Nurse Education Today 128 (2023) 105889

Contents lists available at ScienceDirect

Nurse Education Today

journal homepage: www.elsevier.com/locate/nedt

Research article

Development and validation of experienced work-integrated learning instrument (E-WIL) using a sample of newly graduated registered nurses – A confirmatory factor analysis

Anna Andersson [a,*], Eva Brink [a], Kajsa Hansen Young [a,b], Maria Skyvell Nilsson [a]

[a] Department of Health Sciences, University West, SE-46132 Trollhättan, Sweden
[b] Department of Education and Special Education, Gothenburg University, Box 100, SE-40530 Gothenburg, Sweden

ARTICLE INFO

Keywords:
Confirmatory factor analysis
assessment instrument
newly graduated nurses
nursing
professional development
registered nurses
transition
work-integrated learning
workplace learning

ABSTRACT

Introduction: Research indicates that newly graduated registered nurses struggle to develop practical skills and clinical understanding and to adapt to their professional role. To ensure quality of care and support new nurses, it is vital that this learning is elucidated and evaluated.

Aim

The aim was to develop and evaluate the psychometric properties of an instrument assessing work-integrated learning for newly graduated registered nurses, the *Experienced Work-Integrated Learning* (E-WIL) instrument.

Method: The study utilized the methodology of a survey and a cross-sectional research design. The sample consisted of newly graduated registered nurses ($n = 221$) working at hospitals in western Sweden. The E-WIL instrument was validated using confirmatory factor analysis (CFA).

Results: The majority of the study participants were female, the average age was 28 years, and participants had an average of five months' experience in the profession. The results confirmed the construct validity of the global latent variable E-WIL, "Transforming *previous notions and new contextual knowledge into practical meaning,"* including six dimensions representing work-integrated learning. The factor loadings between the final 29 indicators and the six factors ranged from 0.30 to 0.89, and between the latent factor and the six factors from 0.64 to 0.79. The indices of fit indicated satisfactory goodness-of-fit and good reliability in five dimensions with values ranging from $\alpha = 0.70$ to 0.81, except for one dimension showing a slightly lower reliability, $\alpha = 0.63$, due to the low item number. Confirmatory factor analysis also confirmed two second-order latent variables, "Personal mastering of professional roles" with 18 indicators, and "Adapting to organisational requirements" with 11 indicators. Both showed satisfactory goodness-of-fit, and factor loading between indicators and the latent variables ranged from 0.44 to 0.90 and from 0.37 to 0.81, respectively.

Conclusion: The validity of the E-WIL instrument was confirmed. All three latent variables could be measured in their entirety, and all dimensions could be used separately for the assessment of work-integrated learning. The E-WIL instrument could be useful for healthcare organisations when the goal is to assess aspects of newly graduated registered nurses' learning and professional development.

1. Introduction

This study describes an evaluation of the psychometric properties of a self-report instrument developed to assess the work-integrated learning (WIL) of newly graduated registered nurses (NGRNs) supporting their professional development. In Sweden, NGRNs have completed a three-year bachelor's programme and are thereby authorized by the regulatory authority to practise nursing in various health care settings (SFS, 1993:100). During their education, nursing students are prepared for a professional role that encompasses general competences to deliver safe and person-centred care for patients who are disabled, or physically or mentally ill (ICN, 1987).

The transition from the familiar educational setting to the workplace is described as demanding, requiring time and support for learners to be able to transfer their educational knowledge, skills, and competence to a new practical context (Eraut, 2009). Eraut (2009) also underlines that

* Corresponding author at: Department of Health Sciences, University West, Gustav Melins gata 2, SE-46132 Trollhättan, Sweden.
E-mail address: anna.andersson.3@hv.se (A. Andersson).

https://doi.org/10.1016/j.nedt.2023.105889
Received 17 October 2022; Received in revised form 30 May 2023; Accepted 19 June 2023
Available online 22 June 2023

generic educational knowledge (theoretical and methodological knowledge, practical skills and techniques, generic skills, and general knowledge about the occupation) differs in form from the knowledge and skills needed at specific workplaces. In contrast to learning during education, learning at the workplace focuses on skills required for tasks, decision-making, and judgment in practical situations. Social integration is also important, in order to gain access to contextual knowledge and develop an understanding of the workplace culture and values.

Duchscher (2008) describes this transition period as a process of "becoming," characterised by NGRNs' efforts to increase their levels of knowledge, broaden their understanding of professional practice, and develop their personal and professional identities. Benner's (1984) professional development theory describes nurses' contextual skill development as the acquisition of skills. Nurses progress through years of practical experience, from being dependent on collegial support and rules as a novice, to reaching a level of expertise comprising a deeper understanding of caring and a readiness for action in complex care situations. Consequently, NGRNs' transition is characterised by intensive learning.

Research also reveals that during their transition NGRNs struggle with adaptation and lack of preparedness for their professional roles (Rudman et al., 2020; Widarsson et al., 2020). NGRNs also experience being unprepared for professional demands, stating that their nursing duties are too advanced for their level of competence (Labrague et al., 2019; Widarsson et al., 2020), and that they experience difficulties applying their educational knowledge in practical situations (Widarsson et al., 2020). Furthermore, research has shown that the lack of professional competence experienced by NGRNs results in stress, burnout, and even workforce dropouts (Rudman et al., 2020).

In this context, the quality of NGRNs' work-integrated learning (WIL) becomes significant. The concept of WIL is traditionally used to refer to workplace learning during higher educational programs (Cooper et al., 2010; Patrick et al., 2008). Work-integrated learning for NGRNs is also described as more targeted learning that supports the development of professional roles and professional knowledge and capabilities (Andersson et al., 2022). A deeper understanding of NGRNs' WIL is important, in order to better support their transition to working life, and represents learning that needs to be assessed and evaluated.

2. Aim

The aim is to develop and evaluate the psychometric properties of the instrument Experienced Work-Integrated Learning (E-WIL), an instrument to assess the WIL of NGRNs.

3. Methods

3.1. Study design

The study utilized survey methodology and a cross-sectional research design to evaluate the psychometric properties of the instrument E-WIL. The instrument was developed from the theoretical framework presented by Andersson et al. (2022).

3.2. Development of the Experienced Work-Integrated Learning instrument

The theoretical framework of the E-WIL instrument derives from a qualitative focus group interview using an inductive analysis approach. The aim was to describe NGRNs' experience of work-integrated learning (WIL) from an educational and occupational perspective (Andersson et al., 2022). The results were described in the form of one main theme: *Transforming previous notions and new contextual knowledge into practical meaning*, with two sub-themes and six categories summarizing the NGRNs' learning. Three categories were linked to the subtheme *Personal mastering of professional roles*. These three categories described the development of three diverse roles: *Developing a self-directed learning role, Developing a relational nursing role* and *Transitioning to a collegial role.* The self-directed learning role implies that NGRNs are able to engage with, and reflect on, their own knowledge development. A relational nursing role incorporates an ability to use nursing theories in practical care situations, while transitioning to a collegial role refers to socialisation and understanding the workplace culture. The last three categories were summarized in the subtheme *Adapting to organisational requirements.* This sub-theme comprises the categories *Developing contextual workplace knowledge and understanding, Striving for confidence in medical-technical performance* and *Developing an experience-based understanding of clinical situations*. This sub-theme concerns the development of capabilities related to the requirements of a particular workplace. Contextual knowledge comprises the development of nursing responsibilities and medical work tasks related to ward-specific care. Medical-technical performance includes the development of confidence in nursing skills in daily work and in emergency situations. Experience-based understanding concerns NGRNs' accumulation of experiences, which develops clinical insight and an ability to act efficiently in various care situations.

Based on the six categories (henceforth described as "dimensions") in the theoretical framework, the research group created 42 items which were intended to constitute a self-reported outcome of experienced WIL (E-WIL) (see Table 2). Initially, three researchers (AA, EB and MSN) proposed questions, and these were discussed by the research group to create consensus. After this, definitive items could be formulated. All items began with the construction: "During the last two weeks, I have …" The six dimensions were: *Developing a self-directed learning role* – SWIL (10 items), *Developing a relational nursing role* – RWIL (six items), *Transitioning to a collegial role* – CWIL (11 items), *Developing contextual workplace knowledge and understanding* – WWIL (six items), *Striving for confidence in medical-technical performance* – MWIL (four items), and *Developing an experience-based understanding of clinical situations* – EXWIL (five items). The 42 items were answered using a five-point Likert scale, ranging from 1, "do not agree at all," to 5, "completely agree," with higher values representing a higher level of WIL.

3.3. Face validity of the Experienced Work-Integrated Learning instrument

After the development of the 42-items, the survey was tested in a pilot study, in order to ensure the instrument measured what it claimed to measure (Mikkonen et al., 2022). The face validity was accomplished by inviting 11 NGRNs (as a target sample) to participate in the evaluation individually. The NGRNs completed the survey, with one of the researchers present, and afterwards they discussed the items to ensure the quality and relevance of the questions. These NGRNs were not included in the final data sample. As a result of this pilot test, seven items that were of a similar nature or difficult to understand were excluded. The remaining 35 items were partly revised and corrected to ensure participants would understand the questions before the full-scale data collection was launched. Finally, to ensure accuracy, all questions were further discussed in the research group, which included two researchers who are experts in the field of nursing education.

3.4. Final Experienced Work-Integrated Learning (E-WIL) instrument

After the full-scale data collection, the construct validity and reliability of the data were evaluated. This evaluation resulted in six additional items being excluded because of low factor loading (see results section). Table 2 presents the descriptive statistics of the indicators and the reliability of each dimension. It should be noted that there were only two indicators for the dimension *Striving for confidence in medical-technical performance*, and Cronbach's alpha was rather low, meaning that the dimension may not be well represented. However, the qualitative study revealed the importance of this dimension of WIL (Andersson et al., 2022), and the researchers decided to keep it in the current

study. This led to a final version of the instrument which comprised 29 items to represent the six dimensions of WIL and a global latent factor of E-WIL (see Fig. 1). In addition, the six dimensions were also grouped into two sub-themes, *Personal mastering of professional roles* (E-WILPM), comprising subdimensions SWIL, RWIL and CWIL, and *Adapting to organisational requirements* (E-WILOR), comprising subdimensions WWIL, MWIL and EXWIL (see Figs. 2 and 3).

3.5. Data analysis and process

The software program SPSS (IBM SPSS 28.0) was used to calculate the descriptive statistics (mean and standard deviation), analyzing the demographic characteristics and 29 indicators, and exploring the reliability (Cronbach's alpha) of each of the six dimensions. The commonly used guideline of requiring a sample size of 20 cases per parameter in confirmatory factor analysis (CFA) was described by Jackson (2003). However, the adequacy of the sample size is also influenced by factors such as data quality (e.g., missing data and data distribution) and model complexity. No consensus has been reached on the appropriate sample size. Muthén and Muthén (2002) have suggested that a reasonable sample size for a simple CFA model is around $N = 150$, assuming normally distributed variables and no missing data. Reviewing simulation studies examining the sample size requirement of CFA models revealed a minimum sample size of 100 cases for models with two to four factors, with 200 cases being preferable if feasible (Loehlin, 1992). In the current study, each latent variable consists of two to six indicators. Even with adherence to the commonly used guideline, the sample size of NGRNs' ($n = 221$) is therefore deemed sufficient.

The item-factor relationships were captured by factor loadings. Brown (2015) proposed 0.30 as the lower limit of a factor loading, explaining at least 10 % of the variance of its indicator. A variety of indices of fit were used. The indices of fit have certain cut-off values: The chi-square test ($\chi 2$) is a likelihood ratio test, while $\chi 2$ / degrees of freedom provides information on model parsimony close to <2–3 (Schreiber et al., 2006). The comparative fit index (CFI) has a range of 0–1, with a value near 0.9 or greater implying good model fit (Brown, 2015). The root mean square error of approximation (RMSEA) with a score close to 0.06 or below indicates a good model fit (Hu and Bentler, 1999); however, with a smaller sample size, a value of 0.08 implies that the model is acceptable (Brown, 2015). The standardised root mean square residual (SRMR) is an absolute model fit measuring the deviation between the model implied and the observed variance-covariance matrices. A value close to 0.08 or below indicates that the model fits the data well (Hu and Bentler, 1999). Mplus applies the full information maximum likelihood estimator (FIML) to estimate model parameters. FIML estimation is robust against non-normality and uses all available information to estimate missing values in the data (Muthén and Muthén, 2017; see also Yuan et al., 2012). The total amount of internal missing data is relatively small, and overall data coverage is around 0.99. The modelling process was done stepwise using Mplus (Muthén and Muthén, 2015), and data preparation was performed with IBM SPSS 28.0.

A single-factor model was estimated for six theoretical dimensions of the E-WIL construct (see Instrument section above). The MWIL dimension consists of only two indicators and cannot be tested as a stand-alone measurement model. For the rest of the dimensions, the single-factor measurement model of CFA was tested (see Fig. 1). The models were adjusted according to the modification indices for improving model fit. In the next step, the measurement models of the E-WIL dimensions were used to measure the second-order latent construct E-WIL in a hierarchical CFA (also called a second-order factor analysis model; see Figs. 2 and 3).

3.6. Sample

This study resulted in a total sample of 221 participants. The inclusion criteria for the study sample were NGRNs that had completed a three-year bachelor's programme and were in their first two years in practice. All NGRNs were employed at three larger hospitals in western Sweden, one of which is a university hospital and two are rural hospitals. The NGRNs' employment was in different departments, for example, surgical, medical and emergency wards. All three hospitals had implemented a one-year introductory programme as a mandatory requirement for new NGRNs. All NGRNs participated in the introductory programme at their respective hospitals. The programme provided them with an introduction to the care unit, joint seminars, simulation training and study visits. The programme also aimed to facilitate support from experienced nurses and mentors during the introductory period. Each hospital had one coordinator responsible for the programme.

3.7. Data collection

The first author contacted the coordinators at the respective hospitals in order to get in touch with potential respondents, that is, NGRNs during their first two years of practice. The first author was then invited by the programme coordinators to attend altogether six programme seminars to inform potential respondents about the study, obtain consent and carry out the data collection. The programme seminars were held in the educational departments of the respective hospitals. Data were collected between October 2021 and March 2022, that is, during the COVID-19 pandemic. Due to physical restrictions imposed in December 2021, the method of data collection was changed to email, a method that had also been approved by the original ethics application, and the coordinator provided the contact information of the NGRNs. A total of 433 NGRNs was approached during the introduction seminars and later through email. During six different seminars, 190 NGRNs were invited to participate, and 182 gave their informed consent and responded to the questionnaire. In addition, 243 email requests were sent out and 39 participants responded and gave their consent. This resulted in a total sample of 221 participants.

3.8. Ethical considerations

This study was approved by the Swedish Ethical Review Authority (Dnr. 2021–03785) and follows the ethical principles of the World Medical Association's Declaration of Helsinki (World Medical Association, 2001). The researchers promoted the participants' wellbeing and rights during the research process. Before the data collection, the participants were provided with information about the research, both orally and in written form. Signed consent forms were obtained from the participants, and they were informed that involvement was voluntary and that they could withdraw from the project at any time without giving a reason. Participants had to complete a digital survey. They were provided with contact information, and the researcher was available for the participants throughout the whole research process. Personal information was carefully handled and coded to ensure the participants' privacy and confidentiality (Allea, 2017; Swedish Research Council, 2017).

4. Results

4.1. Participants' characteristics

In summary, a total of 221 registered nurses ($N = 221$) responded to the questionnaire, representing a response rate of 51 %. As shown in Table 1, most of the participants were female (86 %), the average age was 28 years, and participants had an average of five months' experience in the profession. Most of the participants were born in Sweden (86 %).

4.2. Psychometric evaluation of the Experienced Work-Integrated Learning (E-WIL) instrument

The single-factor measurement of CFA was modified by adding

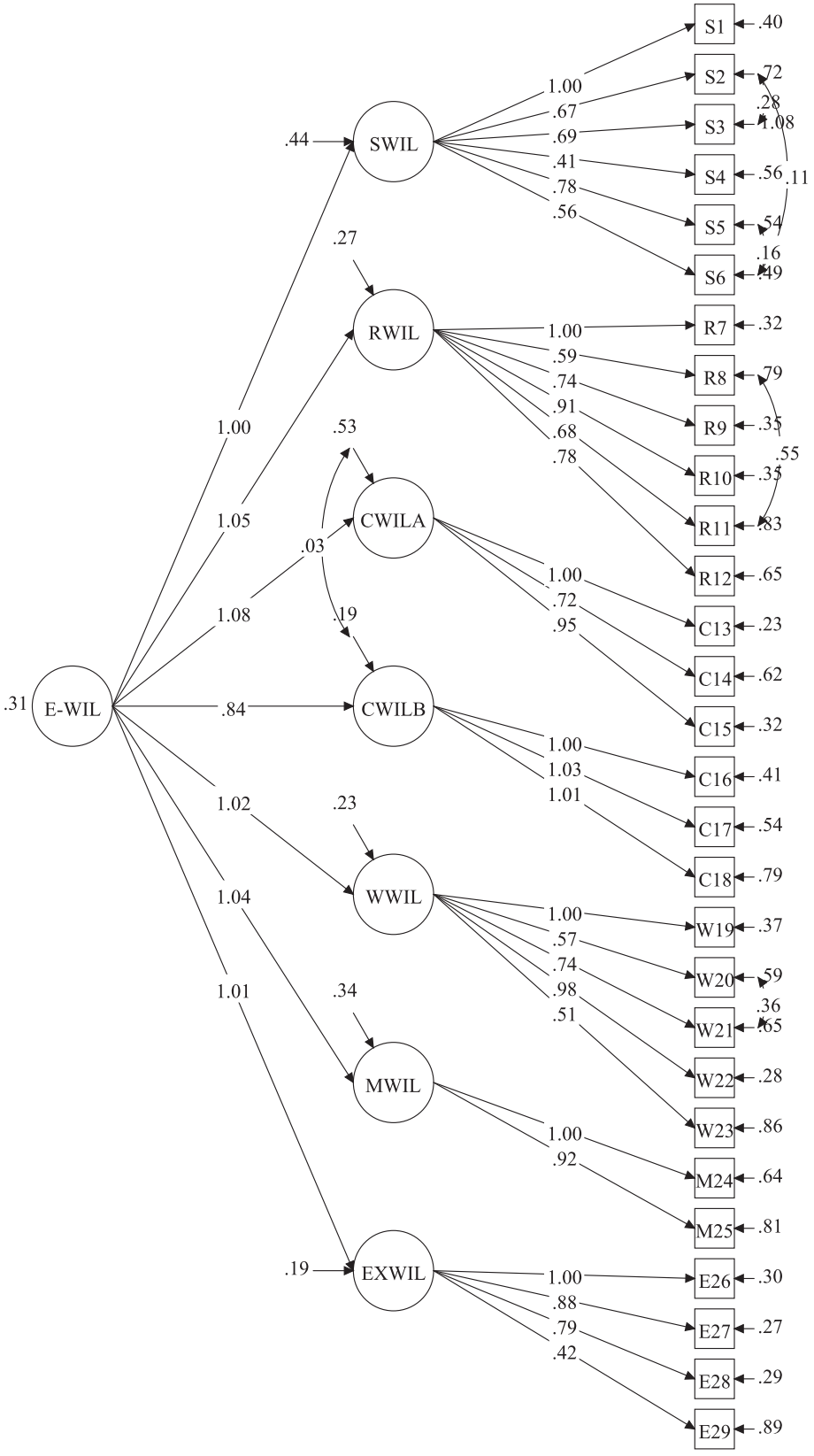

Fig. 1. The hierarchical model of experienced work integrated learning (E-WIL).

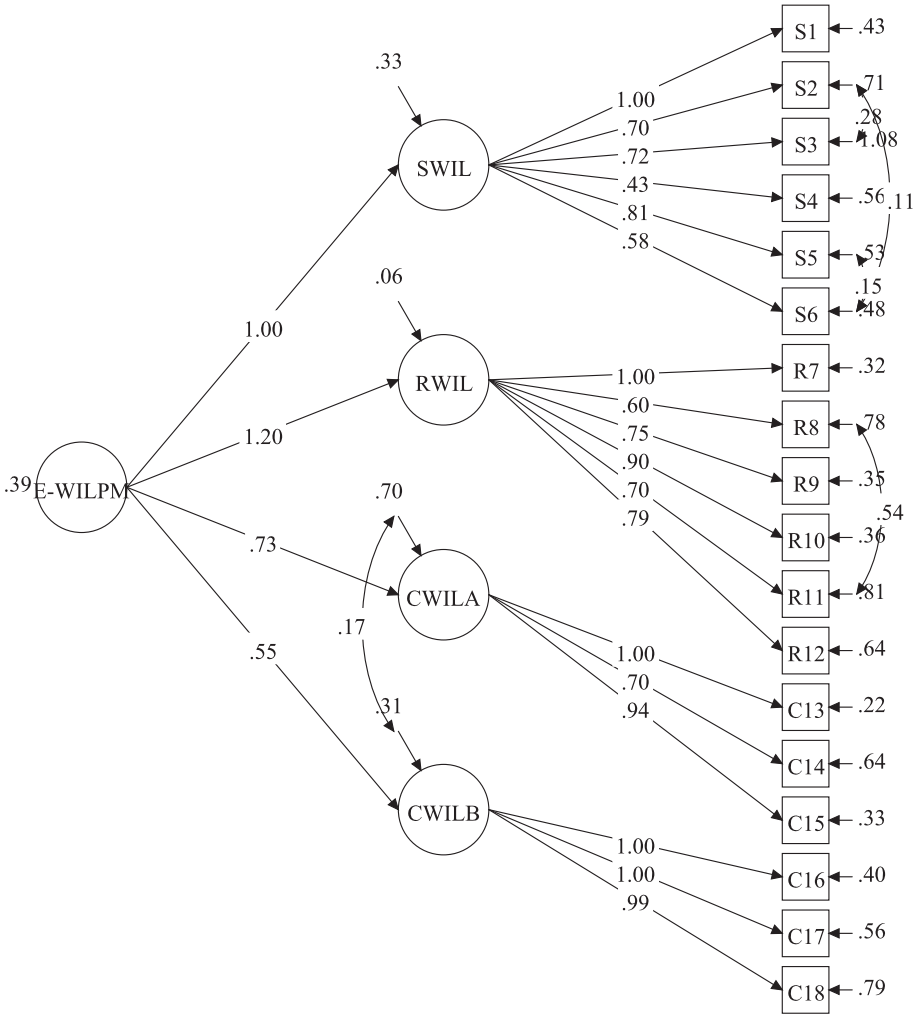

Fig. 2. The hierarchical second order model: personal mastering of professional roles (E-WILPM).

correlated residual terms in some dimensions to improve the model fit, as suggested by the modification indices. The correlated residuals indicated a narrow underlying sub-dimension that will not affect the measurements of the general dimension. For the dimension transitioning to a collegial role (CWIL), two correlated factors were identified, namely the subdimensions *Transitioning to a collegial role* (CWILA) and *Transitioning to a collegial learning role* (CWILB). The two sub-dimensions correlated significantly and can therefore be treated as one dimension (CWIL), but can also clearly be distinguished from one another. Items with factor loadings below 0.30 were removed, resulting in a total of 29 items (Fig. 1). Table 3 presents the model fit indices for the separate CFA of six E-WIL dimensions and the three hierarchical constructs (E-WIL, E-WILPM and E-WILOR).

The E-WIL dimensions indicated high reliability, with five values ranging from α = 0.70 to 0.81. However, the factor MWIL had lower reliability, α = 0.63, due to the low item number (Table 2). The descriptive statistics of the hierarchical construct E-WIL was: Mean (*SD*) = 3.85 (*0.55*).

4.2.1. The global latent variable

The global latent variable of E-WIL was based on indicators in six major dimensions obtained in the first descriptive analysis (Table 2). We conducted a CFA to psychometrically evaluate the theoretical model of E-WIL, including three different latent variables. This resulted in acceptable fit indices representing a global latent variable, E-WIL, comprising all dimensions: *Developing a self-directed learning role* (SWIL), *Developing a relational nursing role* (RWIL), *Transitioning to a collegial role* (CWIL), *Contextual workplace knowledge and understanding* (WWIL), *Striving for confidence in medical-technical performance* (MWIL), and *Developing an experience-based understanding of clinical situations* (EXWIL). The results indicate that the factor loadings between factors and the global factor range from 0.64 to 0.79. The standardised factor loadings indicate that all 29 items are positively and significantly associated with one of the factors to which they belong. The factor loadings between indicators and factors range from 0.30 to 0.89 (see Fig. 1).

All factors indicated acceptable variance of the global latent variable, as presented in Table 3. The goodness-of-fit indices showed a relatively good model fit, with a CFI value of 0.86. The value seems acceptable, due to the model's complexity with several dimensions and indicators.

4.2.2. Second-order latent variables

The second-order latent construct *Personal mastering of professional roles* (E-WILPM) comprised four dimensions: SWIL, RWIL, CWILA and CWILB. The factor loadings between the latent variable E-WILPM and the four different dimensions ranged from 0.48 to 0.95. The factor loadings between the 18 indicators and the four different dimensions ranged from 0.44 to 0.90 (see Fig. 2). The goodness-of-fit indices indicated that the model is fit (Table 3); that is, all 18 items are valid indicators for measuring the construct E-WILPM. The descriptive statistics of the hierarchical construct was E-WILPM: Mean (*SD*) = 3.80 (*0,57*).

The second-order latent construct, *Adapting to organisational*

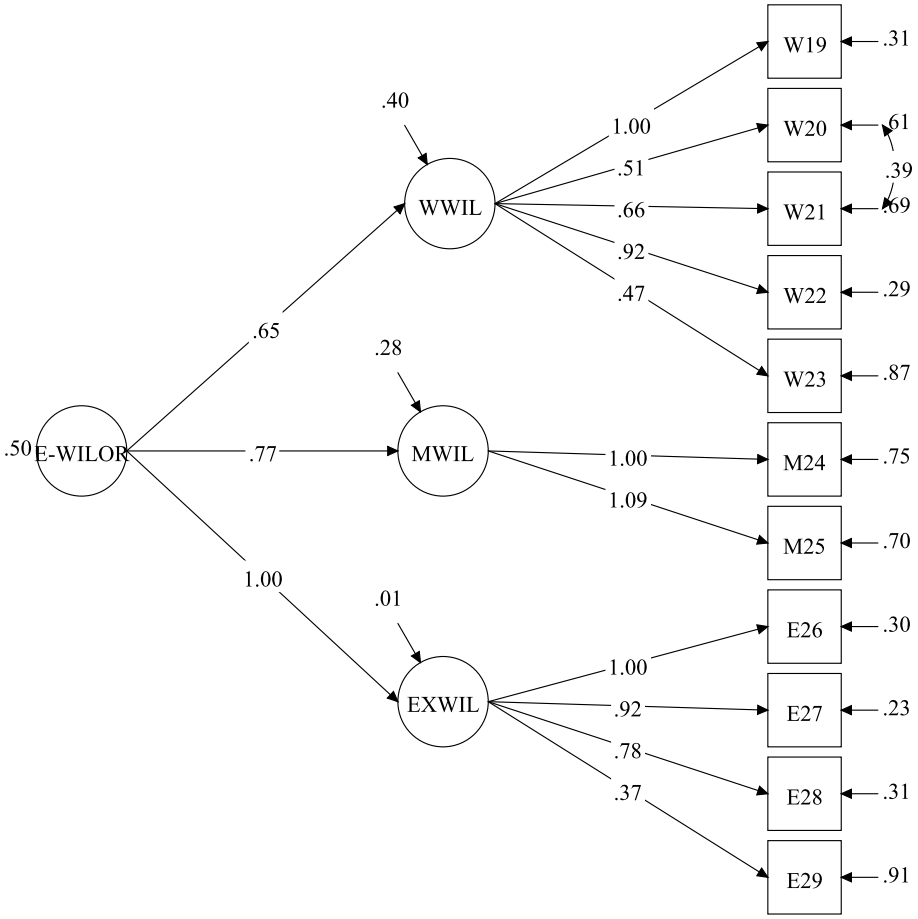

Fig. 3. The hierarchical second order model of the adapting to organisational requirements (E-WILOR).

Table 1
Demographic characteristics of the participants in the data.

Demographics		
Gender n (%)	Female	190 (86 %)
	Male	28 (12.7 %)
	Missing data	3 (1.4 %)
Age	Mean (*SD*)	28.33 (5.71)
Experience	Mean (*SD*)	5.25 (4.52)
Country of birth n (%)	Sweden	189 (85.50 %)
	Asia	11 (5 %)
	Remaining Europe	6 (2.70 %)
	Afrika	6 (2.70 %)
	Remaining Scandinavia	2 (0.90 %)
	North Amerika	2 (0.90 %)
	Missing data	3 (1.4 %)
Country of birth Parents n (%)	Sweden	158 (72.5 %)
	Others	60 (27.5 %)
	Missing data	3 (1.4 %)
Total		221

requirements (E-WILOR), comprised three dimensions: WWIL, MWIL and EXWIL. The factor loadings between the latent variable and the three dimensions ranged from 0.58 to 0.98. The factor loadings between 11 indicators and the three different dimensions ranged from 0.37 to 0.81 (see Fig. 3). The goodness-of-fit indices indicated that this model was fit (see Table 3), that is, all 11 items are valid for measuring the construct E-WILOR. The descriptive statistics of the hierarchical construct was E-WILOR: Mean (*SD*) = 3.89 (*0.60*).

5. Discussion

The purpose of the current study was to develop and validate the psychometric properties of the instrument E-WIL. Confirmatory factor analysis confirmed and validated each of the six dimensions, and the items were reduced from 35 to a total of 29 items, due to the low factor loadings (< 0.3). The results indicate that five out of six factors have acceptable reliability with Cronbach's alpha values of >0.7. One factor, *Striving for confidence in medical-technical performance*, indicate a Cronbach's alpha value of 0.63. This could be because the factor only comprised two items (Field, 2018). However, the dimension represented vital learning regarding NGRNs' medical-technical skills that may impact their ability to provide safe care to patients and were therefore not excluded. Also, CFA could confirm the global latent construct E-WIL in terms of goodness-of-fit indices (CFI), with values near 0.9, implying a good model fit (Brown, 2015). The analysis also confirms the two second-order latent constructs E-WILPM and E-WILOR, showing satisfactory goodness-of-fit indices, with values of 0,94 and 0.92, respectively (Brown, 2015). Furthermore, model fit indices indicated that the dimensions could be used separately to evaluate parts of NGRNs' WIL, with high CFI values ranging from 0.98 to 1.

This validated instrument may contribute to a new perspective to research on NGRNs' professional development. Some similarities have been found with other instruments aimed at assessing nurses' competence (Ma et al., 2021; Meretoja et al., 2004; Nilsson et al., 2014). The Nurse Competence Scale (NCS), developed by Meretoja et al. (2004), is one of the most widely used generic instruments to assess registered nurses' competence. Similarities were found with this instrument in relation to certain learning activities. The NCS is validated for nurses with up to 11 years of experience, which indicates that it is not entirely

Table 2
Dimensions of WIL, Constructs indicators, mean, standard deviation and Cronbach's α(n = 219–221).

Dimensions and constructs indicators	Item	Mean	Standard deviation	Cronbach's α
Developing a self-directed learning role (SWIL)		3,49	0,69	0.78
During the last two weeks, I have:				
Taken time to reflect on what is about to happen in a care situation.	S1	3.21	1.07	
Prepared myself theoretically for a new care situation.	S2	3.37	1.03	
Practised performance prior to a new care situation.	S3	2.65	1.20	
Reflected on the knowledge I need to develop as a professional nurse.	S4	4.11	0.83	
Reflected on what is happening during an ongoing care situation.	S5	3.67	1.00	
Reflected on my actions after a care situation.	S6	3.92	0.85	
Developing a relational nursing role (RWIL)		3,76	0,70	0.81
Reflected on my ethical approach.	R7	3.95	0.96	
Put theoretical nursing knowledge into action in a care situation.	R8	3.52	1.00	
Reflected on my understanding of the patient's life situation.	R9	4.11	0.82	
Reflected on my patient-centred approach.	R10	4.06	0.92	
Used theoretical nursing knowledge to understand a care situation.	R11	3.43	1.06	
Reflected on my own norms and values.	R12	3.56	1.01	
Transitioning to collegial role (CWIL)[a]				0.79
Developed my ability to collaborate.	C13	4.07	1.06	
Developed my ability to lead nursing work.	C14	3.83	1.04	
Developed my ability to communicate with colleagues.	C15	4.00	1.06	
Received support from colleagues when dealing with challenging care situations.	C16	4.15	0.91	
Discussed challenging care situations with colleagues.	C17	3.88	0.99	
Taken on board the advice and opinions of colleagues regarding my actions when in challenging care situations.	C18	4.01	1.10	
Developing contextual workplace knowledge and understanding (WWIL)		4,11	0,67	0.75
Reflected on the organization of caring in my current workplace.	W19	4.00	0.95	
Reflected on what specific medical knowledge is required in my current workplace.	W20	4.26	0.88	
Reflected on what specific nursing knowledge is required in my current workplace.	W21	3.99	0.97	
Reflected on how teamwork functions in my current workplace.	W22	4.12	0.89	
Used the administrative system I am expected to work with in my current workplace.	W23	4.24	1.00	
Striving for confidence in medical technical performance (MWIL)		3,40	0,99	0.63
Developed the self-confidence to take on new medical-technical tasks.	M24	3.69	1.15	
Developed the self-confidence to deal with emergency care situations.	M25	3.10	1.17	
Developing an experience-based understanding of clinical situations (EXWIL)		4,18	0,64	0.70
Used my clinical experience to understand care situations.	E26	4.07	0.90	
Used my clinical experience to prioritise in care situations.	E27	4.15	0.82	
Used my clinical experience in order to act safely and effectively.	E28	4.29	0.78	
When faced with a care situation that is new to me, I have first sought the advice and guidance of more experienced nurses.	E29	4.22	0.99	

[a] This dimension was later due to confirmatory factor analysis divided in two sub-dimensions transition to a collegial role (CWILA) mean (SD) =3,97(0,91) and transitioning to a collegial learning role (CWILB) mean (SD) = 4,01 (0,79).

Table 3
Model fit indices, R square.

Model fit indices	χ2/df	CFI	RMSEA	SRMR	R-square
Dimension:					
SWIL	11.515/6	0.98	0.06	0.03	0.41
RWIL	11.587/8	0.99	0.04	0.03	0.56
CWIL	16.839/8	0.98	0.07	0.04	0.47
WWIL	5.526/4	0.99	0.04	0.03	0.59
MWIL					0.50
EXWIL	3848/4	1	0	0.02	0.63
Model E-WIL	714.70/364	0.87	0.06	0.08	
Model E-WILPM	213.74/126	0.94	0.05	0.06	
Model E-WILORG	100.33/40	0.92	0.08	0.07	

focused on the specific demands facing NGRNs. Similarities were also found with an instrument developed by Nilsson et al. (2014), the Nurse Professional Competence (NPC) scale, targeting nursing students, NGRNs and practising nurses. The NPC scale focuses specifically on evaluating nurses' self-reported competence. Both the NPC and E-WIL instruments have the potential to assess the development of the professional nursing role. However, the E-WIL instrument focuses specifically on NGRNs' learning and development of their professional roles and clarifies such learning during recent weeks in practice. Even more similar is the Transition Status Scale for Newly Graduated Nurses developed by Ma et al. (2021), which includes items regarding NGRNs' ability to integrate theory with practice and to reflect on their practice. The difference between the instruments is that this instrument focuses on competence and emotions while at work as well as social life wellbeing.

The instrument developed in this study captures learning aspects that are important for NGRNs. The content of the dimension *Developing a self-directed learning role* has also been described by Billett et al. (2018), who stated that the development of occupational expertise is dependent on learners' engagement, in other words, how they use and value new experiences in the practical context. Through reflection, learners can problematise and use theoretical knowledge in relation to practical experiences, and, if needed, change and re-evaluate intended courses of action (Schon, 1984). *Developing a relational nursing role* is essential for the delivery of person-centred care. This role increases nurses' ability to act ethically and to include patient participation in care situations (Rosengren et al., 2021). This learning also encompasses the integration

of nursing theory into clinical care situations, which is crucial for managing the professional role in practice (Billett, 2011). Like Daws et al. (2020), the *Transitioning to a collegial role and a collegial learning role* highlights the importance of being comfortable in a team, and in this way develop the confidence and courage to ask questions, which is a critical prerequisite for being able to learn at work. A study which focused on nurses' socialisation processes – that is, levels of task mastery, role clarity, and feelings of social acceptance – also revealed that a high level of socialisation is associated with lower stress levels (Frögéli et al., 2019). The development of *contextual workplace knowledge and understanding* is in line with Labrague et al. (2019), who highlighted the need for NGRNs to develop an understanding of ward-specific practices. The importance of NGRNs *striving for confidence in medical-technical performance and handling acute situations* is well described in the literature. For example, Della Ratta (2016) found that NGRNs often have difficulty managing acute care situations, and they experienced a significant difference between what they consider themselves able to handle and what they are expected to do. Södersved Källestedt et al. (2020) also indicated the importance of improving NGRNs' self-confidence in practical situations. Self-confidence entails the ability to take on a wider perspective in clinical situations, for example, to be able to communicate with patients during practical performance of tasks. Finally, NGRNs' *experience-based understanding of clinical situations* is central in their professional development toward expertise (Benner, 1984). Through experience, NGRNs can increase their ability to understand emerging care situations and be able to act firmly and competently in clinical situations (Benner, 1984), as well as be able to respond to future work challenges (Billett, 2016).

This study has strengths and limitations. First, it is a strength that the instrument has been carefully developed from a theoretical model. Newly graduated registered nurses have also contributed to the design and development of the instrument questions. Another strength is that the participants worked in various departments in three different hospitals, which gives a greater variety in terms of different contexts and experiences.

A limitation of this study is the unbalanced gender representation; however, this mirrors the gender distribution among nurses in Sweden. Another limitation is that the theoretical framework and the validation was performed in NGRNs' hospital settings, which may limit the possibility of transferability to other healthcare settings. Furthermore, a limitation could be the response rate. However, it is worth noting that almost all nurses attending the seminars chose to participate in the study. This suggests that the main reason for the total response rate is related to the fact that the data collection switched to email, and participants chose not to open or take the time to respond to email.

The validated E-WIL instrument, with its specific focus on NGRNs' learning, could be used to assess NGRNs' WIL in various clinical contexts. The instrument may be used to identify specific learning needs of individuals or to ensure that all dimensions of WIL are developed in daily work. This validated instrument could also be used to identify areas for improvement, in developing a learning environment for NGRNs at a care unit or healthcare organization. We also suggest that, even though this study was validated with a sample of NGRNs in a hospital setting, WIL is also crucial for nursing students, perhaps especially during the later semesters of the programme. A self-reported E-WIL while studying could be useful for identifying learning areas that are particularly challenging for the student during workplace education, or to evaluate pedagogical strategies aimed to support WIL, for example, how reflective conversations with supervisors could benefit WIL. In addition, the instrument may also be useful for identifying learning potential in specific learning settings, for example in simulation-based education. However, further research is needed in order to validate the instrument with a sample of nursing students.

The validation supports the fact that the instrument can either be used in its entirety (global E-WIL) or to assess sub-dimensions, such as *Personal mastering of professional roles* (E-WILPM) and *Adapting to organisational requirements* (E-WILOR). For more targeted questions, only one or more of the six dimensions can be used.

6. Conclusion

This study confirmed six dimensions and a global latent variable E-WIL instrument representing 29 items, aimed to measure NGRNs' work-integrated learning to support professional development. In addition, two second-order latent constructs were validated, namely, E-WILPM and E-WILOR. The E-WIL instrument could be used in research related to NGRNs' learning in the early stages of their working life. The instrument could also be of value for healthcare organisations to evaluate key learning processes related to NGRNs' professional development.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

Allea, 2017. The European Code of Conduct for Research Integrity.
Andersson, A., Graneheim, U.H., Nilsson, M.S., 2022. Newly-graduated nurses' work integrated learning: a qualitative study from an educational and occupational perspective. Nurse Educ. Pract. 103290 https://doi.org/10.1016/j.nepr.2022.103290.
Benner, P., 1984. From Novice to Expert: Excellence and Power in Clinical Nursing Practice.
Billett, S., 2011. Curriculum and pedagogic bases for effectively integrating practice-based experiences. In: Australian Learning and Teaching Council. Final Report 2011. Griffith University, Brisbane.
Billett, S., 2016. Learning through health care work: premises, contributions and practices. Med. Educ. 50 (1), 124–131. https://doi.org/10.1111/medu.12848.
Billett, S., Harteis, C., Gruber, H., 2018. Developing occupational expertise through everyday work activities and interactions. In: The Cambridge Handbook of Expertise and Expert Performance, pp. 105–126.
Brown, T.A., 2015. Confirmatory Factor Analysis for Applied Research. Guilford publications.
Cooper, L., Orrell, J., Bowden, M., 2010. Work Integrated Learning: A Guide to Effective Practice. https://doi.org/10.4324/9780203854501.
Daws, K., McBrearty, K., Bell, D., 2020. "If somebody just showed me once how to do it": how are workplace cultures and practice development conceptualised and operationalised for early career nurses? Nurse Educ. Today 85, 104267. https://doi.org/10.1016/j.nedt.2019.104267.
Della Ratta, C., 2016. Challenging graduate nurses' transition: care of the deteriorating patient. J. Clin. Nurs. 25 (19–20), 3036–3048. https://doi.org/10.1111/jocn.13358.
Duchscher, J.B., 2008. A process of becoming: the stages of new nursing graduate professional role transition. J. Contin. Educ. Nurs. 39 (10), 441–450. https://doi.org/10.3928/00220124-20081001-03.
Eraut, M., 2009. Transfer of Knowledge between Education and Workplace Settings.
Field, A., 2018. Discovering Statistics Using IBM SPSS Statistics, 5th ed. Sage.
Frögéli, E., Rudman, A., Gustavsson, P., 2019. The relationship between task mastery, role clarity, social acceptance, and stress: an intensive longitudinal study with a sample of newly registered nurses. Int. J. Nurs. Stud. 91, 60–69. https://doi.org/10.1016/j.ijnurstu.2018.10.007.
Hu, L.T., Bentler, P.M., 1999. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. Struct. Equ. Model. Multidiscip. J. 6 (1), 1–55. https://doi.org/10.1080/10705519909540118.
ICN, 1987. Definition of a Nurse. International Council of Nurses. [online] Available at: Nursing Definitions | ICN - International Council of Nurses [Accessed 3 mars 2023].
Jackson, Dennis L., 2003. Revisiting sample size and number of parameter estimates: some support for the N:q hypothesis. Struct. Equ. Model. Multidiscip. J. 10 (1), 128–141. https://doi.org/10.1207/S15328007SEM1001_6.
Labrague, L.J., McEnroe-Pettite, D., Leocadio, M.C., 2019. Transition experiences of newly graduated Filipino nurses in a resource-scarce rural health care setting: a qualitative study. Nurs. Forum 0 (0). https://doi.org/10.1111/nuf.12330.
Loehlin, J.C., 1992. Latent Variable Models: An Introduction to Factor, Path, and Structural Analysis, 2nd ed. Lawrence Erlbaum Associates, Inc.
Ma, W., He, Y., Zhao, W., Xu, R., Liang, T., 2021. Developing and validating the transition status scale for newly graduated nurses in China. J. Nurs. Manag. 29 (6), 1819–1829.
Meretoja, R., Isoaho, H., Leino-Kilpi, H., 2004. Nurse competence scale: development and psychometric testing. J. Adv. Nurs. 47 (2), 124–133.

Mikkonen, K., Tomietto, M., Watson, R., 2022. Instrument development and psychometric testing in nursing education research. Nurse Educ. Today 119, 105603.
Muthén, Linda K., Muthén, Bengt O., 2002. How to use a Monte Carlo study to decide on sample size and determine power. Struct. Equ. Model. Multidiscip. J. 9 (4), 599–620. https://doi.org/10.1207/S15328007SEM0904_8.
Muthén, L., Muthén, B., 2015. Mplus User's Guide, 7th ed. Muthén & Muthén, Los Angeles, CA.
Muthén, L.K., Muthén, B., 2017. *Mplus user's guide: Statistical analysis with latent variables, user's guide*. Muthén & Muthén.
Nilsson, J., Johansson, E., Egmar, A.-C., Florin, J., Leksell, J., Lepp, M., Lindholm, C., Nordström, G., Theander, K., Wilde-Larsson, B., 2014. Development and validation of a new tool measuring nurses self-reported professional competence—the nurse professional competence (NPC) scale. Nurse Educ. Today 34 (4), 574–580.
Patrick, C.-J., Peach, D., Pockknee, C., Webb, F., Fletcher, M., Pretto, G., 2008. The WIL (work integrated learning) report: A national scoping study [Australian Learning and Teaching Council (ALTC) Final report]. http://catalogue. nla. gov. au/Record/4584343 http://www. acen. edu. au/resources/docs/WIL-Report-grants-project-jan09. pdf, 1-111.
Rosengren, K., Brannefors, P., Carlstrom, E., 2021. Adoption of the concept of person-centred care into discourse in Europe: a systematic literature review. J. Health Org. Manag. 35 (9), 265–280.
Rudman, A., Hörberg, A., Dahlgren, A., Gustavsson, P., 2020. Hälsa ett decennium efter karriärstart: Långtidsuppföljning av LUST-studien. In: Vetenskaplig slutrapport till AFA Försäkring (d nr 150284). Karolinska Institutet.
Schon, D.A., 1984. The Reflective Practitioner: How Professionals Think in Action. Basic books.
Schreiber, J.B., Nora, A., Stage, F.K., Barlow, E.A., King, J., 2006. Reporting structural equation modeling and confirmatory factor analysis results: a review. J. Educ. Res. 99 (6), 323–338. https://doi.org/10.3200/JOER.99.6.323-338.
SFS, 1993:100. The Higher Education Ordinance. [online] Available at: Högskoleförordning (1993:100) Svensk författningssamling 1993:1993:100 t.o.m. SFS 2023:83 - Riksdagen - [Accessed 3 March 2023].
Södersved Källestedt, M.L., Asp, M., Letterstål, A., Widarsson, M., 2020. Perceptions of managers regarding prerequisites for the development of professional competence of newly graduated nurses: a qualitative study. J. Clin. Nurs. (John Wiley & Sons, Inc.) 29 (23/24), 4784–4794. https://doi.org/10.1111/jocn.15522.
Swedish Research Council, 2017. Good Research Practice. Vetenskapsrådet, Stockholm [online] Available at: Good research practice (vr.se). [Accessed 7 july 2022].
Widarsson, M., Asp, M., Letterstål, A., Källestedt, M.L.S., 2020. Newly Graduated Swedish Nurses' Inadequacy in Developing Professional Competence. J. Contin. Educ. Nurs. 51 (2), 65–74.
World Medical Association Declaration of Helsinki, 2001. Ethical principles for medical research involving human subjects, 79C.F.R. (2001),. [online] Available at: Microsoft Word - DoH-Oct2008.rtf (wma.net) [Accessed 21 May 2023].
Yuan, K.-H., Yang-Wallentin, F., Bentler, P.M., 2012. ML versus MI for missing data with violation of distribution conditions. Sociol. Methods Res. 41 (4), 598–629. https://doi.org/10.1177/0049124112460373.