu and Bentler, 1999).

Table 3
Frequencies of Felder Learning Styles among Cohorts of Graduate Entry Nursing Students 2012–2017.

cohort	n	Active (%)	Sensing (%)	Visual (%)	Sequential (%)
2012–2017	202	59	82	80	66
2012	39	59	77	80	51
2013	43	58	81	74	56
2014	52	62	92	82	82
2015	9	67	89	89	78
2016	24	50	79	79	71
2017	27	60	71	77	77

Table 4
Learning Style Results (n = 202).

Dimension	n	%	Very Strong Preferences*	n	%
active	121	58.9	Active	9	4.5
reflective	81	41.1	Reflective	24	11.9
sensing	167	81.7	Sensing	38	18.8
intuitive	55	18.3	Reflective	7	3.5
visual	159	79.7	Visual	41	20.3
verbal	43	20.3	Verbal	9	4.5
sequential	133	65.8	Sequential	15	7.4
global	69	34.2	Global	12	6.0

* Very strong preferences were demonstrated by scores of 0, 1, 10 or 11.

5. Discussion

5.1. Scoring

As indicated in Table 2, the predominances of active, sensing, visual and sequential learning styles were similar across the 6 cohorts (2012–2017), a significant portion of the graduate entry nursing cohorts had "very strong preferences" for sensing and visual styles. Results indicate that faculty should manipulate the learning environment and use strategies within the curriculum for sensing learners, who are practical, detail-oriented, and focus on facts and procedures, and for visual learners, who learn most effectively through pictures, diagrams, flow charts, and demonstrations.

5.2. ILS Properties

Two of the four scales in this study had KR-20 reliability estimates <0.70. Similar estimates have been reported in the ILS literature (Hosford and Siders, 2010; Litzinger et al., 2007) and may be explained

Table 5
Binary EFA with Loadings for 3-Factor Constrained Solution.

Items	Factor 1	Factor 2	Factor 3
ACT/REF 1	**0.570***	0.181	0.132
ACT/REF 5	**0.542***	-0.143	-0.186
ACT/REF 9	**0.141**	-0.140	-0.263*
ACT/REF 13	**0.646***	-0.010	-0.367
ACT/REF 17	**0.376***	-0.043	0.066
ACT/REF 21	**0.478***	0.096	-0.278
ACT/REF 25	**0.547***	0.005	0.013
ACT/REF 29	**0.523***	0.017	0.391*
ACT/REF 33	**0.413***	0.086	-0.037
ACT/REF 37	**0.474***	-0.131	-0.461*
ACT/REF 41	**0.326***	0.070	-0.093
VIS/VERB 3	-0.260	**0.537***	-0.175
VIS/VERB 7	0.048	**0.871***	-0.033
VIS/VERB 11	-0.023	**0.688***	-0.008
VIS/VERB 15	-0.190	**0.728***	-0.112
VIS/VERB 19	0.210	**0.392***	0.021
VIS/VERB 23	-0.229*	**0.472***	-0.203
VIS/VERB 27	0.211	**0.545***	0.036
VIS/VERB 31	0.146	**0.720***	0.065
VIS/VERB 35	0.079	**0.304***	0.164
VIS/VERB 39	0.109	**0.221***	0.088
VIS/VERB 43	0.222	**0.284***	-0.306
SENS/INT 2	-0.106	-0.058	**0.571***
SENS/INT 6	0.161	0.128	**0.797***
SENS/INT 10	0.334*	-0.234*	**0.520***
SENS/INT 14	0.035	-0.042	**0.510***
SENS/INT 18	0.153	0.003	**0.801***
SENS/INT 22	-0.310*	-0.232	**0.607***
SENS/INT 26	0.009	-0.228*	**0.458***
SENS/INT 30	-0.028	-0.129	**0.470***
SENS/INT 34	-0.077	-0.215	**0.545***
SENS/INT 38	0.009	0.052	**0.902***
SENS/INT 42	0.029	-0.137	**0.166**

by the homogeneity of this sample. All participants demonstrated rigorous admission criteria with high cumulative grade point averages from non-nursing bachelor's degree programs.

When the unconstrained/unrestricted model was tested, a 15-factor solution emerged with 60.30% of the variation accounted for. This obtained solution is a marked departure from the constrained four factor solution of 27.51%, and does bring into question the stability of the instrument factors/components. When the constrained model was tested, this result is strikingly similar to a previously reported result 27.5% (Hosford and Siders, 2010). When using a matrix of tetrachoric correlations, the resulting $\chi^2(776) = 895.59$ $p < 0.001$, CFI = 0.876, TLI = 0.849 and SRMR = 0.099 was considered poor; generally, one desires a non-significant chi-square statistic, incremental fit indices (CFI, TLI) > 0.95, and SRMR < 0.05. However, using the very constrained solution (3 factors and no sequential/global items), for which CFI = 0.828, TLI = 0.801, and SRMR = 0.109, it does appear the items loaded on the postulated factors/components. (Table 5).

For the binary CFA, though the RMSEA is within an acceptable range, the other fit statistics point to a poor fit. Moreover, quite a few of the items yielded low r^2 values and non-significance.

When testing the 3-factor model (no sequential items) with CFA, 16 of 33 items obtained r^2 values >0.30 (Table 6). The 3-factor constrained solution shows some promise in regards to the construct validity of the ILS and may be of some practical use for either predictive or between-group comparisons, given the equivocality of the instrument at the item level (and hence the explication of the hypothesized constructs). Caution should be exercised when using this tool for making individual decisions.

Table 6
Binary CFA with Loadings for 3-Factor Constrained Solution.

Items	b	B	r^2
ACT/REF 1	1.000	0.471	0.222
ACT/REF 5	0.974	0.459	0.211
ACT/REF 9	0.466	0.220	0.048
ACT/REF 13	1.590	0.750	**0.562**
ACT/REF 17	0.516	0.243	0.059
ACT/REF 21	1.313	0.619	**0.383**
ACT/REF 25	0.905	0.426	0.182
ACT/REF 29	0.668	0.315	0.099
ACT/REF 33	0.972	0.458	0.210
ACT/REF 37	1.227	0.579	**0.335**
ACT/REF 41	0.821	0.387	0.150
VIS/VERB 3	1.000	0.548	**0.301**
VIS/VERB 7	1.573	0.863	**0.744**
VIS/VERB 11	1.197	0.656	**0.431**
VIS/VERB 15	1.308	0.717	**0.515**
VIS/VERB 19	0.818	0.449	0.201
VIS/VERB 23	0.740	0.406	0.165
VIS/VERB 27	1.131	0.620	**0.385**
VIS/VERB 31	1.364	0.748	**0.560**
VIS/VERB 35	0.570	0.313	0.098
VIS/VERB 39	0.466	0.256	0.065
VIS/VERB 43	0.774	0.425	0.180
SENS/INT 2	1.000	0.584	**0.341**
SENS/INT 6	1.311	0.766	**0.586**
SENS/INT 10	0.942	0.550	**0.303**
SENS/INT 14	0.849	0.496	0.246
SENS/INT 18	1.408	0.822	**0.675**
SENS/INT 22	1.067	0.623	**0.388**
SENS/INT 26	0.819	0.478	0.229
SENS/INT 30	0.825	0.482	0.232
SENS/INT 34	1.079	0.630	**0.397**
SENS/INT 38	1.529	0.893	**0.797**
SENS/INT 42	0.326	0.190	0.036

b = unstandardized coefficient.
B = standardized coefficient.
Bolded $r^2 > 0.30$.

6. Conclusions

With a generous sample collected in cohorts over a five-year period, the graduate-entry nursing students in this study can be described as being concrete thinkers oriented toward facts (sensing vs intuitive); preferring pictures, diagrams, flow charts, and demonstrations (visual vs verbal); and enjoying working in groups and trying things out (active vs reflective). In addition, a significant percentage of these students displayed very strong learning style preferences (19% sensing and 20% visual) and may have difficulty in a learning environment that does not support their preference for applied examples when learning theoretical material (sensing) and for physical demonstrations within lectures (visual). The internal consistency and construct validity results reported here concur with reported findings among engineering (Felder and Spurlin, 2005; Zywno, 2003) and medical students (Cook and Smith, 2006), suggesting that the ILS is a suitable psychometric tool to assess the learning styles of graduate entry nursing students, particularly in the active/reflective, sensing/intuitive and verbal/visual dimensions. As a classroom activity, this research project design engaged students and faculty in data collection, analysis, and dissemination of results.

6.1. Implications

These results support encouraging faculty to follow: (a) the National League for Nursing recommendations within the Core Competencies for Nurse Educators that the individual learning styles of each student be identified and addressed (Halstead, 2007) and (b) the American Association of Colleges of Nursing (AACN) Master's Essential IX that includes the application of learning, and teaching principles to the design, implementation, and evaluation of health education programs for individuals or groups in a variety of settings. Sample content for nursing programs enumerates the principles of adult learning, including evidence based practice regarding learning styles (AACN, 2011).

Students who are taught using methods matched to their learning styles may be more satisfied with instruction (Felder and Brent, 2005). A focus on student-centered teaching and learning will foster preparedness of the new graduate nurse to meet the ever changing health care environment. Understanding the learning style of the nurse fosters skill in reducing barriers to educating patients and in selecting effective teaching techniques (Beagley, 2011).

One effective strategy for incorporating learning style preferences within nursing education is the use of simulation (Shinnick and Woo, 2015). These graduate entry nursing students were predominantly active, sensing, and visual learners. Simulation requires the educator to teach concepts through discussion (active) and application of knowledge (sensing) while allowing the student to explain to or teach others (visual).

Shinnick and Woo (2015) found that when using simulation as a classroom teaching strategy, learning styles have reportedly been associated with achievement of knowledge gains in nursing and medical students. For example, evidence was presented for prelicensure nursing students' increased knowledge of ECG interpretation for the assimilator, divergent, and balanced Kolb learning style preferences. Similarly there was a relationship in medical students between the bodily-kinesthetic Gardner MIDAS learning style and increased learning of laparoscopic manipulation (Windsor et al., 2008). In baccalaureate nursing students, the kinesthetic Dunn and Dunn learning style preference was significantly correlated with team achievements (Hallin et al., 2015).

The ILS instrument can be used by international colleagues as its psychometric properties have been explored. It is concise and easy to administer and to understand (Cook and Smith, 2006). In five years of instrument administration in the current study, not one question was asked by students to clarify the interpretation of an item or response. ILS has been translated into Spanish, Portuguese, Italian, German, and several other languages (Felder, 2003)

Nursing education should continue to offer a variety of learning experiences including standardized patients, simulation laboratory, lecture, clinical experiences, and the opportunity to engage in classroom activities that engage students and faculty in active learning. Faculty might also profit from assessing the learning style preferences of new cohorts of students as direction for selecting the most effective teaching modalities with particular cohorts. To ensure an adequate number of quality applicants to meet the growing demand for nurses, nursing education must continue to seek new and innovative approaches to appeal to adult learners.

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