The structure of mentors' behaviour in clinical nursing education: confirmatory factor analysis

Yanhua CHEN, RN, PhD, The Affiliated Hospital of Southwest Medical University, China

Email: chen_yanhua25@163.com

Roger WATSON PhD RN, Professor of Nursing, The University of Hull, UK

Email: r.watson@hull.ac.uk

Andrea HILTON, PhD, Senior Lecturer, The University of Hull, UK

Email: a.hilton@hull.ac.uk

Word count 3990

Aims

To study if a three-factor structure of mentors' behaviour identified through exploratory factor analysis could be confirmed in a dataset assessing mentors' performance using structural equation modelling.

Background

To measure mentor's behaviour in clinical nursing education in China, a specific instrument was developed and preliminarily validated; a three-factor structure (professional development, facilitating learning and psychosocial support) was identified in a dataset of assessment of the importance of mentors' each behaviour using exploratory factor analysis and Mokken scale analysis.

Design

A cross-sectional study with online and hard copy survey was applied.

Methods

Convenience sampling was conducted. Nursing students (n=634) in Southwest China participated in the study from July to August in 2014. Confirmatory factor analysis was used.

Results

Mentors' behavior can be perceived as a secondary order factor with three first order factors: professional development, facilitating learning and psychosocial support.

Conclusion

The three-factor structure of mentors' behaviour was confirmed by structural equation modelling. This structure is visible in mentors' real performance and implies that this

instrument could be used to assess mentors' behaviour in addition to students' expectation from mentors.

Key words

mentors' behaviour; professional development, psychosocial support; facilitating learning, nursing,

Highlights

- The mentors' behaviour was a general factor at the second-order, having a direct effect on the three first-order factors.
- This confirmed the three-interrelated-factor structure of mentors' behavior identified in former studies as they are equivalent in structure
- This study showed that the scale of mentors' behaviour was useful in assess mentors' real performance.
- This could be useful to select good mentors and identify which behaviour is missing or weak.

Introduction

In clinical teaching of pre-registered nursing students, mentors are key members of the team. A mentor is a Registered Nurse, facilitating a student's learning and supporting his/her professional development in clinical placement on a one-to-one, day-to-day basis. A nursing student, simply being with a staff nurse does not guarantee that mentoring and learning take place, some 'toxic mentor' may even block study (Darling, 1986). Gray and Smith (2000) also identified the characteristics of bad mentors, such as disliking their job, over-protecting students, lack of knowledge, intimidating students and being unfriendly. Therefore, mentors' behaviour needs assessment (Sawatzky and Enns, 2009), and a reliable measurement instrument is in need.

Nursing academia used mentoring instruments from other fields to measure mentorship in nursing (Chen et al, 2016a), such as doctoral mentoring, faculty mentoring, and leadership mentoring as no suitable tool was found in nursing. But with regard to nursing students mentoring in clinical teaching, no tools from other fields have been adopted (Chen et al, 2016a). Nursing researchers started to develop their specific instrument. Till now a scale to measure faculty mentorship (Berk et al, 2005), and one instrument (Chow & Suen, 2001) to evaluate clinical nursing students mentoring have been developed. Unfortunately, these are not suitable to assess students' mentoring due to difference of conceptualization between faculty mentorship and students mentorship and/or poor psychometric evidence (Chen et al, 2016 a)). Therefore, a specific instrument – the Mentors' Behaviour Scale in Nursing has been developed recently (Chen, et al, 2016b), but further validation is needed.

Background

The Mentors' Behaviour Scale in Nursing is focused on mentors' behaviour in clinical teaching of pre-registered students. This scale is based on a tentative theoretical framework generated from review of 43 studies. Mentors' behaviour was conceptualised as a three-dimensional model. It includes facilitating learning, professional development and psychosocial support. Psychosocial support includes establishment of relationships and support and encouragement. Facilitating learning contains planning and organizing learning activities, teaching and guiding, plus feedback and assessment. Finally professional development consists of promoting students' professional socialization and role modelling (unpublished PhD thesis).

This scale was validated in a group of Chinese nursing students (n=699) to explore the structure of mentors' behaviour and students were asked to assess the importance of mentors' behaviour, each behaviour rated by five steps (scoring 1-5) (Chen, et al, 2016b). Both exploratory factor and Mokken scale analysis identified a three-factor model, professional development, facilitating learning and psychosocial support (Chen, et al, 2016b), which implies that this instrument could be used to match students with mentors according to students' perspective of the importance of mentors' behaviour. However it is unclear if the structure of mentors behaviour could be confirmed and if this scale could be used to assess mentors real performance, identify any deficiency and monitor quality of mentorship.

This study

Aims

This paper aims to investigate if the structure of mentors' behaviour can be confirmed in the dataset of mentors' real performance assessment using the structural equation modelling facility in AMOS 22.0

Design

A cross-sectional study using an online and a hard-copy survey was employed.

Participants

A convenience sampling was applied in this study (Chen *et al*. 2016b). Eighty nursing students completed the online questionnaires among 900 potential respondents in one southwest medical school in China from July to August 2014. Nursing students (n=610) from different programs in three hospitals of one city in southwest China completed the questionnaires at the end of a lecture in twenty minutes in hard-copy survey in August 2014.

The measurement instrument

The instrument used in this study is a newly developed and validated tool with 47 items and three inter-related factors (professional development (α =0.91); facilitating learning (α =0.87) and psychosocial support (α =0.87) (Chen *et al*. 2016b). The scale level content validity index, S-CVI was 0.95 based on the nine mentoring experts in the UK. The test-retest reliability is high (ICC=0.92).

Data collection

Data were collected from the same sample at the same time as that applied in EFA (Chen *et al*.2016b); ideally different database should be used to do EFA and CFA separately. There is an unresolved debate about if same database can be used to do both EFA and CFA (Watson *et al*. 2013), but there is no discussion about whether or not the data and results will be influenced by the survey using same sample at the same time. In the main research project (the unpublished PhD thesis) two different databases (importance and assessment database) were established in the same sample.

In the importance dataset students were invited to rate the importance of mentors' behaviour; in the assessment database, students were asked to rate the extent to which they did witness the behaviour of their mentors and a clear stem question: 'Thinking about your most recent mentor, how much do you agree that they show the following behaviours?' was presented in the questionnaire and students responded on a 5-point Likert scale (1-5) from 'strongly disagree' to 'strongly agree'.

Questionnaires were administered to approximately 900 nursing students through the Bristol Online Survey tool because students were allocated in different hospitals across provinces in clinical learning. One month was given to finish the online questionnaire, and reminders were sent out to increase response rate in this period in 2014.Unfortunately, only 80 students responded; the response rate was low (80/900=8.89%) and the quality was problematic as the data showed low variance in response (15 cases were excluded due to this). Then three hard-copy surveys in three hospitals in one southwest city of China were conducted (Chen *et al*. 2016b) as a complement in the same year, and the response rate ranged from 82-85%.

Ethical considerations

Ethical approval was granted by Faculty of Health and Social care (University of Hull) ethical committee in the UK and data collection permission was obtained from one university and three hospitals in China. The confidentiality and security of data were maintained.

Data analysis

After checking the quality of data, cases with missing data and low variance were excluded. Finally 634 cases were included in analysis, which was sufficient for structure equation modelling.

In confirmatory factor analysis, distribution of variables was checked first as it can affect the model fit index and accuracy of model estimation. In addition, distribution can also guide the selection of estimation methods. Because multivariate normality inspection is difficult to carry out, univariate normality was checked as a base. According to Kline (2005), multivariate normality is usually met when univariate normality holds. All the measured variables are normally distributed, as all the absolute values of skewness are <3 and all values of kurtosis are <7.

AMOS®, which is the statistical package used for confirmatory factor analysis in this study, also requires large sample size for accurate estimation and this was satisfied in this data set (n=634): the ratio of cases to variables is >20:1 (634:29), which is over the recommended rule of thumb value (5~10:1). At the same time no case with missing data was included to assure stable and precise model estimation.

Multicollinearity was also checked using linear regression, putting each variable in the dependent variable box in turn, and other variables in the independent variable box in SPSS 22.0. No tolerance is below 0.1, nor is any Variance Inflation Factor (VIF) is over 10. No VIF is even over 5. The correlation matrix was also checked: no correlation coefficient was over 0.85, so these suggest that there is no multicollinearity among all the observed variables (Kline 2005, Field 2009).

Specifying the model

According to the results generated from EFA, the model was specified (Chen *et al*. 2016b). The preliminary modelling found that the three factors were highly correlated (r>0.8) which suggested a general second-order factor ‘mentorship’ may exist. So the final model was modified as mentors’ behaviour was a general factor at the

second-order, having a direct effect on the three first-order factors (professional development; facilitating learning and psychosocial support).

Model fit estimation and modification

Maximum likelihood method (ML) was used to estimate the model fitness as it is a robust method. This data set, with large sample size, normality and no missing data basically meets all the requirements of conducting ML. The preliminary model fit index showed that the model did not fit the data well, so modification based on the model modification indices was conducted by co-varying several pairs of errors, and the corresponding observed variables of correlated errors measure similar concepts; so this will not cause change to the hypothesised model.

Equivalent model and model stability

When establishing a model, an alternative model or equivalent model should be considered to find out which model is preferable. Under some conditions there are infinite equivalent models (Kline 2005). After a model is established in one data set, model stability across data sets should be checked (Kline 2005).This model was also checked in the importance data set (N=669) (Chen *et al*. 2016b) using CFA with ML in AMOS 22.0.

Validity and reliability/rigour

This instrument was developed following a rigorous procedure, and showed satisfactory psychometric evidence (Chen *et al*. 2016b). In this study the sample is large (n=634), which is unlikely to cause model instability.

Results

Demographic information

Students in this dataset were from four programs, degree 126 (19.87%), associate degree 225 (35.49 %), 5-year diploma 94 (14.83%) and 3-year diploma 189 (329.81%); the majority were female 621 (97.95%). Students from hard copy survey accounted 89.72%, while the online survey only had 65 (10.28%) students. The mean age was 20.30, ranging from 17-24 years.

Model fit estimation

The preliminary model fit index showed that the model did not fit the data well, so modification based on the model modification indices was conducted by co-varying 14 pairs of errors measuring similar concepts. The final indices showed that the model fits the data; both the original fit index and final one are shown in Table 1 and error pair's correlation coefficients are shown in Table 2.

The indices for the final model show model fit and the model improvement. For example, the original chi-square value (χ^2 (612) =1381.44 ($p<0.05$)) did not suggest a model fit. Due to sensitivity to sample size, it is not surprising to obtain a large chi-square with this big sample size (N=634) but it changed from 2269.10 (626) to 1381.44 (612) after correlating the errors, which suggests substantial model improvement. CMIN/DF (χ^2/df) is approximately 2 (2.26), suggesting model fit.

The comparative fit index (CFI) is 0.95, suggesting model fit; parsimony-adjusted index (root mean squared error approximation, RMSEA) having a correction for model complexity is 0.04 (90% confidence from 0.04-0.05) which is <0.05, indicating a close approximate fit (Kline 2005 p.139). Goodness of fit index (GFI=0.89) is approximately 0.9 which suggests model fit. Standardised root mean squared residual (SRMR) is 0.03, which is under 0. 08 suggesting model fit.

The observed variables in the model have strong loadings (regression weights) on first-order factors; loadings of variables on F1 (professional development) range from 0.62-0.74; loadings of variables on F2 (facilitating learning) range from 0.58-0.78; loadings of variables on F3 (psychosocial support) range from 0.58-0.82, shown in Table 3. The three first-order factors have loadings from 0.90-0.97 on the second-order general factor, shown in Figure 1, and the squared multiple correlation coefficients of indicators are shown in Table 3, which denotes the variance each observed variable can explain.

The final model implies that when students perceive mentorship, the differences students perceive derive from the 37 observed behaviours, which can be agglomerated into three factors which are correlated; then the difference in the three factors can be agglomerated further into one general mentorship concept. One noteworthy thing is that, although the three factors are correlated, there is no significant cross loading and the loadings of indicators on putative factors are significant.

Equivalent model and model stability

In this study, mainly one alternative model is discussed. The model with three correlated first-order factors and 37 indicators is the equivalent model to the hierarchical, second-order model, which has the equivalent model fit index, but the second-order model conveys a broader understanding and richer information about the mentorship construct. For model stability check, this model was also checked in the importance data set (n=669) and the model fits that data set well. Therefore, the hierarchical, second-order mentorship model is confirmed, showing model stability (Kline 2005).

Discussion

In this study the three-correlated factor model of mentor's behaviour identified in the importance dataset using exploratory factor analysis and Mokken scale analysis (Chen *et al*. 2016b) was confirmed, which is equivalent to the hierarchical model, a second-order factor (one general mentorship factor) with three first-order factors (professional development, facilitating learning and psychosocial support) and 37 measured variables. This is supported by the rigorous procedures of conducting CFA (model specification and re-specification, model estimation, equivalent model consideration and model stability cross check) in the large dataset of mentors' real performance assessment (n=634), which implies that this model can be applied to assess mentors' real behaviour and students' expectations.

This three-factor structure has confirmed the three dimensional theoretical framework (professional development, facilitating learning and psychosocial support) generated in the literature review (unpublished PhD thesis), which included 46 international qualitative and quantitative studies. This theoretical framework guided the construction of the item pool from the literature (including scales related to mentoring in the nursing field and studies of nursing students mentoring) and from the six contextualized focus group interviews in China. This structure then went through expert review in the UK and rigorous statistical testing using Classic Test Theory (EFA and CFA) and Item Response Theory, e.g. Mokken scale analysis in two large sample data sets (n=669 & 634, respectively) of Chinese nursing students, which implies that the three-factor structure is guided by theory and empirically precise and stable, mirroring both international perspectives (mainly the UK experts' perspectives) and the local context in China.

One advantage of the final model against the preliminary framework is that the relationships of the three dimensions were explored and their interrelated nature was discovered, which gives a clearer theoretical understanding, interpretation of and practical guidance to mentors' behaviour. This relationship suggests that a mentor who does not show good professional support behaviour may be perceived as not facilitating learning nor demonstrating sufficient psychosocial support. This is new, compared to the former studies (Chow &Suen2001, Hou *et al*. 2011), which mainly simplified a set of observed variables to several factors, without investigating their relationships. This is not sufficient for construction and understanding of a model or a theory without exploring relationships of concepts or internal structure.

Nursing education implication

This study shows that this instrument is not only useful in assessing the importance of each mentors' behaviour to match students' expectation and mentors' mentoring quality, but also can be used to measure mentors' real performance, i.e. how well do the mentors behaviour in mentoring. This can be useful to select good mentors and identify which behaviour is missing or weak, then corresponding training can be introduced.

Mentor preparation programs should include at least the content of professional development, facilitating learning and psychosocial support. To help students' professional development, mentors should emphasise and demonstrate professionalism and professional integrity, only showing nursing competency is not sufficient. Pedagogic knowledge and competency also needs to be fostered in mentors, particularly adult learning and experiential learning theory should be integrated into training programs. Personal respect and treating students as learners is

the foundation required to establish workable relationships and realize learning and teaching objectives, which is the content of psychosocial support.

This research outcome should be disseminated to enhance management and educational staff awareness of students' expectations and the role requirement and responsibility of a mentor. This instrument should be widely and constantly used to boost a mentoring culture, and in turn, this will serve as a way to improve nursing image and the students' quality of learning and to decrease attrition substantially.

Limitations

This cross-sectional survey design provides a one-point observation of mentors' performance, and this only allows description and inference of correlation and comparison across groups but not causality. Response rate is also a main concern when using a survey; in the online survey, the response rate was very low, fortunately this was compensated by the hard-copy survey. Here the final response rate was over 80%, which was very good (Babbie 1990). The low response rate and low engagement of the online survey drew the attention of research team; the low response may have been due to low access to the website and low access to computers; while the reason for the low engagement (questionnaires showing high percentage of no and low variance in item scores) was not clear, but the attitude of respondents and their motivation to participated in this study deserve our attention and further research.

Other limitations need to be addressed, such as the single method of data collection, i.e. self-report data collection. There might be response bias, known as the halo effect (Streiner & Norman 2008). If a mentor was perceived well in one aspect, e.g. humorous, she/he might be rated highly in every item, and vice versa. In addition,

students completed the questionnaires from their perspective and they might not understand some requirements from professional bodies and higher educational institutes, such as leadership, planning and organising inter-professional learning opportunity: in this situation, participants' triangulation such as mentors' perspectives are needed.

This study used convenience sampling; one local large sample from southwest China may not be representative of all Chinese nursing students, for there is no national clinical mentoring guideline or routine monitoring system of clinical nursing education: the mentoring style and quality varies across the country.

Future study

One crucial quality of an instrument is responsiveness or sensitivity to change and it is the capability of an instrument to detect the change in respondents and the change difference across groups (Streiner & Norman 2008). This mentors' behaviour instrument can be tested for responsiveness to students' expectations and mentors' real behaviour. For the former, a longitudinal study can be carried out, which is a better design in inferring causal-effect relationship than a cross-sectional survey, and can also be used to test the measurement invariance over time.

Experimental studies, such as training mentors, should be carried out to test if this instrument can detect the mentors' behavior change after training; so before and after training, mentors and/or students will be invited to complete the questionnaires. In addition, control groups and randomizing methods need to be considered to minimize biases.

Measurement invariance tests are the basis for carrying out multiple group comparison as people from different cultures or sub-groups may conceive a latent

structure differently, and it is becoming more and more popular (Vandenberg &Lance 2000, Cheung &Rensvold 2002). Measurement invariance testing has been used in business mentoring studies (Crisp & Cruz, 2010, Hu *et al*. 2011a) but not as yet in nursing. We can go further to test if there is measurement invariance among student pharmacists, allied health professionals, dentist and doctors. If measurement invariance does not hold it can show how people from different groups perceive mentorship differently and it can serve as a basis for treating them differently, to some extent, on some aspects.

Measurement invariance across cultures can also be studied (Hu, et al. 2011), as cross-culture testing can pave the way for international use of this new scale and provide a possibility of comparing differences across countries in nursing education and approaching a unanimous understanding. In addition, measurement invariance testing over time can be done. Longitudinal study can be carried out to detect whether at different stages students' perception of mentorship varies or not, which will give a foundation for understanding that students' needs vary over time. It is also a prerequisite for responsiveness test over time.

Conclusions

The structure of this newly developed instrument to measure mentors behavior and students' expectation from mentors was confirmed using structural equation modeling in this study. Mentors' behavior can be perceived as a secondary order factor with three first order factors: professional development, facilitating learning and psychosocial support. It would be useful in match students with mentors and identifying weakness in mentorship to imply training needs.

References

Babbie, E. R. 1990. Survey research methods. Belmont, CA: Wadsworth Publishing Company.

Berk, R. A., Berg, J., Mortimer, R., Walton-Moss, B. & Yeo, T. P. (2005) Measuring the Effectiveness of Faculty Mentoring Relationships. Academic Medicine. 80 (1) , 66-71.

Chen, xxxxxxxxxxx2016a. A review of mentorship measurement tools. Nurse Educ. Today.40. 20-28.

Chen, xxxxxxxxxxx 2016b. An exploration of mentor's behavior structure-using exploratory factor analysis and Mokken scale analysis Nurse Educ. Today 40,161-167.

Cheung, G W. &Rensvold, R. B. 2002. Evaluating goodness-of-fit indexes for testing measurement invariance. Structural equation modelling.9 (2), 233-255.

Chow, F. L. W. &Suen, L. K. P. 2001. Clinical staff as mentors in pre-registration undergraduate nursing education: students' perceptions of the mentors' roles and responsibilities. Nurse Education Today. 21 (5), 350-358.

Crisp, G. & Cruz, I. 2010. Confirmatory factor analysis of a measure of "mentoring" among undergraduate students attending a Hispanic serving institution.Journal of Hispanic Higher Education. 9 (3), 232-244.

Field, A. 2009. Discovering statistics using SPSS. 3rd ed. London: Sage publications

GRAY, M. A. & SMITH, L. N. (2000) The qualities of an effective mentor from the student nurse's perspective: findings from a longitudinal qualitative study. Journal of Advanced Nursing. Vol. 32 (6) pp. 1542-1549.

Hou, X., Zhu, D. & Zheng, M. 2011.Clinical Nursing Faculty Competence Inventory–development and psychometric testing. Journal of advanced nursing. 67 (5), 1109-1117.

Hu, C., Pellegrini, E. K. &Scandura, T. A. 2011. Measurement invariance in mentoring research: A cross-cultural examination across Taiwan and the U.S. Journal of Vocational Behavior. 78 (2),274-282.

Kline, R. 2005. Principles and practice of structural equation modeling. 2nd ed. New York: Guilford Press.

Sawatzky, J.-A. V. & Enns, C. L. (2009) A mentoring needs assessment: Validating mentorship in nursing education. Journal of Professional Nursing. 25 (3),145-150.

Streiner, D. L. & Norman, G. R. 2008. Health measurement scales: a practical guide to their development and use. 4th ed. Oxford: Oxford university press

Vandenberg, R. J. & Lance, C. E. 2000. A review and synthesis of the measurement invariance literature: Suggestions, practices, and recommendations for organizational research. Organizational research methods. 3 (1), 4-70.

Watson, R., Chen, YH. IP, M. Y., Smith, G. D., Wong, T. K. &,Deary, I. J. 2013. The structure of stress: Confirmatory factor analysis of a Chinese version of the stressors in Nursing Students Scale (SINS). Nurse education today 33,160-165.

Table(s)

Click here to download Table(s): Table 1.doc