ORIGINAL RESEARCH

The development and validation of a five-factor model of Sources of Self-Efficacy in clinical nursing education

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Abstract

Background: The aim of this study is to validate a newly developed nurses' self-efficacy sources inventory. We test the validity of a five-dimensional model of sources of self-efficacy, which we contrast with the traditional four-dimensional model based on Bandura's theoretical concepts.

Methods: Confirmatory factor analysis was used in the development of the newly developed self-efficacy measure. Model fit was evaluated based upon commonly recommended goodness-of-fit indices, including the χ^2 of the model fit, the Root Mean Square Error of approximation (RMSEA), the Tucker-Lewis Index (TLI), the Standardized Root Mean Square Residual (SRMR), and the Bayesian Information Criterion (BIC).

Results: All 22 items of the newly developed five-factor sources of self-efficacy have high factor loadings (range .40-.80). Structural equation modeling showed that a five-factor model is favoured over the four-factor model.

Conclusions and implications: Results of this study show that differentiation of the vicarious experience source into a peer- and expert based source reflects better how nursing students develop self-efficacy beliefs. This has implications for clinical learning environments: a better and differentiated use of self-efficacy sources can stimulate the professional development of nursing students.

Key words

Self-efficacy, Nursing education, Clinical learning environment

1 Introduction

In nursing education, clinical experience has become an important part of performance assessments. These assessments are used to evaluate educational programs, or to assess students' self-efficacy beliefs [1, 2]. The relevance of self-efficacy beliefs in nursing and nursing education has been demonstrated by several authors. For example, Peterson [3] relates self-efficacy to predicting academic success in Bachelor degree nursing programs. Pisanti, Lombardo, Lucidi, Lazzari and Bertini [4] relate self-efficacy to nurses' coping ability in stressful situations.

Although the concept of self-efficacy is extensively studied, the sources underlying self-efficacy beliefs are poorly investigated [5-7]. The aim of this study is to develop and validate a newly developed nurses' self-efficacy sources inventory. We test the validity of a five-dimensional model of sources of self-efficacy, which we contrast with the traditional four-dimensional model based on Bandura's theoretical concepts [8].

Background

Definition of self-efficacy

Self-efficacy is defined by Bandura [8] as "the belief in one's competence to tackle difficult or novel tasks and to cope with adversity in specific demanding situations. It reflects the belief in one's capabilities to organize and execute the courses of action required to produce given attainments" Self-efficacy makes a difference in how people feel, think, and act. Those with high self-efficacy beliefs want to overcome difficult situations instead of avoiding them [9, 10]. Increasing self-efficacy enhances the sense of self-control and helps one to perform at a higher level [11].

Sources of self-efficacy

Bandura's idea that self-efficacy is based on the interpretation of information from four sources is widely accepted [12-14]. These sources are mastery experiences, vicarious experience, verbal/social persuasion and physiological/affective states [8, 14, 15]. Mastery experiences are seen as the most powerful source of information in the formation of self-efficacy beliefs [8]. Students gain evidence that is authentic, which feeds a strong sense of self-efficacy in performing and succeeding at particular tasks [16].

The second source of self-efficacy beliefs is vicarious experience: obtaining information through observational experiences to assess one's own capabilities and performance [8, 14]. Comparing performance, especially to that of peers, can increase or decrease self-efficacy beliefs. Research indicates that students differentiate between the vicarious experience sources [17, 18]. They make different comparisons with regard to the experiences of peers and experienced colleagues which they see as experts. For example, evaluating performances of experienced colleagues can lead to a decline in self-efficacy beliefs: one might think that he or she will never achieve a comparable level of performance. Several authors report that information based on vicarious experience especially enhances self-efficacy beliefs if the experience or knowledge is of a similar level [8, 19].

The third source as identified by Bandura [8] is verbal persuasion. This pertains to the influence of persuasive communication by significant others [14]. Evaluative information and feedback is most powerful when provided by people who are perceived by students as knowledgeable and reliable [20].

Physiological symptoms such as increased heart rate and transpiration and emotions or feelings such as excitement are the fourth source of self-efficacy beliefs [8, 14].

Sources of self-efficacy and clinical nursing education

To date it is not clear, how nursing students use sources of self-efficacy and how they relate to the formation of self-efficacy beliefs.

Insight into how these sources influence self-efficacy beliefs has implications for nursing education. It can contribute to the design of learning environments in clinical practice. For example, Baeten, Kyndt, Struyven and Dochy [21] looked at factors that stimulate deep approaches to learning. They found that self-confidence and self-efficacy are important factors in students' adoption of a deep approach to learning. Self-confidence and self-efficacy can be enhanced in (clinical) learning environments. Hence, further insight into how self-efficacy sources influence self-efficacy beliefs can help improve the professional development of nursing students and nurses. Clinical learning environments however, tend to have an informal character [22]. Often, there is no formal structure to guide or define what learning should take place.

Furthermore, as the focus is generally on treatment and care, less attention is paid to learning and professional growth [23]. This does not mean, however, that no learning takes place. Tynjälä [24] reviewed the different perspectives on learning at the workplace. One of the research questions was how people learn at the workplace. He found that people learn by doing the job itself, by interacting with colleagues, and by reflection on and evaluation of one's performance. The need for tailored supervision was underlined by the results of a study by Warne, Johansson, Papastavrou, Tichelaar, Tomietto, Van den Bossche, Moreno and Saarikoski [25]. They found that individually tailored mentorship helps nursing students in their professional development. They argue that mentoring in combination with working with patients are the two core elements of professional development in nursing.

This is in line with Bandura's [8] theory that, by learning, people gather information on which they form self-efficacy beliefs. Examining the role of self-efficacy sources and making these sources explicit opens up means of enhancing self-efficacy beliefs, which will stimulate the professional development of individuals.

2 Operationalization and methods

Sources of self-efficacy

Since, to our knowledge, there are no validated instruments to assess sources of self-efficacy in nursing, we developed a new instrument. We used the Sources of Self-Efficacy Inventory (SOSI) developed by Kieffer and Henson [26] as a basis to develop an instrument for the nursing context. The SOSI is a 35-item inventory developed to assess students' self-efficacy in a baccalaureate teaching program. The items are divided into four subscales based on the work of Bandura [8]. The reliability coefficient of these subscales ranges from .47 to .78 [26]. Mohamadi, Asadzadeh, Ahadi and Jomehri [27] examined the construct validity of the SOSI using confirmative factor analysis. After translation and some adjustments, they found an acceptable fit for a four-factors model (RMSEA .043, CFI .96), which is in line with Bandura's theory.

To build an initial item pool, we adapted the items from the teacher context to the specific nursing context. Items were written as first-person statements. Based on earlier research findings that students differentiate within the vicarious source [17, 18], we included both peer-based and expert-based experiences. This means that the vicarious experience source is divided into two factors, leading to a five-sources model. A 5-point self-rating scale, ranging from 1 to 5, was used.

Content and face validity of the initial item pool was evaluated through two feedback channels, one consisting of experts (lecturers who are familiar with workplace learning) and one based on feedback from members of the target population. For the expert channel we organized a focus group session for lecturers in nursing (n =18), with the aim of critically examining the validity of the items and the fit in the five-sources model. Usher and Pajares [6] state that many instruments used to rate self-efficacy beliefs contain items that are inconsistent with Bandura's sources of self-efficacy. The lecturers were asked to evaluate the following issues: (i) fit of the items with the sources, (ii) formulation of the items, (iii) uniqueness of each item, and (iv) the content validity of the instrument as a whole. In addition, a small group of students (n = 16) was invited to complete the questionnaire and to provide feedback on item wording, clarity and fit with the theoretical model. All students had completed at least one period of clinical learning (22 weeks per period), enabling them to reflect on the content of the instrument.

Based on these two feedback channels, items were then reformulated. Of the initial 35 items in the questionnaire, 13 items were eliminated because they had factor loadings lower than .40 on the target factor. An overview of the final item pool of 22 items is given in Table 1. The five sources in this blueprint are Mastery Experiences (ME), Vicarious Learning Experts (VLE), Vicarious Learning Peers (VLP), Verbal Persuasion (VP) and Physiological Symptoms (PS). Each source is operationalized by a set of 4 to 5 items.

Table 1. Conceptual blueprint of the item pool for the Sources of Self-Efficacy Inventory

Source	Items	Example
1. ME: mastery experiences	5	"Providing good care gave me a sense of personal success".
2. VLE: expert-based vicarious experiences	4	"I have learned a lot by watching registered nurses in action".
3. VLP: peer-based vicarious experiences	4	"I often compared my actions with actions performed by peers".
4. VP: verbal/social persuasion	4	"Feedback gave me a sense of self-confidence".
5. PS: physiological affective states	5	"When making mistakes, I felt that my heart was beating faster and louder".
Total	22	

Participants

A total of 230 Dutch Bachelor degree nursing students participated in the study. The nursing students (mean age 23.7, sd = 7.0) had prior clinical workplace experience of one period (n = 80), two periods (n = 86) or three periods (n = 64). Each period consists of 22 weeks. Participants were approached by e-mail. All participants completed the newly developed sources of self-efficacy inventory (digitally assessed). Participation was voluntary and written informed consent was obtained prior to the study.

Analysis

The alternative theoretical conceptualizations of sources of self-efficacy were formalized in a series of measurement models. This series of measurement models was compared by means of confirmatory factor analysis (CFA) with respect to their fit to the data gathered using the newly developed SOSI (sources of self-efficacy inventory). The following rival measurement models were considered (see also Figure 1): (i) a 5-factor simple structure CFA corresponding to the inventory blueprint in Table 1, (ii) the traditional 4-factor simple structure CFA in which the two types of vicarious experiences (VLE and VLP) are seen as a single source, instead of as two different factors.

The models were specified starting from the covariance matrix and were fitted using maximum likelihood. Model fit was evaluated based upon commonly recommended goodness-of-fit indices [28], including the $\chi 2$ of the model fit, the Root Mean Square Error of approximation (RMSEA), the Tucker-Lewis Index (TLI), the Standardized Root Mean Square Residual (SRMR), and the Bayesian Information Criterion (BIC).

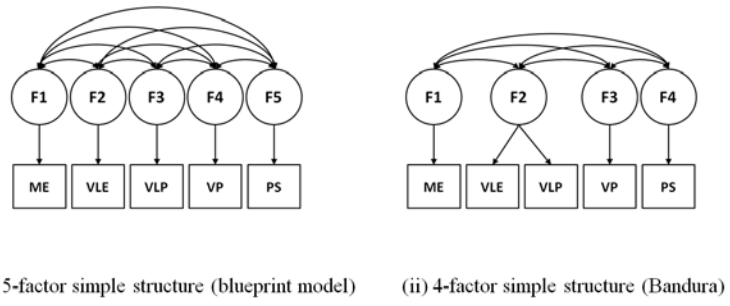

Figure 1. Alternative theoretical conceptualizations for sources of self-efficacy.

Note. Circles represent latent factors and squares manifest variables. Each set of items is represented by only one square and error terms are omitted to allow for a parsimonious representation.

3 Results

Measurement model of the sources of self-efficacy survey

The correlation matrix and descriptive statistics of the 22 indicators used to operationalize sources of self-efficacy are presented in Table 2. Within-source subset correlations are relatively large and positive. Between-source subset correlations are small and negative for source 5 (physiological symptoms; PS), though some larger positive correlations occur among source 1 (mastery experiences: ME), 2 (vicarious learning experts: VLE), and 4 (verbal persuasion: VP) indicators.

Table 2. Correlation Matrix and Descriptive Statistics of the Sources of Self-Efficacy indicators

X	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1	1																					
2	.52	1																				
3	.32	.40	1																			
4	.31	.19	.29	1																		
5	.54	.41	.48	.47	1																	
6	.12	.18	.34	.12	.28	1																
7	.15	.26	.42	.29	.40	.63	1															
8	.17	.30	.51	.30	.39	.46	.52	1														
9	.18	.20	.39	.38	.38	.51	.53	.45	1													
10	-.10	-.08	-.08	.05	-.11	.07	.08	-.05	.05	1												
11	.00	.05	.04	.13	.00	.12	.06	.05	.14	.57	1											
12	-.02	.00	.06	.15	.01	.17	.20	.07	.19	.43	.49	1										
13	-.10	.03	.08	.02	-.09	.23	.22	.05	.24	.32	.32	.38	1									
14	.19	.21	.31	.29	.30	.17	.33	.19	.23	.07	.09	.17	.06	1								
15	.18	.20	.33	.30	.35	.29	.41	.36	.35	-.05	-.02	.06	.07	.43	1							
16	.15	.08	.19	.23	.17	.29	.29	.21	.18	.18	.32	.26	.31	.19	.18	1						
17	.23	.13	.36	.32	.34	.17	.32	.34	.12	.11	.09	.08	-.04	.23	.31	.18	1					
18	-.14	-.07	-.03	.04	-.05	.10	.06	-.05	.09	.17	.09	-.01	.30	.17	.07	.05	-.14	1				
19	-.24	-.15	-.08	-.12	-.15	.11	.00	-.09	.07	.12	.09	.02	.34	.05	.05	.14	-.20	.45	1			
20	-.21	-.13	-.09	-.07	-.19	.00	-.09	-.20	.05	.09	.04	-.06	.30	.01	-.03	.10	-.25	.51	.49	1		
21	-.12	-.11	.01	.12	.01	.16	.11	.05	.19	.22	.23	.11	.30	.10	.09	.17	.02	.53	.40	.45	1	
22	-.21	-.16	-.12	-.03	-.15	.07	.02	-.11	.11	.15	.15	.06	.32	-.01	-.03	.11	-.04	.47	.47	.46	.63	1
M	4.53	4.08	4.30	4.40	4.30	3.85	4.09	3.96	4.17	2.98	3.56	3.42	3.39	3.93	4.21	3.76	3.89	3.19	2.25	2.70	3.35	2.68
SD	.65	.94	.82	.68	.71	.90	.76	1.06	.86	1.02	.96	.98	1.11	.69	.66	.90	.81	1.10	1.10	1.23	1.07	1.21

Note. Indicators 1 to 5 reflect source1 (ME), indicators 6 to 9 reflect source2 (VLE), indicators 10 to 13 reflect source3 (VLP), indicators 14 to 17 reflect source4 (VP), and indicators 18 to 22 reflect source5 (PS).

Table 3 offers a summary of the model comparison results. The $\Delta\chi 2$ likelihood ratio test for model comparison and other model fit statistics all point to the five-factors model as the preferred measurement model for the sources of self-efficacy inventory. The BIC is the lowest, RMSEA and SRMR are below or near the rule of thumb of .08, and the $\Delta\chi 2$ likelihood ratio test of equal fit with the four factor model is rejected. The TLI fit measures depends on the average size of the correlations in the data, as it compares the model against a null model (i.e., all items are uncorrelated). Given a low average correlation among items of .16, the TLI will by definition be lower than the recommended threshold.

Table 3. Model Comparison for Rival Measurement Models of the Sources of Self-Efficacy inventory.

Model	χ^2	d*f*	TLI	RMSEA	SRMR	BIC	$\Delta\chi^2$
5-factors (blueprint)	450	199	.82	.07	.09	12163	.
4-factors (Bandura)	645	203	.69	.10	.11	12336	195**

Note.** $p < .0001$; $\Delta\chi 2$ likelihood ratio test against the 5-factors model.

These model comparison results imply that the proposed 5-source differentiation is favored over the 4-source alternative, providing evidence for the further differentiation of the vicarious experiences into peer-based and expert-based factors for the developed inventory.

To illustrate a good fit of the newly developed five factor model, the factor loadings and interfactor correlations for this model of sources of self-efficacy inventory are shown in Table 4. The good fit of this CFA model also shows in the

substantial factor loadings of the indicators that are all equal to or above .40. The source factors 1(ME), 2(VLE), and 4 (VP) show moderately strong positive correlations among each other, whereas source 5(PS) is relatively independent of the other source factors.

Table 4. Five-Factor Measurement Model of the Sources of Self-Efficacy inventory.

	Factor loadings β				
Indicator	**F1 ME**	**F2 VLE**	**F3 VLP**	**F4 VP**	**F5 PS**
X1	.63				
X2	.56				
X3	.64				
X4	.53				
X5	.80				
X6		.73			
X7		.83			
X8		.65			
X9		.68			
X10			.71		
X11			.74		
X12			.65		
X13			.51		
X14				.55	
X15				.63	
X16				.40	
X17				.49	
X18					.69
X19					.63
X20					.65
X21					.76
X22					.76
Factor Intercorrelations ρ					
F1:ME	1	.62**	-.02	.73**	-.20*
F2:VLE		1	.22**	.72**	.08
F3:VLP			1	.23*	.30**
F4:VP				1	.06
F5:PS					1

4 Discussion

The aim of this study was to develop and validate a newly developed nurses' self-efficacy sources inventory and to examine if this five-factor model is favored above the traditional four-factor model. The results of this study indicate that the newly developed inventory showed a good fit. We found a differentiation between expert-based and peer-based vicarious experiences. Based on the results of this study, a five-source model was favored over the traditional four-source model. We provided evidence that support the idea that nursing students use different vicarious sources in the formation of self-efficacy beliefs. This is in line with earlier research findings [17, 18]. However, further research is required to test the five-factor model in practice. Focusing on nursing students learning processes might give more insight in how students differentiate between vicarious sources.

A limitation of this study is the variety of clinical learning environments in which participants acted. Participants were asked to reflect on sources they use in the formation of self-efficacy beliefs. It is possible that some respondents did not interact with fellow students during clinical placement. Therefore, the clinical learning environment in which they were

placed, acted as their frame of reference. Another issue regarding context is the effect of the type of the clinical setting. For example, working in a general hospital or in mental health care might make a difference. We did not investigate possible effects of these contextual factors. It is stated by Compeau, Gravill, Haggerty and Kelley [29] that contextual/external factors have an effect on self-efficacy. Taking context into consideration might yield further insight into the relationship between sources of self-efficacy and self-efficacy beliefs. In this study, the aim was to validate a general five-source model for nursing self-efficacy. We therefore did not include specific clinical learning environment characteristics. We suggest that further research can take contextual elements (such as number of staff and students) into consideration.

A further limitation of this study is that in the development of the sources of self-efficacy inventory, we did not use input of clinical practice nurses. We used a panel of students and experienced lecturers (familiar with clinical learning in nursing practice) to reflect on the items. Using practice nurses who guide nursing students, may have contributed to content validity of the inventory. We suggest that in the further validation process of the newly developed inventory, practice nurses should participate.

Future research could achieve a further optimization of the item pool/inventory and/or measurement model. Further research, for example an intervention design into the key sources of self-efficacy, might result in a more detailed and precise formulation of items.

5 Conclusions and implications

The results of this study show that a five-source model of sources of self-efficacy is favored over a traditional four-source model. We showed that differentiation of the vicarious experience sources into a peer- and expert based sources reflects better how nursing students develop self-efficacy beliefs. We suggest that better understanding of how sources of self-efficacy relate to learning in a clinical learning environment has implications for nursing education programs: better use of sources present in clinical learning environments, especially the use of a peer-based source, can stimulate students' professional development and hence positively influence their performance [30]. This is in line with the finding by Warne et al. [25], that individually tailored mentorship contributes to nursing students' professional development. They argue that mentoring combined with working with patients are core elements of professional development in nursing. Given our results that students do differentiate in the use of self-efficacy sources, we consider it useful to pay attention to the use of peer-based vicarious learning in nursing programs.

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