

ORIGINAL RESEARCH

The self-rating scale of self-directed learning tool: findings from a confirmatory factor analysis

Lucia Cadarin¹, Valerio Ghezzi², Monica Camillo³, Alvisa Palese^{*4}

¹Continuing Education Centre, CRO Aviano National Cancer Institute, Aviano, Pordenone, Italy

²Department of Psychology, Sapienza University, Rome, Italy

³Medical Department, Ulss7 Pieve di Soligo-Treviso, Italy

⁴Department of Medical and Biological Science, University of Udine, Udine, Italy

Received: May 9, 2016

Accepted: August 18, 2016

Online Published: September 19, 2016

DOI: 10.5430/jnep.v7n2p31

URL: <http://dx.doi.org/10.5430/jnep.v7n2p31>

ABSTRACT

Introduction: Healthcare students and professionals possess self-directed learning abilities at different levels of development. For educators, measuring these abilities allow to tailor teaching and mentoring interventions. The aim of this study was to validate the structure of the Self-Rating Scale of Self-Directed Learning, Italian version (SRSSDL-Ita).

Methods: A cross-sectional study design was adopted involving a convenience sample of 593 healthcare students and professionals. A Confirmatory Factor Analysis was performed to confirm the validity of the measurement model of the original structure of the SRSSDL-Ita.

Results: The Maximum Likelihood Mean-and-Variance (MLMV) to confirmatory factor analysis was used to examine the underlying latent variable structure of the SRSSDL-Ita, which was composed of 40 items. All standardized factor loadings were > 0.42. Latent dimensions were all positively correlated, ranging in magnitude between 0.28 and 0.78. The Chi-square value for the overall model was $\chi^2(712) = 1,104.273$ with $p < .001$, Root Mean Square Error of Approximation (RMSEA) (90% confidence interval (CI)) = 0.031 (lower bound 0.027; upper bound 0.054) with $p = 1.00$, and Standardized Root Mean Square Residual (SRMR) = 0.055. The overall interpretation of the fit indices suggests a more than acceptable fit between the hypothesized model and the data. The emerged structure confirms the original structure of the instrument composed of eight factors: "Awareness", "Attitudes", "Motivation", "Learning Strategies", "Learning Methods", "Learning Activities", "Interpersonal Skills" and "Constructing Knowledge".

Conclusions: The SRSSDL-Ita structure was confirmed. Therefore, SRSSDL-Ita is a valid and practical tool that may contribute to determining learning needs among students and healthcare professionals; helping educators in identifying and implementing strategies to enhance SDL abilities in both groups.

Key Words: Confirmatory factor analysis, Construct validity, Healthcare students, Healthcare professionals, Instrument, Tool, Self-Directed Learning, Self-Rating Scale of Self-Directed Learning

1. INTRODUCTION

Self-directed learning (SDL) is widely recognized as an essential competence for healthcare professionals.^[1] Healthcare professionals must keep abreast of new information and

critically evaluate emerging evidence in order to function effectively in a constantly changing workplace.^[1,2] SDL helps healthcare workers to remain flexible, open to change, and continuously up-to-date. Therefore, university and continu-

*Correspondence: Alvisa Palese; Email: alvisa.palese@uniud.it; Address: University of Udine, Viale Ungheria, 20-33100, Udine, Italy.

ing education strategies should be based upon SDL principles,^[1,3] which are aimed at developing professionals who are capable of life-long learning (LLL).

The role of healthcare teachers, both at the university and at the continuing educational level, has been exposed to important changes in its mission in recent years: in fact, healthcare students and professionals will be expected to assume increasing responsibilities regarding their learning processes, reflecting on and evaluating their goals as progressively achieved. Specifically, in healthcare sciences, this change will require reducing dependence on traditional educational strategies designed and implemented by teachers and progressively increasing participation in self-assessment, peer-assessment and self-evaluation.^[4]

According to Longworth and Davis et al., LLL is the development of human potential through a continuously supportive process that stimulates and empowers individuals to acquire all knowledge, values, skills, and understanding that they will require throughout their lifetimes. In turn, individuals acquire these skills with confidence, creativity and enjoyment in all their roles, contexts and environments. In the field of healthcare, LLL is considered to be a dynamic process, involving both personal and professional life, and occurring in formal and informal settings. Professionals and students capable of undertaking LLL appreciate new ideas, gain new perspectives and critically evaluate skills and interactions.^[5,6] Reflecting, questioning, enjoying learning, understanding the dynamic nature of knowledge, and engaging in learning by actively seeking opportunities, are the main principles of LLL.^[6] Therefore, the promotion of LLL requires changes in teaching and learning methods: teachers or clinical instructors should play a more facilitating role while students and/or professionals should undertake more responsibility towards achieving their learning goals.^[4]

Progressive independence in learning processes is a core attribute of effective LLL.^[2,3,5] Independence in LLL is based on responsibility, confidence, patience, persistence, diligence, and attention to details;^[5] therefore, independence in LLL reflects one's ability to self-direct the learning process. According to Knowles, SDL is a process whereby a person determines his/her learning aim(s) with or without the help of teachers/mentors, selecting appropriate learning resources and methods, and evaluating learning outcomes.^[7] In addition, SDL integrates self-monitoring, which is the process by which the learners monitor, evaluate and regulate their own cognitive and meta-cognitive strategies, including monitoring the repertoire of strategies and awareness and having the ability to think about their learning.^[7]

All healthcare students and professionals possess SDL abili-

ties at different levels of development, according to internal factors, learning styles, and self-confidence as learners.^[8] Measuring SDL abilities allows faculties and managers to identify those healthcare students or professionals who require specific support, as well as to measure the effectiveness of any implemented educational strategies.^[9]

With the current state of the knowledge in the field, the following tools measuring SDL abilities have been documented in scholarly publications:

- Self-Directed Learning (SDLRS) by Guglielmino, updated by various authors and tested among nursing and other medical students,^[10-13]
- Self-Directed Learning Instrument (SDLI), developed and validated by Cheng,^[2] devoted to nursing students, and
- Self-Directed Learning Aptitude Scale (SDLAS) developed by Abd-El-Fattah,^[14] and devoted to college students.

The abovementioned tools have also been extensively validated through Confirmatory Factor Analysis (CFA), testing the competing hypotheses regarding the underlying factor structures.^[15]

In 2007, the Self-Rating Scale of Self-Directed Learning (SRSSDL) was developed by Williamson^[16] and validated among nursing students. With author permission, an Italian validation of the instrument^[9] was undertaken. According to LLL principles and based on a continuing process of learning throughout professional life beginning with university education,^[7] the Italian validation was based on an innovative approach. Instead of a single professional group (e.g., nurses) in a single stage of life (e.g., university education), different groups of students and healthcare workers (Registered Nurses [RNs], paediatric nurses, midwives, radiology technicians, etc.) both during their university education and their work-life, were involved. The aim was to develop a unique tool that would be valid in different stages of professional life and based on LLL principles.^[17] The SRSSDL-Ita tool's validity was assessed through Explorative Factor Analysis (EFA) which documented a structure composed of eight factors and 40 items that explain 54.30% of the total variance. The alpha coefficient of the tool was 0.92.^[9] However, according to Watson and Thompson, a rigorous testing of hypothesized structures of a set of data can be obtained only using CFA given that EFA does not allow for rigorous testing of hypothesized structures. EFA is a preliminary step in the factor analysis process and the factor structures emerged have to be confirmed by CFA.^[18] The aim of this study was, therefore, to test the structure of the SRSSDL-Ita through CFA among a wide group of healthcare students and professionals

who have the common aim to be self-directed learners and lifelong learners in order to offer higher quality of care.

2. METHODS

2.1 Study design and settings

A cross-sectional survey was performed in 2013. Three hospitals and three Bachelor's degree nursing programmes offered by two universities in northern Italy, selected with a convenience criteria, were approached. Healthcare professionals were eligible who were working in the selected Hospitals as Registered Nurses (RNs), paediatric nurses or midwives; nursing students attending their Bachelor's degrees in the selected universities were also eligible. Aiming at assuring a higher variability of the participants, exclusion criteria were not stated and all those participants who agreed to participate in the study after having received a detailed explanation on the research aims, were included.

2.2 Instrument

The Self-Rating Scale of Self-Directed Learning (SRSSDL) originally developed by Williamson and then validated in the Italian context^[19] was adopted. According to the validation, the SRSSDL-Ita consists of 40 items distributed into eight factors: "Awareness," which included seven items ($\alpha = 0.80$); "Attitudes" eight items ($\alpha = 0.77$); "Motivation" six items ($\alpha = 0.78$); "Learning strategies" five items ($\alpha = 0.78$); "Learning methods" four items ($\alpha = 0.67$); "Learning activities" four items ($\alpha = 0.68$); "Interpersonal skills" four items ($\alpha = 0.68$); and "Constructing knowledge" two items ($\alpha = 0.73$). These factors were labelled in accordance with the findings that emerged from EFA^[9] and according to the andragogical theory developed by Knowles.^[7] The responses for each item were rated using a five-point Likert scale (1 = never; 5 = always).

Healthcare professionals and nursing students were approached during continuing education or university meetings in 2013. The scale, including also a questionnaire including demographic data, was distributed and collected by the researchers, and participant anonymity was ensured.

2.3 Ethical Issues

Ethical approval was obtained from the Internal Review Boards of the hospitals and Internal Review Boards of the universities involved. Healthcare professionals and students were informed regarding the aims of the study, and they were invited to fill in the full questionnaire (10-15 min). After having expressed their consent, they were free to participate in the study.

2.4 Statistical analysis

Descriptive statistics were performed using SPSS Inc. (Chicago, IL, USA) Version 22, aimed at describing the main characteristics of participants: continuous variables were analysed as average and Standard Deviations (\pm) while categorical variables as frequencies and percentages.

Using the software Mplus 7,^[20] we performed CFA, testing the oblique structure described in previous research based on other samples.^[9] Since some of the items approached or exceeded^[11] and since the variances of the scores were slightly different between items, we performed CFA using a robust estimator that appropriately corrects the standard errors of parameters (Maximum Likelihood Mean-and-Variance adjusted, MLMV), using listwise deletion to handle missing data for that very small percentage within the dataset.^[21] Overall goodness of fit of the tested model was evaluated using the following criteria:

- Chi-square significance (if Chi Square was not significant, a perfect fit between the hypothesized model and data was reached);
- Root Mean Square Error of Approximation (RMSEA);^[22] values $\leq .05$ or 0.08 indicated a good fit, such as at its upper bound of 90% of the confidence interval;^[23]
- Standardized Root Mean Square Residual (SRMR);^[24] values $\leq .05$ indicated a good fit.

Since the RMSEA of the null model was lower than 0.16 (in our case, 0.082), in accordance with Kenny's reasoning,^[25] Comparative and Non-Normed Fit Indices (CFI & NNFI) can be considered not informative.

3. RESULTS

3.1 Participants

A total of 773 questionnaires were distributed (nursing students = 238; RNs, paediatric nurses and midwives = 535), and 593 were completed (return rate = 76.7%). A total of 201 nursing students (34%) and 392 RNs, paediatric nurses and midwives (66%) participated. Among students, 145 (72.1%) were female; their mean age was 21 years (\pm [Standard Deviation] 4.40). Among healthcare professionals, 337 (86%) were female, and the mean age was 42.3 years (\pm 8.10).

3.2 Confirmatory factor analysis

The MLMV confirmatory factor analysis was used to examine the underlying latent variable structure of the 40-item SRSSDL-Ita. As indicated in Figure 1, all standardized factor loadings were > 0.42 . Latent dimensions were all positively correlated, ranging in magnitude between 0.28 and 0.78. The Chi-square value for the overall model was χ^2 (712) =

1104.273 with $p < .001$, RMSEA = 0.031 (90% confidence interval (CI) (lower bound 0.027; upper bound 0.054) with $p = 1.00$, and SRMR = 0.055. Therefore, confronting the

fit criteria with those established by the literature,^[22–25] the model underlying the instrument has been confirmed with acceptable fit indices.

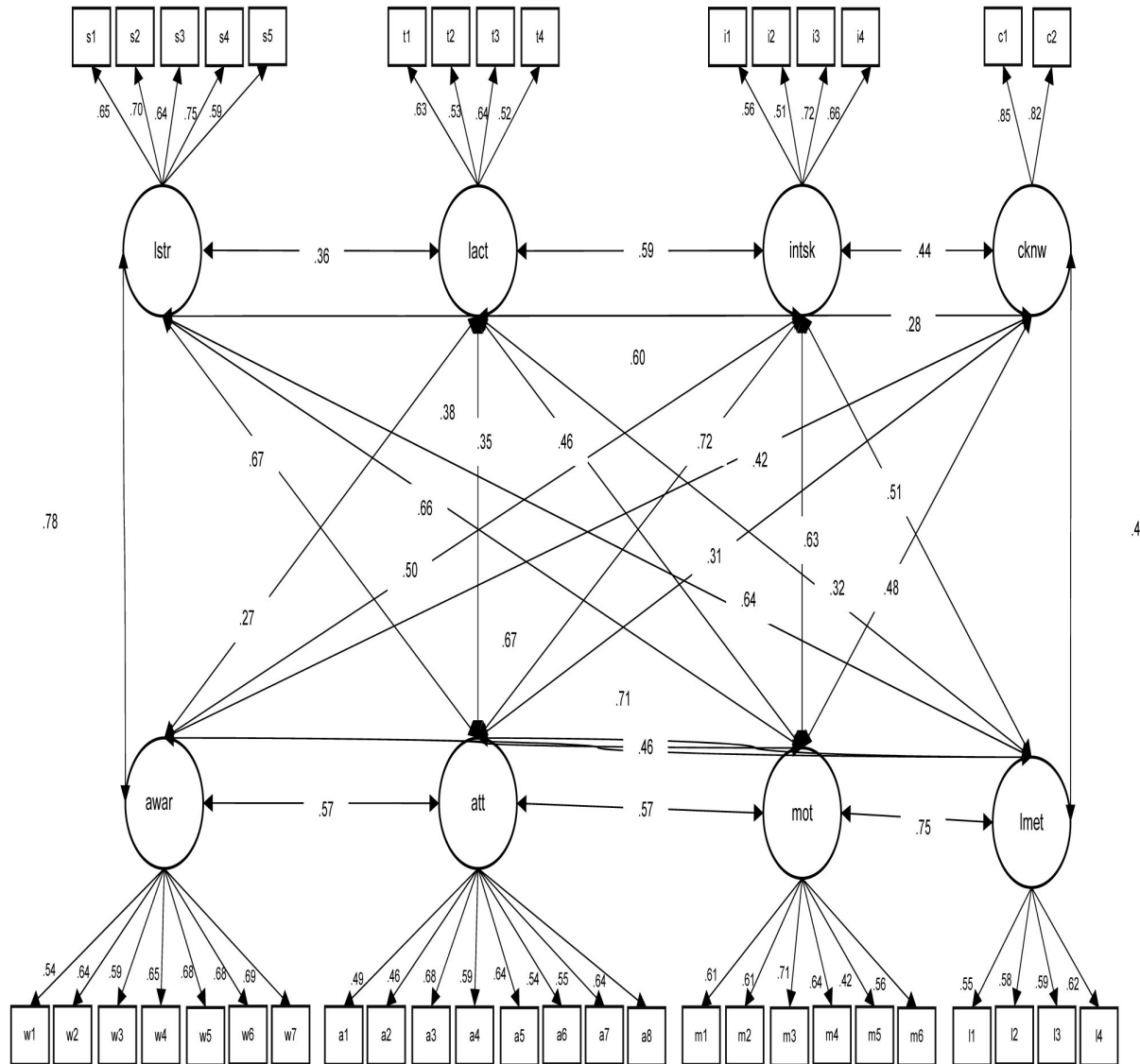


Figure 1. Confirmatory factor analysis of SRSSDL-ITA

All loadings and correlation are presented in the completely standardized metric and are significant for $p < .001$. AWAR=Awareness; ATT=Attitudes; MOT=Motivation; LSTR=Learning Strategies; LMET=Learning Methods; LACT=Learning Activities; INTSK=Interpersonal Skills; CKNW=Constructing Knowledge

4. DISCUSSION

The assumptions of the study were based on the fact that SDL principles should pervade healthcare professions, from their university education, which should be based on LLL pre-requisites.^[26] Therefore, a large group of students and healthcare professionals were involved in the study in order to evaluate the theoretical structure of the SRSSDL-Ita instru-

ment. Thus, there were included diverse individuals for age, discipline, role and stage of professional life, all variables that may affect learning processes. A more diverse group of healthcare professionals and student participants should be involved in future studies in order to develop a more comprehensive instrument valid in different stage of life and settings. In addition, a greater diversity in countries and healthcare

contexts (e.g. community care) is recommended.

CFA was performed to test the SRSSDL-Ita instrument's factor structure^[15] aimed at confirming the theoretical assumptions^[26] and whether or not the factors generated by EFA could be confirmed.^[27] The overall interpretation of the fit indices suggests a more than acceptable fit between the hypothesized model and the data. Therefore, the structure that emerged confirms the construct validity of the instrument composed of eight first order factors. The "Awareness" factor is composed of seven items and was aimed at evaluating prerequisites of learners to adopt SDL; the "Attitudes" factor includes eight items evaluating the thinking and behavioural attitudes of learners to adopt SDL; the "Motivation" factor, composed of six items, was aimed instead at evaluating the internal and external stimuli increasing the desire to learn. In accordance with andragogical theory,^[7,9,28] these three factors may be considered to be antecedents to effective self-directed learning. In fact, SDL integrates motivation and volition in initiating and maintaining efforts towards learning. Motivation includes both entry and task motivation: the first establishes the learner commitment to a particular goal and the intent to act at the beginning; the second measures the learner tendency to focus on and to persist in learning activities and goals. Finally, volition is a part of motivation, determining learners' ability to activate intentional efforts and diligence that may influence persistence in learning.^[5,14,29]

The following factors included in the instrument - "Learning strategies," "Learning methods," "Learning activities" and "Interpersonal skills" - were also confirmed in their validity. The "Learning strategies" factor is composed of five items, aimed at assessing individual skills to be engaged effectively, by using the necessary strategies to achieve established learning objectives.^[7] The "Learning methods" factor includes four items, aimed at evaluating skills to identify and to undertake appropriate learning methods,^[3] while the "Learning activities" factor, including four items, was aimed at measuring the ability to design and implement personalized activities that promote learning (e.g., simulations).^[16] The "Interpersonal skills" factor is then composed of four items aimed at assessing verbal and non-verbal communication with other students or colleagues. The last factor measures interaction in different fields (academic and healthcare sectors) which are considered crucial to facilitating adaptation, socialization and further learning.^[7]

All the above-mentioned factors confirmed by CFA, measure skills needed to effectively manage SDL processes, to use appropriate resources in order to effectively achieve learning goals and to interact with others promoting collaboration with peers and/or teachers/mentors who can become

learning resources.^[7] Therefore, these factors measure SDL self-management abilities as defined by those abilities that are aimed at understanding how to manage strategies and resources.^[14,29]

The eighth factor, "Constructing knowledge" is composed of two items aimed at evaluating the use of tools to graphically represent knowledge on a given subject or topic. This factor reflects the Constructivist theory that considers a person to be responsible for the learning process; in addition, in accordance with Constructivist theory, knowledge is developed progressively and not passively. This process is facilitated through the use of concept mapping,^[30] allowing the learner to understand the meaning of the new knowledge with regard to what has been possessed previously and the reciprocal influences. In this process, the learner takes responsibility for the construction of personal meaning by integrating new and previous knowledge, a process also known as meaningful learning.^[14,29,31]

The similarity of the factorial structures between two different samples (EFA and CFA), suggest that the instrument is suitable for nurses in different professional phases, from initial education to continuing and advanced education, in an LLL perspective. Periodically evaluating SDL abilities is recommended to develop awareness among healthcare students and professionals and define how to improve these abilities which is crucial in LLL.^[5]

Therefore, the study findings contribute to developing the research field, by creating the basis for effective SDL measurement through a valid and reliable instrument. This will allow cross-sectional comparison also among international settings.

Limitations

The present study has several limitations. A convenience sample from three hospitals and three Bachelor's degree nursing programmes was involved and this may threaten the generalizability of the findings. The responses of the students and professionals were analysed together as a single sample. It is possible that they have different latent structures and future studies are needed to confirm or not these assumptions. In addition, a self-reported SDL assessment was performed: it is also possible that a ceiling effect, social desirability or memory bias were present since all items were positively scored.

5. CONCLUSIONS

For students, professionals, teachers and clinical instructors, having a validated tool to measure SDL skills may support pedagogical and andragogical decisions regarding appropri-

ate strategies to develop SDL abilities. In the healthcare field, SDL is considered a key principle of life-long learning, capable of ensuring continuing and critical revision of the possessed knowledge in a challenging world characterized by increasing new evidence.

Regarding construct validity, the findings provide additional evidence documenting SRSSDL-Ita as a valid tool for evaluating SDL abilities in healthcare students and professionals. Eight first-order factors were confirmed in their construct: "Awareness", "Attitudes", "Motivation", "Learning strategies", "Learning methods", "Learning activities", "Interpersonal skills" and "Constructing knowledge". The instrument is then composed of 40 items, being therefore more concise than the original version including 60 items.

Therefore, SRSSDL-Ita is a valid and practical tool that may contribute to a) determining learning needs among students and healthcare professionals; b) helping educators (teachers, mentors, tutors, preceptors) in identifying and implementing strategies to enhance SDL abilities both in students and in healthcare professionals; c) increasing awareness among

students and professionals regarding their SDL abilities and responsibilities in the learning processes.

Mixed-methodological approaches, including both qualitative and quantitative methods, may further improve instrument validity by promoting a broad and deeper understanding of the underlying concepts, and increasing control over the validity of the SRSSDL-Ita.

Finally, a qualitative study design aiming at understanding experiences of SDL among students and healthcare professionals, identifying other factors promoting or limiting SDL readiness and abilities, such as those environmental or cultural, is suggested.

ACKNOWLEDGEMENTS

The authors would like to express their sincere gratitude to Bernardo Balboni who offered his help at the beginning of this study.

CONFLICTS OF INTEREST DISCLOSURE

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the article.

REFERENCES

- [1] Shen WQ, Chen HL, Hu Y. The validity and reliability of the self-directed learning instrument (SDLI) in mainland Chinese nursing students. *BMC Med Educ.* 2014; 14(1): 108. <http://dx.doi.org/10.1186/1472-6920-14-108>
- [2] Cheng SF, Kuo CL, Lin KC, et al. Development and preliminary testing of a self-rating instrument to measure self-directed learning ability of nursing students. *Int J Nurs Stud.* 2010; 47(9): 1152-1158. <http://dx.doi.org/10.1186/1472-6920-14-108>
- [3] O'Shea E. Self-directed learning in nurse education: a review of the literature. *J Adv Nurs.* 2003; 43(1): 62-70. <http://dx.doi.org/10.1046/j.1365-2648.2003.02673.x>
- [4] Collins J. Education Techniques for Lifelong Learning Lifelong Learning in the 21st Century and Beyond. *Radiographics.* 2009; 29(2): 613-622. <http://dx.doi.org/10.1148/rg.292085179>
- [5] Davis L, Taylor H, Reyes H. Lifelong learning in nursing: a Delphi study. *Nurse Educ Today.* 2014; 34(3): 441-445. <http://dx.doi.org/10.1016/j.nedt.2013.04.014>
- [6] Longworth D. Lifelong learning. 2nd ed. In: Guthrie, J. (Ed.), *Encyclopedia of Education*, vol. 4. Thomson Gale, Cleveland, OH; 2003.
- [7] Knowles MS, Holton III EF, Swanson RA. *When the Adult Learns. Andragogy and Development of the Person.* Milano: Franco Angeli; 2008.
- [8] Wo-Hwan A. Self-directed Learning trend: a critical review of research. *The Journal of Korean Teaching and Learning.* 2007; 2: 1-13.
- [9] Cadarin L, Bortoluzzi G, Palese A. The Self-Rating Scale of Self-Directed Learning (SRSSDL): a factor analysis of the Italian version. *Nurse Educ Today.* 2013; 33(12): 1511-1516. <http://dx.doi.org/10.1016/j.nedt.2013.04.010>
- [10] Guglielmino LM. Development of the Self-Directed Learning Readiness Scale. Unpublished Doctoral Dissertation, University of Georgia. Dissertation Abstracts International. 1977; 38(11a): 6467.
- [11] Hoban JD, Lawson SR, Mazmanian PE, et al. The Self-Directed Learning Readiness Scale: a factor analysis study. *Med Educ.* 2005; 39(4): 370-379. <http://dx.doi.org/10.1016/10.1111/j.1365-2929.2005.02140.x>
- [12] Fisher MJ, King J. The Self-Directed Learning Readiness Scale for nursing education revisited: a confirmatory factor analysis. *Nurse Educ Today.* 2010; 30(1): 44-48. <http://dx.doi.org/10.1016/j.nedt.2009.05.020>
- [13] Williams B, Brown T. A confirmatory factor analysis of the Self-Directed Learning Readiness Scale. *Nurs Health Sci.* 2013; 15(4): 430-436. <http://dx.doi.org/10.1111/nhs.12046>
- [14] Abd-El-Fattah SM. Garrison's model of self-directed learning: preliminary validation and relationship to academic achievement. *Span J Psychol.* 2010; 13(2): 586-596. <http://dx.doi.org/10.1017/S1138741600002262>
- [15] Charalambous A, Raftopoulos V, Talias MA. The confirmatory factor analysis of the job diagnostic survey: the oncology nursing setting. *J Nurs Manag.* 2013; 21(2): 273-282. <http://dx.doi.org/10.1111/j.1365-2834.2012.01386.x>
- [16] Williamson SN. Development of a self-rating scale of self-directed learning. *Nurse Res.* 2007; 14(2): 66-83. PMID:17315780 <http://dx.doi.org/10.7748/nr2007.01.14.2.66.c6022>
- [17] Murad MH, Varkey P. Self-directed learning in health professions education. *Ann Acad Med Singapore.* 2008; 37(7): 580-590. PMID:18695772
- [18] Watson R, Thompson DR. Use of factor analysis in Adv Nurs: literature review. *J Adv Nurs.* 2006; 5(3): 330-341. <http://dx.doi.org/10.1111/j.1365-2648.2006.03915.x>

- [19] Cadarin L, Suter N, Saiani L, et al. Self-rating scale of self-directed learning (SRSSDL): Preliminary results from the Italian validation process. *J Res Nurs*. 2011; 16(4): 363-373. <http://dx.doi.org/10.1177/1744987110379790>
- [20] Muthén LK, Muthén BO. *Mplus user's guide*. 7th ed. Los Angeles, CA: Muthén & Muthén; 1998-2012.
- [21] Tabachnick BG, Fidell LS. *Using multivariate statistics*. Boston: Pearson/Allyn & acon; 2007.
- [22] Steiger JH. Structural model evaluation and modification: An interval estimation approach. *Multivariate Behavioral Research*. 1990; 25: 173-180. PMID:26794479 http://dx.doi.org/10.1207/s15327906mbr2502_4
- [23] Hu L, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*. 1999; 6: 1-55. <http://dx.doi.org/10.1080/10705519909540118>
- [24] Jöreskog KG, Sörbom D. *LISREL8 user's reference guide*. Chicago: Scientific Software International; 1993.
- [25] Kenny D. *Measuring Model Fit*. 2015. Available from: <http://davidakenny.net/cm/fit.htm> [Cited 2016 Jan 16].
- [26] Pryce-Miller MA. 2010. Are first year undergraduate student nurses prepared for self directed learning? *Nurs Times*. 2010; 106(43): 21-24. PMID:21192595
- [27] O'Connel BOC, Hawkins M. Construct validity and reliability of the Handover Evaluation Scale. *J Clin Nurs*. 2014; 23: 560-570. <http://dx.doi.org/10.1111/jocn.12189>
- [28] Boyer SL, Edmondson DR, Artis AB, et al. Self-Directed Learning: A Tool for Lifelong Learning. *JME*. 2014; 36(1): 20-32. <http://dx.doi.org/10.1177/0273475313494010>
- [29] Bin Yuan H, Williams B, Fang JB, et al. Chinese baccalaureate nursing students' readiness for self-directed learning. *Nur Educ Today*. 2012; 32: 427-431. <http://dx.doi.org/10.1016/j.nedt.2011.03.005>
- [30] Pudelko B, Young M, Vincent-Lamarre P, et al. Mapping as a learning strategy in health professions education: a critical analysis. *Med Educ*. 2012; 46: 1215-1225. <http://dx.doi.org/10.1111/medu.12032>
- [31] Johannsen A, Bolander-Laksov K, Bjurshamar N, et al. Enhancing meaningful learning and self-efficacy through collaboration between dental hygienist and physiotherapist students – a scholarship project. *Int J Dent Hyg*. 2012; 10: 270-276. <http://dx.doi.org/10.1111/j.1601-5037.2011.00539.x>