



The Construct Validity and Internal Consistency of the Adult Learning Inventory (AL-i) among Medical Students

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Abstract

Objective: To determine the internal consistency and construct validity of the AL-i among first year medical students.

Methods: Cross sectional study was done on 196 first year medical student in Universiti Sains Malaysia (USM). The items of AL-i were framed based on the adult learning principles. The Cronbach's alpha reliability analysis and factor analysis were applied to measure internal consistency and construct validity respectively. The analysis was done using Statistical Package for Social Science (SPSS) version 18.

Result: A total of 196 medical students responded to this study. The Cronbach's alpha value of the AL-i was 0.798. The Cronbach's alpha values of adult learner and child learner domains were 0.85 and 0.81 respectively. Factor analysis showed that on 10 items were nicely loaded into two constructs as their factor loading values were more than 0.3. Approximately 2 out of 12 items were removed from the inventory because they did not fit into the intended domain. Each domain of the final version AL-i has 5 items.

Conclusion: The AL-i has shown good psychometric values. It is a valid and reliability tool to determine adult learner status among medical students. It is a promising psychometric instrument that can be used to determine types of learner among students in future.

Introduction

The variation between individuals is almost never-ending because each one of us has very unique characters that make our ways of learning are different from others. In general learning is referred to an active and lifelong process of acquiring information through various medium where the information are transformed and translated into meaningful ideas that lead to formation of knowledge, skills, behaviour and attitude (1-3). The core characteristics of how person learn that remain stable for life can be referred as

learning traits. They are thus a good and visible predictor of learning patterns and styles. It is worth noting that part of an effective educator involves understanding how learners learn best (4).

In general, learners can be grouped into two types which are adult learner (andragogic learner) and child learner (pedagogic learner) (4-7). The word andragogy was derived from the Greek word aner which means man not boy and agogus which means leading. While the term pedagogy was originated from Greek word paid which means child. That is why andragogy and pedagogy are commonly referred as the art and science of teaching adults and children respectively (6, 7). It is worth to mention that part of an effective learning involves understanding of how we learn best (6, 8).

Adult learners are always known to be as independent learner and self-directed learner (6, 8). They decide what important to learn and act as a resource for learning whenever they are needed by other learners (8). Their learning are driven and affected by the need to know something or to do something where they validate any information given to them before accepting it. When they learn they relate their belief and experience upon their new learning experience where they tend to immediately make use the learning experience to their jobs (6, 8). They tend to take active role in planning, monitoring and evaluating their learning (8). In contrast, pedagogic learners are known to be as dependent learner and more teacher-directed where they rely on others to decide what is important to be learnt (6 -8). Their learning is affected by desire to meet course requirement and tend to be rote learners where they accept all information given to them at face value without validating it (7, 8). They have very limited knowledge and experience to relate upon their learning where they expect their learning to be useful in long-term future; that is why they have little ability to serve as resource learning to other learners (5-8). It should be noted that understanding of nature of learners will be advantages for educators to enhance learning experience of the learners (9-11). One of instruments that can be used to identify types of learners is the Adult Learning Inventory (AL-i) (8).

Validity is defined as to what extent the measurement measures what it should measure, whereas reliability is generally defined as consistency or reproducibility of measurement over time or occasions(12-15). Both validity and reliability are important qualities that an inventory must be tested for in order to ensure it measures what it is supposed to measure and the measurement obtained is reproducible over time and occasion if similar measurements are being measured. The Reliability analysis of Cronbach's alpha and factor analysis are commonly used by researchers to determine the internal consistency and construct validity of an inventory (13-14). From that notion, similar analyses were applied to determine the internal consistency and construct of the AL-i.

This study described the reliability and validity of the AL-i, which was developed based on the andragogy and pedagogy theories (6, 7) to assess nature of learners with the hope that it can be used as a valid and reliable instrument among medical students. It is hoped that this study may provide some validity evidence in the use of the AL-i to identify nature of learners thus will help medical educators to understand better about their students' nature of learning.

Methods

The Adult Learning Inventory (AL-i)

The inventory was developed based on the principles of pedagogy and andragogy that were proposed by learning theory researchers [6, 7]. The items of AL-i were framed literature review and discussion with the experts in medical education. The items were designed based on its compatibility and suitability with medical professional qualities, local culture and values. Items conveying characteristics of the andragogic and pedagogic learner most clearly were selected. About six items were selected for each group of learner. The items were undergone a process of scrutiny and evaluation as a result of it the language of the items was modified to make it simple and suitable to express the concept implied. Each item of the AL-i was rated using 5-likert scores (1=least like you, 2=in between scores of 1 and 3, 3= 50% like you, 4=in between scores of 3 and 5, 5=most like you) to indicate how close the statement described the respondents' behaviour.

Expert evaluation of the items

In order to establish the content validity of the AL-i, the items were subjected to experts' evaluation. The experts were drawn from the field of Medical Education. Necessary modifications were made with

the feedback given by the experts.

Preliminary try-out

The items were administered to a sample of 100 first year medical students and 20 medical teachers to check their applicability and face validity during separate face-to-face sessions. The students and medical teachers were encouraged to express their doubts freely. Necessary modifications were made with the experience gained through this preliminary try-out. The selected 12 items according to the learner groups are shown in table 2.

Validation study

Purposive sampling method was applied. Approximately all 196 new first year medical students were selected as respondents. Proper instructions were given before the administration of the questionnaire. The applicants were asked to respond to all the statements and no time limit was imposed. During the time of administration the investigator gave proper assistance and directions whenever necessary.

Study subjects

Population of this present study was 196 new first year medical students at the School of Medical Sciences, Universiti Sains Malaysia. All of them were selected as study subjects.

Collection of data

The investigator obtained permission and clearance from the School of Medical Sciences and Human Ethical Committee of Universiti Sains Malaysia. Informed consent was obtained from the respondents and they were requested to fill in the questionnaire. Completion of the questionnaire was voluntary and the respondents were informed that not returning the questionnaire would not affect the students' progress in the course. Data was collected by guided self-administered questionnaire. The questionnaires were collected on the same day.

Factor Analysis

Collected data was analysed using Statistical Packages Social Sciences (SPSS) version 18. Factor Analysis was done to determine construct validity of the AL-i. Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity was applied to measure the sampling adequacy (16). The sample was considered adequate if i) KMO value was more than 0.5 and ii) Bartlett's test was significant (p-value less than 0.05). Principal Component Analysis (PCA) method was applied in extraction of components. Components with Eigen values of over 1 were retained. With the assumption that all items were uncorrelated with each other, Varimax rotation was applied in order to optimize the loading factor of each item on the extracted components. Items with loading factor of more than plus or minus 0.3 were considered as an acceptable

loading factor (16). Once constructs of the AL-i were finalised, reliability analysis for each construct was done.

Reliability analysis

Reliability analysis was done to determine the reliability of the questionnaire. Internal consistency of the items was measured by using Cronbach's alpha coefficient. For an estimation of reliability, statistical reliability of individual items was done. Items with corrected-item total correlation value of more than 0.3 were selected and items with corrected-item total correlation value of less than 0.3 were deleted. The Cronbach's alpha value of deleted item could determine which item highly contributed to the reliability of the AL-i. If the Cronbach's alpha value for those items-deleted decreased, it would indicate that the items highly contributed to alpha value. In contrast, if the Cronbach's alpha value for those items-deleted increased, it would indicate that the items poorly contributed to alpha value. The items of AL-i were considered to represent measure of good internal consistency if the total alpha value was more than 0.6 (15).

Results

A total of 196 (100%) medical students participated in study.

Table 1 shows the demographic profile of the respondents. In general the demographic profile represents the Malaysian population. Majority of the respondents were female (65.3%), Malays (53.6%) and came from the matriculation (88.8%) stream. It seems that most of the respondents originated from urban areas (50.5%) and various economic strata.

Initial factor & reliability analysis

The sample was adequate as indicated by i) a KMO value of 0.798 and ii) Bartlett's test of sphericity being significant (p -value < 0.001).

Table 2 showed the initial factor analysis where 2 components were extracted using principal component analysis (PCA with rotation of Varimax). It seems that Q9 were loaded into different group therefore this item was removed from the inventory for final analysis. Q3 and Q8 were loaded on both groups; item will be removed if the Cronbach's alpha value for those items-deleted increased. Total variance explained by these two components was 55.88%.

Table 2 showed that the Cronbach's alpha value of the AL-i was 0.703. The Cronbach's alpha values of the andragogy and pedagogy domains were 0.57 and 0.77 respectively. The reliability analysis showed that Q3

poorly contributed to the reliability of AL-i as the Cronbach's alpha value increased after deleting the item. While other items highly contributed to the reliability of AL-i as the Cronbach's alpha value decrease after deleting them. Item Q3 was removed from this inventory due to its poor contribution to the inventory reliability.

Final factor & reliability analysis

After the initial analysis, 10 items were remained for final analysis; 5 items for each domain.

Table 3 shows the total number of components that was extracted remained two similar to the initial analysis. It shows that all items have loading factors more than 0.3. Therefore all items were retained. Total variance explained by these 5 factors was 62.723% which is acceptable (16) and better than the initial analysis; these findings show that the final 10 items AL-i has better construct.

Reliability analysis shows that the total Cronbach's alpha value of the AL-i was 0.798 which indicated a high level of internal consistency (12-15) and better than the initial analysis (table 3). The Cronbach's alpha values of the andragogy and pedagogy domains were 0.85 and 0.81 respectively as shown in table 3. Those domains show very good level of internal consistency (15, 17). Table 3 also shows that all the items has corrected-item total correlation of more than 0.3 and highly contributed to the inventory reliability. Thus they were retained in the inventory. These findings suggested that the 10 items AL-i is reliable and has high internal consistency.

Discussion

The demographic profile of the respondents was almost parallel with that of the Malaysian population in terms of gender and ethnic group. Even more, the distribution also can be considered to represent those from rural areas and lower social strata. These facts were considered as evidence of a good level of representativeness of study samples to the Malaysian population. Therefore findings of this study represent the study population.

The factor analysis showed that the final 10 items were loaded into the two domains (table 3) without forced extraction. All the items loaded well into the two predetermined domains as all the items had loading factor of more than 0.3 (16). These findings concurred that the AL-i has a good construct. It provides evidence to suggest that the inventory measures what it should measure and that it is a valid tool to be utilised in identifying types of learner among medical

students. However, it is recommended that confirmatory factor analysis be conducted in the future to test the existence of the AL-i latent constructs.

The reliability analysis suggested that the final 10 items of AL-i exhibited a measure of high internal consistency as their Cronbach's alpha values were more than 0.7 as shown in table 3; it reflected the internal reliability of the inventory (17). The two domains had also shown a measure of good internal consistency as the Cronbach's alpha values were more than 0.7; it was another evidence to support the reliability of the inventory. These findings provided evidence to support that the AL-i is a reliable instrument that could be used in the future to identify types of learner among medical students.

The reliability and factor analyses have provided evidence of validity and reliability of the AL-i in determination of learner types among medical students of Universiti Sains Malaysia. However, a limitation of this study is that it is only confined to one institution. Therefore it is recommended that a multi-centre validation study should be conducted in the future to determine the validity and reliability of the AL-i across institutions. Apart from that, this study has provided useful baseline information for future studies in this area.

Conclusion(s)

The AL-i has shown good psychometric values. It is a valid and reliability tool to determine adult learner status among medical students. It is a promising psychometric instrument that can be used to determine types of learner among students in future.

Abbreviation(s)

Nil

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Illustrations

Illustration 1

Table 1: Profile of participants. (n = 196)

Variable		(n = 196)
Gender, n (%)	Male	68 (34.7)
	Female	128 (65.3)
Qualification, n (%)	Matriculation	174 (88.8)
	High School Certificate (HSC)	13 (6.6)
	A-Level	9 (4.6)
Race, n (%)	Malay	105 (53.6)
	Chinese	61 (31.1)
	Indian	22 (11.2)
	Others	8 (3.6)
Origin, n (%)	Urban	99 (50.5)
	Rural	88 (44.9)
	Missing data	9 (4.6)

Parent income, n (%)	RM 1 – RM 500	8 (4.1)
	RM 501 – RM 1000	41 (20.9)
	RM 1001 – RM 2000	30 (15.3)
	RM 2001 – RM 3000	25 (12.8)
	RM 3001 – RM 4000	29 (14.8)
	RM 4001 – RM 5000	8 (4.1)
	RM 5001 – RM 7500	30 (15.3)
	RM 7501 – RM 10000	6 (3.1)
	More than RM 10000	6 (3.1)
Missing data	13 (6.6)	
CGPA result, mean \pm SD (minimum, maximum)	3.97 \pm 0.05 (3.88, 4.00)	

Illustration 2

Table 2: The initial reliability and factor analysis of the 12 items AL-i.

No	Item	^a Component		^b Corrected Item-Total Correlation	^b Cronbach's Alpha if Item Deleted	^c Domain	^b Cronbach's Alpha
		1	2				
Q1	Most of the time, I decide what is important to be learned.	0.788	0.037	0.496	0.675	Andrago gy (adult learner)	0.57
Q2	I need to validate the information based on my beliefs and experiences.	0.836	0.038	0.512	0.674		
Q3	I expect what I'm learning to be immediately useful.	0.323	0.225	0.302	0.806		
Q4	I have much experience to relate upon my learning.	0.795	0.021	0.506	0.670		
Q5	I like to participate and involve in a discussion.	0.706	-0.093	0.339	0.687		
Q6	I have abilities to serve as a knowledgeable resource to teachers or fellow classmates.	0.733	0.148	0.521	0.670		

Q7	Most of the time, I rely on others to decide what is important to be learned.	0.364	0.583	0.468	0.669	Pedagogy (child learner)	0.77
Q8	I accept all the information being presented at face value.	0.496	0.472	0.525	0.668		
Q9	I expect what I'm learning to be useful in my long-term future.	0.609	0.054	0.342	0.689		
Q10	I don't like to participate and involve in a discussion.	-0.058	0.826	0.356	0.682		
Q11	I have little or no experience to relate upon my learning.	-0.044	0.870	0.362	0.682		
Q12	I have little or no ability to serve as a knowledgeable resource to teachers and fellow classmates.	-0.002	0.878	0.426	0.674		

^a Factor Analysis; Exploratory Factor Analysis with varimax rotation, total variance explained was 55.88%, Kaiser-Meyer-Olkin (KMO) measure was 0.785 and Bartlett's test of sphericity $p < 0.001$

^b Reliability analysis; Cronbach's Alpha Coefficient, overall Cronbach's alpha = 0.703

^c Domains were predetermined based on adult learning principles.

Illustration 3

Table 3: The final reliability and factor analysis of the 10 items AL-i.

No	Item	^a Component		^b Corrected Item-Total Correlation	^b Cronbach's Alpha if Item Deleted	^c Domain	^b Cronbach's Alpha
Q1	Most of the time, I decide what is important to be learned.	0.767	0.040	0.461	0.782	Andrago gy (adult learner)	0.85
Q2	I need to validate the information based on my beliefs and experiences.	0.838	0.044	0.523	0.776		
Q4	I have much experience to relate upon my learning.	0.814	0.017	0.475	0.780		
Q5	I like to participate and involve in a discussion.	0.731	-0.089	0.346	0.793		
Q6	I have abilities to serve as a knowledgeable resource to teachers or fellow classmates.	0.750	0.148	0.527	0.774		
Q7	Most of the time, I rely on others to decide what is important to be learned.	0.390	0.588	0.558	0.769	Pedagogy (child learner)	0.81
Q8	I accept all the information being presented at face value.	0.492	0.476	0.556	0.771		
Q10	I don't like to participate and involve in a discussion.	-0.062	0.822	0.383	0.793		
Q11	I have little or no experience to relate upon my learning.	-0.052	0.876	0.444	0.784		
Q12	I have little or no ability to serve as a knowledgeable resource to teachers and fellow classmates.	-0.003	0.878	0.487	0.778		

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