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RESEARCH ARTICLE

Learning Style Scales: a valid and reliable questionnaire

Abdolghani Abdollahimohammad[1]*, Rogayah Ja'afar[2]

[1]Nursing & Midwifery School, Zabol University of Medical Sciences, Zabol, Iran; [2]Department of Medical Education, School of Medical Sciences, Universiti Sains Malaysia, Kubang Kerian, Malaysia

Abstract

Purpose: Learning-style instruments assist students in developing their own learning strategies and outcomes, in eliminating learning barriers, and in acknowledging peer diversity. Only a few psychometrically validated learning-style instruments are available. This study aimed to develop a valid and reliable learning-style instrument for nursing students. **Methods:** A cross-sectional survey study was conducted in two nursing schools in two countries. A purposive sample of 156 undergraduate nursing students participated in the study. Face and content validity was obtained from an expert panel. The LSS construct was established using principal axis factoring (PAF) with oblimin rotation, a scree plot test, and parallel analysis (PA). The reliability of LSS was tested using Cronbach's α, corrected item-total correlation, and test-retest. **Results:** Factor analysis revealed five components, confirmed by PA and a relatively clear curve on the scree plot. Component strength and interpretability were also confirmed. The factors were labeled as perceptive, solitary, analytic, competitive, and imaginative learning styles. Cronbach's α was >0.70 for all subscales in both study populations. The corrected item-total correlations were >0.30 for the items in each component. **Conclusion:** The LSS is a valid and reliable inventory for evaluating learning style preferences in nursing students in various multicultural environments.

Key Words: *Inventory; Learning style; Nursing students; Reliability; Validity*

INTRODUCTION

Despite remarkable advances in the development of learning-style instruments, there is little research on the application of such an instrument to the field of nursing. Few psychometrically validated learning-style inventories are available. It is essential that instruments used in such research are psychometrically sound. The current study aimed to develop a new, reliable, valid, user-friendly, and brief inventory to measure learning-style preference in nursing students.

METHODS

Subjects

The study was conducted at two universities: Zabol Medical Sciences University (ZBMU) in Iran, and the Health Campus of the Universiti Sains Malaysia (USM) in Malaysia. ZBMU is located in Zabol, Sistan and Balouchestan, southeastern Iran. The Health Campus at USM is located in Kubang Kerian, Kelantan, northeastern West Malaysia.

Purposive sampling was conducted to gather data from the two populations. Of 241 nursing students, 156 met the inclusion criteria, which were as follows. Participants had to be female, Muslim, Iranian or Malaysian, and full-time degree students. Male and non-Muslim nursing students were excluded because there was only one male student at USM, and only one non-Muslim student at ZBMU. There is no consensus regarding sample size requirements for exploratory factor analysis. However, it is recommended that the sample-size-to-variable ratio should be at least 3:1 [1].

Technical information

Curry's onion model [2] was applied to delineate the domain of learning-style preferences, and to determine relevant literature for generating sample items. Curry [2] proposed a three-

*Corresponding email: abdalqani@gmail.com

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layer onion metaphor to classify learning-style models. The first, and least stable, layer of learning-style preference is "instructional preference," which refers to the learning environment design, such as the furniture, sound, and light. This layer is a useful guide when designing specific teaching-learning environments. The second layer is "information processing," which refers to an academic approach to information assimilation. Learning styles in this layer are more susceptible to change if educators aim to modify students' learning styles. The third, and most stable, layer is "cognitive-personality," which relates to how information is acquired, integrated, and adapted. Claxton and Murrell revised Curry's model by adding a new layer called "social interaction" between the information-processing and instructional preference layers. The social interaction layer refers to learning preference in the company of others, that is, how people act and interact in a learning group [3]. The items generated relate to the social interaction and information processing layers of Curry's model, which are the most manageable and approachable for instructors.

A list of 44 items was generated from the relevant literature. A panel of experts screened the list for content validity, overlap, relevance, and usability. Feedback led to elimination of four items owing to overlap and ambiguity. The remaining items were identified as reflecting written, kinesthetic, perceptive, competitive, analytic, holistic, imaginative, sociable, and solitary learning-style dimensions.

Data collection was carried out in two phases, a pilot study and the study proper. The pilot study was conducted to refine methodological issues. In this phase, the original English instruments were translated into Farsi and then re-translated into English by two bilingual experts. The homogeneity of the questionnaire was evaluated by the researcher. After revising the instruments and receiving ethical approval from USM, 70 diploma nursing students were invited to participate in the pilot study.

For the main study, participants included 20 diploma students from all years of study and 85 degree nursing students from USM, as well as 20 degree students and 71 degree students from ZBMU. Anonymity was ensured. Before questionnaires were distributed, the objectives of the study were explained to participants. USM and ZBMU nursing students responded to the English and Farsi versions of the instrument, respectively.

Questionnaires were distributed at the end of the academic year and during regular class time to achieve an optimum response. Before distribution, the objectives of the study were briefly explained, and the importance of answering all the questions was emphasized. Students gave verbal consent in response to an informed consent cover letter. Questionnaires were completed within ten minutes. Malaysian and Iranian nursing students responded to English and Farsi versions of the instrument, respectively. The final version of the LSS was a 22-item inventory with five components, covering the social interaction and information processing layers of Curry's model. All items were measured using a 6-point Likert scale, with "1" denoting "strongly agree" and "6" "strongly disagree," without a neutral point.

Approval for the protection of human rights was obtained from USM's Ethics and Research Board (Human).

Statistics

The LSS construct was established using principal axis factoring with oblimin rotation, a scree plot test, and parallel analysis (PA). Factor selection was based on eigenvalues ≥ 1, a clear curve in the scree plot, the PA test, and interpretability of components. Factor- and cross-loading cut-off points were considered to be at least 0.30 and 0.40, respectively. The reliability of the LSS was tested using Cronbach's α, corrected item-total correlation, and test-retest correlations. The lowest Cronbach's α accepted was 0.70 [4], with a corrected item-total correlation of at least 0.30. Coefficients of > 0.50 were accepted for test-retest reliability [5]. Test-retest reliability was done over a two-week period, with a sample of 20 diploma-nursing students.

RESULTS

Of the 241 nursing students originally screened, 156 met inclusion criteria for the study: 71 (45.51%) from ZBMU in Iran and 85 (54.49%) from USM in Malaysia. The majority of ZBMU students were enrolled in their third year of study (53.7%), whereas the majority of USM students were enrolled in their second year (32.2%). All participants were female and Muslim. The average age of participants from ZBMU and USM was 21.26 years (SD, 1.58) and 22.63 years (SD, 3.45), respectively (Table 1).

An expert panel approved the readability, and face and content validity of the LSS. The Flesch-Kincaid readability score

Table 1. The frequency and percentage distribution of demographic data of ZBMU and USM nursing students (N = 156)

Demographic variable	ZBMU	USM	Total
Year of study, no (%)			
First	19 (15.4)	11 (9.3)	30 (12.4)
Second	24 (19.5)	38 (32.2)	62 (25.7)
Third	66 (53.7)	33 (28.0)	99 (41.1)
Fourth	14 (11.14)	36 (30.5)	50 (20.7)
Total	71 (100)	85 (100)	156 (100)
Age (yr), mean ± SD (range)	21.26 ± 1.58 (18-28)	22.63 ± 3.45 (19-40)	

ZMBU, Zabol Medical Sciences University; USM, Universiti Sains Malaysia.

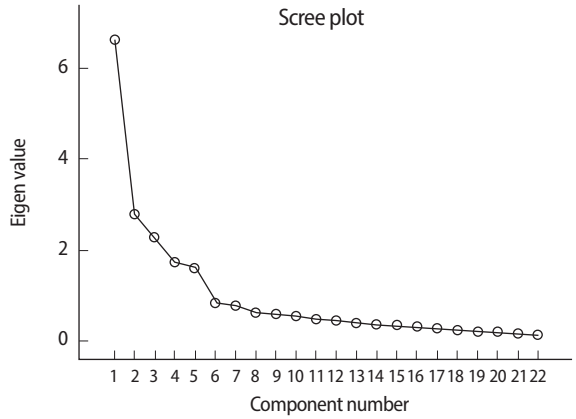

Fig. 1. The scree plot for the 22 items of the Learning Style Scale.

for items was 85.

Factor analysis was conducted on 22 items. The Kaiser-Meyer-Olkin measure of sampling adequacy was 0.784, and Bartlett's test of sphericity was significant ($P < 0.001$). Five components with a variance of 73.53% and 64.14% were revealed by eigenvalues ≥ 1 for students from USM and ZBMU, respectively. In addition, a relatively clear scree plot curve suggested a five-component factor solution (Fig. 1). PA also confirmed a five-component factor solution. Component strength and interpretability were confirmed. Factors were labeled according to the highest positive loading of the original English-version items, as follows: perceptive (seven items), solitary (four items), analytic (four items), competitive (three items), and imaginative (four items) learning styles. Components were unipolar in scale. However, the solitary component was comprised of both negatively and positively worded items. Factor loadings for ZBMU participants ranged from 0.556 to 0.874, and from 0.362 to 0.900 for USM students. Cross-loadings of 0.40 or higher were not found for any items in the USM group. However, item Q1 ("I prefer to study alone"), on the solitary factor, was cross-loaded (0.473) onto the perceptive factor in the ZBMU group. In addition, negatively worded items showed low loadings (< 0.50) in the USM cohort.

The overall Cronbach's α of the LSS was 0.815 and 0.911 in ZBMU and USM students, respectively. The Cronbach's α was > 0.70 for all subscales, in both study populations. Corrected item-total correlations were > 0.30 for items in each component, ranging from 0.424 to 0.910.

DISCUSSION

This study presents the LSS, a newly developed inventory for evaluating learning-style preferences in nursing students. Participants were from two nursing schools, one in Iran and one in Malaysia. The Baccalaureate of Science in Nursing (BScN) programs at ZBMU and USM are highly similar. The BScN is a 4-year nursing education program. Students must obtain 130–140 credits to ensure they are ready to perform nursing professional actions and have personal competencies for comprehensive care in hospital and community settings. Students complete core, elective, and university courses over a three-year period (Semesters 1–6). Thereafter, nursing skill training is completed over a period of one year (Semesters 7–8).

The content and face validity, user-friendliness, and readability of the LSS were approved by a panel of experts. Feedback led to elimination of overlapping and ambiguous items. The remaining items were labeled and categorized according to their meaning on only one learning style dimension. The dimensions were identified as written, kinesthetic, perceptive, competitive, analytic, holistic, imaginative, sociable, and solitary learning styles. In addition, the Flesch-Kincaid score (85) indicates that the LSS is understandable even for 11- to 13-year-olds.

The construct validity of the LSS was analyzed with exploratory factor analysis. A cut-off point of 0.30 for factor loadings and eigenvalues greater than 1 were used as the primary criteria for factor selection. Hair et al. [6] propose that "item loadings over 0.30 are considered significant, over 0.40 are more important, and over 0.50 are considered very significant. There are no accepted 'absolute' standards for the cutoff." All ZBMU and most USM factor loadings were over 0.50, indicating a highly significant item loading for LSS components. Only one item in the USM cohort ("I create a mental picture of what I hear") had a merely significant item loading (0.362). In addition, each item strongly loaded onto only one factor in both the ZBMU and USM cohorts, with the exception of Q1, part of the solitary subscale, in the ZBMU group. Q1 ("I prefer to study alone") was positively cross-loaded with perceptive learning style. This may indicate that students with a perceptive learning style learn through the senses, and may be sensitive to sounds that interrupt their learning process. Furthermore, negatively worded items displayed a low loading on the solitary subscale. Negatively worded items often are less homogeneous than is desirable [7]. The LSS construct was confirmed through the scree plot, PA, and interpretability of the components.

The internal consistency and reliability of the LSS and its subscales are adequate. The Cronbach's α was ≥ 0.80 and ≥ 0.70 for the LSS and its subscales, respectively (an acceptable alpha for a newly developed instrument is > 0.70 [4]). In addition, the corrected item-total correlation was > 0.30, indicating homogeneity between each item and total inventory score. Values < 0.30 indicate that a particular item correlates poorly with the overall scale [8].

The LSS structure is normative. Normative inventories not

only measure individual preference, but provide accurate means of comparing individuals' scores [9]. The LSS items cover the information-processing and social interaction layers of Curry's model. Perceptive, analytic, and imaginative learning styles belong to the information-processing layer proposed by the model. Perceptive students learn more effectively using pictorial information and when actively involved in practical tasks. Analytic students are enthusiastic about learning specific and detailed information by taking notes in a learning situation. Imaginative students learn by creating a mental picture of what they sense, through listening and observing. The competitive and solitary subscales fall under the social interaction layer. Competitive students learn more effectively either by challenging or competing with others. Solitary students prefer to learn or study alone, in contrast to sociable students, who learn better when participating in a group.

The strengths of the current study include the application of Curry's model to the development of the LSS, and the use of a relatively large sample: namely, seven participants per item from two different countries. However, the generalizability of the findings is limited since only female Muslim nursing students were recruited, which may affect the LSS construct. In addition, there is a lack of evidence for the concurrent validity of the LSS. Items included under the perceptive learning style may be confounded with Kolb's reflective observation-active experimentation dimension (reference) and the active/reflective dimension of the Felder-Silverman Inventories (reference). Items under the solitary and competitive learning styles may be closely comparable to Grasha's independent and competitive learning styles (reference), respectively. Items under the analytic learning style may be concurrent with Kolb's abstract conceptualization mode (reference), and Dunn and Riding's analytic styles (reference).

In conclusion, the current study contributes a reliable and valid inventory to the growing body of knowledge on learning styles in the nursing field. We believe that the LSS is applicable to other fields of study in the medical and health sciences as well. Future studies might seek to confirm these findings in different populations across different countries. In addition, the LSS should be compared to similar instruments in order to determine the concurrent validity.

ORCID: Abdolghani Abdollahimohammad: http://orcid.org/0000-0002-7929-5539; Rogayah Ja'afar: http://orcid.org/0000-0003-2625-7720.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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SUPPLEMENTARY MATERIAL

Audio recording of the abstract.

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Appendix. Learning Style Scales (LSS)

This questionnaire was designed to help you find out your preferred way of learning. There are no wrong or right answers. (1, strongly agree; 2, moderately agree; 3, agree a little; 4, disagree a little; 5, moderately disagree; 6, strongly disagree)

Most of the time, I …

1 …prefer to study alone.
2 …enjoy competing.
3 …create a mental picture of what I study.
4 …prefer to study with other students.
5 …compete to get the highest grade.
6 …create a mental picture of what I see.
7 …learn better when someone represents information in a pictorial (e.g., picture, flowchart) way.
8 …learn practical tasks better than theoretical ones.
9 …learn better when I study with other students.
10 …compete with other students.
11 …create a mental picture of what I read.
12 …learn better when someone uses visual aids (e.g., whiteboard, power point) to represent a subject.
13 …learn better when I am involved in a task.
14 …focus more on the details of a subject.
15 …consider the details of a subject more than its whole.
16 …learn better when I watch an educational program.
17 …learn better when I watch a demonstration.
18 …create a mental picture of what I hear.
19 …remember the details of a subject.
20 …learn better when I study alone.
21 …remember specific details of subjects.
22 …learn better when studying practical, job-related, subjects.

پرسشنامه سبک یادگیری

پرسشنامه زیر سبک یادگیری شما را نشان می دهد. پاسخ صحیح یا غلط وجود ندارد.

1= کاملا موافقم، 2= در حد متوسط موافقم، 3= کمی موافقم، 4= کمی مخالفم، 5= در حد متوسط مخالفم، 6= کاملا مخالفم

من اغلب ...

1 ترجیح می دهم به تنهایی درس بخوانم.

2 از رقابت لذت می برم.

3 از آنچه که مطالعه می کنم، در ذهنم یک تصویر می سازم.

4 ترجیح می دهم با سایر دانشجویان درس بخوانم.

5 برای کسب بالاترین نمره رقابت می کنم.

6 از آنچه که می بینم، در ذهنم یک تصویر می سازم.

7 آموزش هایی که با تصویر مثل عکس و نمودار ارایه می شوند، بهتر یاد می گیرم.

8 وقتی کاری را خودم انجام می دهم، بهتر یاد می گیرم.

9 وقتی که با سایر دانشجویان درس می خوانم، بهتر یاد می گیرم.

10 با سایر دانشجویان رقابت می کنم.

11 از آنچه که می خوانم، در ذهنم یک تصویر می سازم.

12 وقتی که از وسایل کمک آموزشی مثل وایت برد و پاورپوینت برای آموزش استفاده می شود، بهتر یاد می گیرم.

13 کاری را که خودم انجام می دهم بهتر یاد می گیرم.

14 برای یادگیری بهتر به جزییات یک درس بیشتر توجه می کنم.

15 به جزییات یک درس بیش از کلیات آن تمرکز می کنم.

16 با مشاهده یک برنامه آموزشی بهتر یاد می گیرم.

17 با مشاهده نحوه انجام یک کار (نمایش) بهتر یاد می گیرم.

18 از آنچه که می شنوم، در ذهنم یک تصویر می سازم.

19 جزییات یک درس را به یاد می آورم.

20 وقتی که به تنهایی درس می خوانم، بهتر یاد می گیرم.

21 جزییات خاص یک درس را به یاد می آورم.