

## The development and validation of the On-the-job Learning Styles Questionnaire for the Nursing Profession

Marjolein G.M.C. Berings, Rob F. Poell, P. Robert-Jan Simons & Marc J.P.M. van Veldhoven

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M.G.M.C. Berings MA PhD  
PhD Student  
Department of Human Resources Studies,  
Tilburg University, Tilburg, The Netherlands

R.F. Poell PhD  
Professor  
Department of Human Resources Studies,  
Tilburg University, Tilburg, The Netherlands

P.R.J. Simons PhD  
Professor  
IVLOS, Department of Education, Utrecht  
University, Utrecht, The Netherlands

M.J.P.M. van Veldhoven PhD  
Associate Professor  
Department of Human Resources Studies,  
Tilburg University, Tilburg, The Netherlands

Correspondence to R.F. Poell:  
e-mail: r.poell@uvt.nl

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### Abstract

**Title.** The development and validation of the On-the-job Learning Styles Questionnaire for the Nursing Profession

**Aim.** This paper is a report of a study to develop and test the psychometric properties of the On-the-job Learning Style Questionnaire for the Nursing Profession.

**Background.** Although numerous questionnaires measuring learning styles have been developed, none are suitable for working environments. Existing instruments do not meet the requirements for use in workplace settings and tend to ignore the influence of different learning situations.

**Method.** The questionnaire was constructed using a situation–response design, measuring learning activities in different on-the-job learning situations. Content validity was ensured by basing the questionnaire on interview studies. The questionnaire was distributed to 912 Registered Nurses working in different departments of 13 general hospitals in the Netherlands at the end of 2005.

**Findings.** The response rate was 41% (372 questionnaires). The internal factor structure of the questionnaire was partly based on the learning activities in which nurses participate and partly on the learning situation in which they are performed. The internal consistency was good. The situation–response design of the questionnaire demonstrated its added value. Construct validity was estimated using intercorrelations between the scales, and criterion validity was estimated based on the relationships of the scales with perceived professional competence.

**Conclusion.** The On-the-job Learning Styles Questionnaire for the Nursing Profession is well suited to describing nurses' learning styles in on-the-job settings and has satisfactory psychometric properties.

**Keywords:** continuous professional development, instrument development, instrument validation, learning styles, nurses, questionnaire, situation–response design

### Introduction

The professional environment of nurses is continuously changing because of, for instance, the development of new technologies in nursing equipment, changing disease patterns

and treatment and knowledge about them, changing task perceptions (Clark 2001) and changing task divisions (Allen 2001). The education that nurses initially receive is insufficient to enable them to adapt to these new work situations, and they therefore need to keep on learning during their

careers (Lawton & Wimpenny 2003). Although hospitals can provide training to enable individual learning, these opportunities are not always financially possible and it often seems difficult to transfer what has been learned to the daily work environment (van Woerkom 2003). On-the-job learning is a promising alternative (Powell 1989). Using a broad definition, we define on-the-job learning as all implicit or explicit mental and/or overt activities and processes, performed in the context of work, which lead to relatively permanent changes in knowledge, attitudes or skills. The challenges of the work itself and interactions with other people in the workplace involve many learning opportunities (Eraut 2004, Poell *et al.* 2004) but receive hardly any attention in the literature on nurses' continuing learning.

It is increasingly expected that nurses will take responsibility for their own professional development (Furze & Pearcey 1999). Therefore, they need to develop learning skills (O'Shea 2003). To be able actively to direct their own learning, people should first know *that* they learn and *how* they learn (Barrie & Pace 1998). The concept of learning style could be helpful in raising people's awareness about their learning. Many different definitions of learning style have been proposed in literature, for example in terms of learning orientations (e.g. Gregorc 1982), learning preferences (e.g. Dunn *et al.* 1989), learning motivations (e.g. Apter *et al.* 1998), learning approaches (Allinson & Hayes 1996), or mixtures of these tendencies (e.g. Kolb 1984, Vermunt 1992). In the present study, on-the-job learning styles were defined in terms of nurses' learning activities and learning strategies (cf. Keefe 1979, Wierstra 2000, Berings *et al.* 2005). Learning activities are the separate activities that people perform in order to learn, or with learning as a side effect. Learning strategies are combinations of learning activities that together contribute to certain explicit or implicit learning goals. Learning styles are people's personal tendencies in their use of learning strategies. These are influenced by the learning situation, and therefore people perform different learning strategies (and thus activities) in different learning situations.

Knowledge about their own and other possible on-the-job learning styles can make nurses aware of their options and choices in learning behaviour and therefore offer opportunities for adaptation. It can offer them a lexicon that enables verbal expression of individual differences in their learning behaviour (Desmedt & Valcke 2003, Coffield *et al.* 2004). Further, it can improve communication and collaboration between team members and offer opportunities to tailor guidance by human resource professionals or managers. However, people are usually not aware of their learning styles (Boekaerts 1996). To help nurses improve their learning skills, it is necessary to raise their awareness of their on-the-

job learning styles. The purpose of this paper is to provide a tool that can help raise this awareness.

## Background

Current on-the-job learning styles instruments are inadequate for our purpose as they do not take into account the workplace setting, usually ignore the influence of different learning situations, and have serious psychometric weaknesses.

### Adequacy in workplace settings

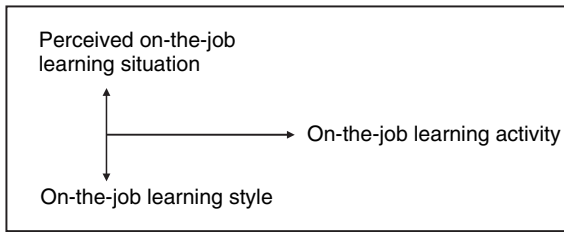
In literature on on-the-job learning, instruments are often simply transferred from research in educational settings to workplace settings, despite the great differences between these contexts. The first point of criticism against using these instruments in the workplace is their lack of attention to the social learning dimension. In learning style instruments the social dimension of learning hardly receives any attention, even though interaction with others is the main source of learning in the workplace (Gear *et al.* 1994, Eraut *et al.* 1998, Doornbos *et al.* 2004).

Secondly, existing learning style instruments focus on the ways in which learners process information offered by teachers and textbooks. In educational contexts, learning opportunities are mostly chosen by the teacher. In on-the-job contexts, however, employees have opportunities for explicitly or implicitly choosing their own learning activities. Focussing a learning style instrument on the variety of learning activities workers choose, instead of on the way they process the information they are offered in courses, can thus offer more opportunities for the improvement of on-the-job learning (Berings *et al.* 2005).

Thirdly, most existing learning style instruments use the word 'learning' in most items. This may cause respondents to think merely about courses they have attended, the books they have read, the coaching they have received and so on, while we are also interested in learning activities that are more integrated into the work process, such as learning from work experience and learning from social interaction with colleagues. Therefore, in our view, nurses should be asked about concrete changes in competences, work processes or outcomes. They could also be asked about their 'development' or 'improvement' (Doornbos & Simons 2001).

### Influence of the learning situation: the interactional approach

Learning situations can differ in many respects, such as in their content, the information environment, the social work



**Figure 1** Interaction model of on-the-job learning styles (adapted from Berings *et al.* 2005, p. 380).

environment, and the learning climate (Berings *et al.* 2005). Learning style instruments generally ignore the influence of these differences by measuring learning activities in ‘general situations’ and regarding these ‘general activities’ as learning styles. We believe that the neglect of the existence of various learning situations is related to the unresolved ‘state-or-trait’ debate in the learning style literature (Loo 1997, Cassidy 2004, Coffield *et al.* 2004). Literature is still unclear on whether learning styles should be regarded as stable across situations – as traits – or as changing with each learning situation – as states. We assume that people adapt their preferred combination of learning activities to different situations in a consistent way, depending on their learning style. In other words, we assume that learning behaviour is neither situation specific – a state – nor cross-situationally consistent – a trait – but that on-the-job learning behaviour should be regarded from an interactional perspective, as is shown in the interaction model in Figure 1 (Berings *et al.* 2005).

This assumption is shared by many learning style theorists (e.g. Kolb 1984, Vermunt 1992, Allinson & Hayes 1996), although almost all learning style instruments still attempt to measure learning styles with one general questionnaire intended to cover all learning situations. This reduces the reliability and predictive validity, as respondents usually adopt a variety of frames of reference to compensate for the lack of specificity in general questionnaires (Spielberger 1971, van Schoyck & Grasha 1981).

Only Boyatzis and Kolb (1993) have developed an instrument that measures people’s learning strategies in different learning situations. This instrument has not been used extensively so far. This could be due to the poor psychometric values in several subscales; for example, Cronbach alpha’s ranged from 0.47 to 0.78. Another reason could be that the only measure calculated that incorporated the situational factor (‘adaptive flexibility’) did not show criterion validity (Mainemelis *et al.* 2002).

In this paper we take into account different learning situations when measuring learning styles.

## Weaknesses in psychometric quality

Only a few psychometrically validated learning style instruments are available. Most of the existing instruments are not statistically validated or are known to be invalid and unreliable (Snyder 1998). Coffield *et al.* (2004) examined 13 of the best-known and most-used learning style instruments in detail and concluded that they lacked psychometric quality. For only one instrument, Allinson and Hayes’ Cognitive Style Index (Allinson & Hayes 1996) were proper internal consistency, proper construct validity, and proper criterion validity reported. Coffield *et al.* therefore advise that use of the other instruments in research and practice should be discontinued. Adequate psychometric instrument properties are essential. If instruments are not valid or reliable, they cannot be used to perform sound scientific research. However, many underlying learning-style models appear to be valuable nonetheless because they provide participants with a framework for understanding differences in learning strategies and vocabulary to discuss their learning issues.

## The study

### Aim

The purpose of this study was to develop and test the psychometric properties of the On-the-job Learning Style Questionnaire for the Nursing Profession (OLSQN).

### Participants

To distribute the questionnaires, we contacted nursing supervisors and human resource professionals working in hospitals in the Netherlands who had attended a conference about on-the-job learning in the healthcare sector that we had organized a year earlier. We asked them to distribute our study scales as part of a larger questionnaire to the nurses working at their departments. Using the snowball method, more supervisors were approached. In this way, the questionnaire was distributed to 912 Registered Nurses working in various departments of 13 general academic, teaching, and peripheral hospitals in the Netherlands at the end of 2005. The respondents received their own learning style profile by email in return for their contribution. Four hundred and thirty-six questionnaires were returned, an initial response rate of 48%.

The dataset contained a relatively large amount of missing data, which was probably due to the questionnaire’s length. Therefore, we imputed the missing data for all cases in which <10% of the variables of the OLSQN scale were missing.

Data imputation improves the efficiency of estimates and the 'power' of statistical tests (de Leeuw 2001). We used 'two-way imputation for separate scales', because this method has been shown to produce almost no bias in Cronbach's alpha in simulation research (van Ginkel 2007). All other cases were deleted listwise. This left us with a final sample of 372 cases, giving a final response rate of 41%, which is modest but still useful. In this way, the effect of missing data was kept within tolerable limits: on average, for each respondent 0.9 missing items had to be imputed.

Of the 372 nurses in the sample, 83.42% were female. The average age was 36.90 years ( $SD = 11.08$ ). The nurses worked 29.13 hours per week on average ( $SD = 6.87$ ) and had an average of 12.51 years of nursing experience since graduating ( $SD = 10.24$ ). The sample was not completely representative of the population of all nurses working in general hospitals in the Netherlands (data from 2004, obtained from the NVZ, Dutch Association of Hospitals). A nonparametric chi-squared test revealed that males were overrepresented ( $\chi^2 = 7.30$ , d.f. = 1,  $P = 0.007$ ). One sample t-tests showed that the nurses in the sample were a little younger ( $t = -4.42$ ,  $P < 0.001$ ) and had a longer working week ( $t = 17.21$ ,  $P < 0.001$ ) than nurses in the population.

### Instrument

The instrument measures nurses' learning activities in various on-the-job learning situations. It describes nurses' learning styles by providing a profile of the learning activities they use in different situations. The scale was deductively constructed following a situation-response design (Endler & Hunt 1966). This means that each of the items on learning activities (responses) is asked for each of a series of different situations in which these activities may be employed. The resulting scale scores for individual respondents are reflective of the way the individual exhibits behaviour over both a range of typical situations and a range of typical responses. The S-R approach to survey design fits with an interactionistic approach to the explanation of human behaviour, as is common in modern psychology (Scott & Spencer 1998).

We based the items on empirical data gathered in interviews concerning nurses' on-the-job learning contents and activities with 20 nurses, 17 supervisors and eight educators in the nursing profession (Berings 2006) and literature to guard the content validity of the scale. First, six different learning situations were operationalized as six different learning contents. Then, analogous items were formulated as responses for each learning content that included the learning activities nurses use. Finally, the mapping sentence was formulated.

### Learning contents

The learning situations were operationalized as six different learning contents. In the above-mentioned interviews, nurses provided many examples of on-the-job learning content. Using inductive analysis, these examples were organized into five categories: the 'technical-practical domain' (e.g. technical nursing skills), the 'socio-emotional domain', the 'organizational domain' (e.g. planning the care of patients), the 'developmental domain' (e.g. finding reliable information sources), and a 'pro-active attitude to work' (e.g. taking initiatives at work). The large socio-emotional domain could be split into a socio-emotional domain towards others (e.g. supporting patients and family) and towards oneself (e.g. putting emotionally difficult situations into perspective). To guarantee the independence and exclusivity of the learning content in the items, each content should be a significant example from one of these domains. We used the examples mentioned to formulate the contents and, to ensure the exclusivity, significance, and recognizability of the examples, we evaluated them with five nurses in the field. After a few changes in wording, the contents fulfilled all requirements.

### Learning activities

In the interview studies the respondents also mentioned many examples of the learning activities nurses employ. They were organized into six domains, which represented several learning activities and could serve as responses in the questionnaire:

- learning by doing one's regular job, such as taking care of patients or watching colleagues;
- learning by applying something new in the job, such as broadening tasks or job rotation;
- learning by social interaction with colleagues, such as asking informative questions or feedback;
- learning by theory or supervision, such as searching the internet, visiting information meetings, or coaching;
- learning by reflection, such as planning or looking back and
- 'learning through life outside work', such as sickness and death in one's own circle and raising children.

The last domain was omitted as most examples mentioned in that category cannot be influenced by the nurses themselves. The category 'learning by theory and supervision' was split into 'learning by theory' and 'learning by supervision', as the source of knowledge used is different for these situations (Estabrooks *et al.* 2005), and it is therefore plausible that they are used for different learning content. Except for the 'learning by reflection' mental domain, all domains found in the interviews represented overt activities. To obtain a valuable distinction within this single mental domain, the

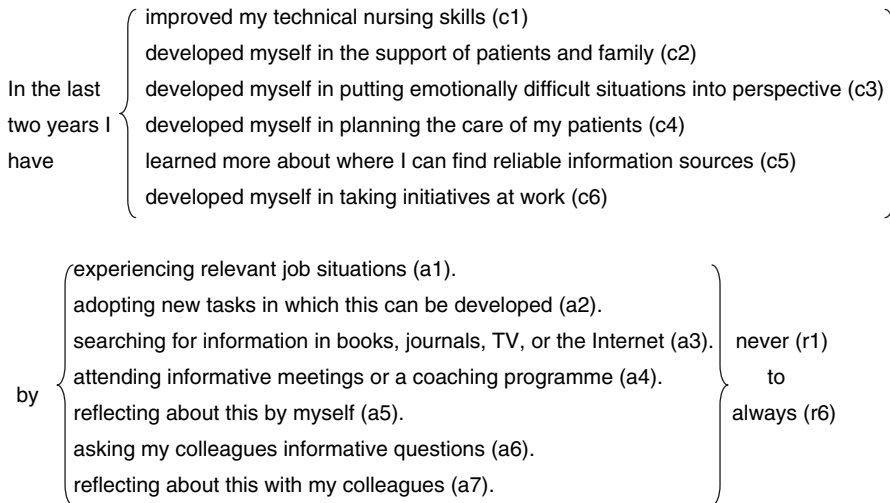


Figure 2 Mapping sentence of the On-the-job Learning Style Questionnaire for the Nursing Profession (OLSQN).

‘learning by reflection’ category was split up into two categories: ‘reflecting by oneself’ and ‘reflecting with others’ (cf. van Woerkom 2003).

#### Pilot and final mapping sentence

The learning contents and learning activities are represented in a so-called mapping sentence, resulting in the formulation of the items shown in Figure 2 (Oosterveld 1996). The scale consists of seven items containing learning activities measured for six different learning contents (42 in total). The 6-point response scale ranged from 1, ‘never’ to 6, ‘always’. In a pilot version we used a 4-point response scale. An item example was provided to help respondents to understand the scale terms. Nine nurses filled in this pilot questionnaire using a thinking aloud procedure attended by one researcher. The nurses recognized the contents and activities and could easily complete the questionnaire. However, the variation in responses was very low. Therefore, the response scale was increased from a 4-point to a 6-point scale.

#### Perceived professional competence

Drawing on previous research, we expected that nurses’ on-the-job learning would positively influence their perceived professional competence. We used two measures to indicate this competence: self-efficacy and perceived development. Self-efficacy refers to the belief in one’s capabilities to achieve a desired result. It is influenced by judgements of personal capabilities and can therefore be influenced by a person’s investment in learning activities (Bandura 1977, Kraiger *et al.* 1993, Parker & Wall 1998). Diverse studies reveal the impact of nursing students’ learning experiences on their self-efficacy (e.g. Williamson *et al.* 1996, Shellman 2007). Self-efficacy was measured by means of six items from a scale developed by Rigotti (Schyns & von Collani 2002) (mean = 4.92,

SD = 0.55,  $\alpha = 0.81$ ). This level of internal consistency is comparable to that reported by the original authors. The six-point response scale ranged from 1, ‘totally disagree’, to 6, ‘totally agree’. An example is ‘*I can usually handle whatever comes my way in my job*’. This scale was shown to correlate highly with the well-known self-efficacy scale by Sherer *et al.* (1982) in a study reported by Schyns and von Collani (2002).

The other indicator of perceived professional competence, perceived development, refers to how a nurse reports their own professional development after graduation. Following van der Heijden (2002), who found a positive relationship between participation in learning activities and how employees’ perceive their own professional development, perceived development was measured by a single item asking ‘*How do you assess your own development as a nurse since your graduation?*’ (mean = 4.74, SD = 0.70). The six-point response scale ranged from 1, ‘very bad’, to 6, ‘very good’.

#### Ethical considerations

As is common in the Netherlands, no ethics committee approval needed to be obtained from the study hospitals for this type of study as it involved only staff and not patients. We followed the Academy of Human Resource Development standards on ethics and integrity (Russ-Eft *et al.* 1999).

## Results

### Factor structure and internal consistency

Principal component analysis indicated that 10 factors could be distinguished in the questionnaire data matrix, with an eigenvalue > 1. We conducted different exploratory analyses

in order to find the most adequate factor structure to describe the data. Factor analyses including all items did not yield any clearly interpretable results. Therefore, we also explored factor analyses in two groups of items in various compositions. The first group contained all 32 items concerning work experience, adding something new, searching for information, visiting information meetings or coaching, and reflecting by oneself. The second group consisted of all 12 items concerning putting questions to colleagues and reflecting together. Separate factor analyses on these two groups of items revealed interpretable results. Kaiser's measure for sampling adequacy was 0.89 for the first group and 0.80 for the second group, indicating good factorability (Kaiser 1974). The first factor solution explained 68.61% of the total variance. The second factor solution also yielded five factors, representing learning by talking with colleagues about five learning contents: technical nursing skills, putting things in perspective, organizing patient care, finding information and taking initiatives. The sixth learning content that was originally put into the design (support of patients and family) was not found in the factor solution. These two items were therefore not integrated in the final questionnaire. The second factor solution also yielded five factors, representing learning

by talking with colleagues about five learning contents: technical nursing skills, putting things in perspective, organizing patient care, finding information, and taking initiatives. The sixth learning content that was originally put into the design (support of patients and family) was not found in the factor solution. These two items were therefore not integrated in the final questionnaire. The second factor solution was estimated to explain 82.92% of the total variance. Cronbach alphas of all 10 scales resulting from these two factor solutions (5 + 5) were estimated to range from 0.67 to 0.87. The varimax rotated factor matrices, mean scores, standard deviations and estimated reliabilities of the factors are presented in Tables 1 and 2.

Learning from work experience and learning from reflecting by oneself were reported most frequently, while learning from attending information meetings or coaching were reported the least. Nurses learned most from talking with their colleagues when discussing technical matters and how to put things into perspective, and least when discussing finding information and taking initiatives. There is considerable variance between the nurses on each scale. Analysis of variance revealed no statistically significant differences between nurses from different types of hospitals (academic,

**Table 1** Varimax rotated factor matrix, mean scores, standard deviations, and reliability coefficients for five learning activities (*n* = 372). Factor loadings lower than 0.32 are not displayed. The item indications in the first column refer to the items as specified in Figure 2

Item	Component: learning by...				
	Information meetings/ coaching	Reflecting by oneself	Adding something new	Work experience	Searching for information
c2*a1				0.79	
c3*a1				0.69	
c4*a1			0.38	0.75	
c4*a2			0.67	0.39	
c5*a2	0.33		0.66		
c6*a2			0.73		
c1*a3					0.77
c2*a3	0.33				0.79
c3*a3	0.43				0.71
c2*a4	0.72				
c3*a4	0.74				
c4*a4	0.79				
c5*a4	0.74				
c6*a4	0.75				
c1*a5		0.78			
c2*a5		0.71			
c3*a5		0.68		0.39	
c5*a5		0.65	0.43		
c6*a5		0.55	0.43		
Mean	3.00	4.22	3.60	4.17	3.37
sd	1.02	0.86	1.11	1.04	1.03
No. items	5	5	3	3	3
Cronbach's alpha	0.87	0.81	0.79	0.79	0.80

Item	Component: learning by talking together about...				
	Finding information	Organizing patient care	Putting things into perspective	Taking initiatives	Technical nursing skills
c1*a6					0.86
c1*a7					0.78
c3*a6			0.85		
c3*a7			0.83		
c4*a6		0.86			
c4*a7		0.80			
c5*a6	0.82				
c5*a7	0.89				
c6*a6				0.87	
c6*a7				0.78	
Mean	3.73	3.84	3.95	3.73	4.01
SD	1.11	1.10	1.09	1.08	0.90
N' items	2	2	2	2	2
Cronbach's alpha	0.85	0.83	0.77	0.80	0.67

**Table 2** Varimax rotated factor matrix, mean scores, standard deviations and reliability coefficients for five learning contents about which nurses learn about by talking with each other ( $n = 372$ ). Factor loadings lower than 0.32 are not displayed. The item indications in the first column refer to the items as specified in Figure 2

**Table 3** Proportions of explained variance of the item scores (frequency) by person, learning content, type of learning activity and two-way interactions ( $n = 372$ )

	$R^2$	$P$
Person	0.44	0.000
Learning content	0.11	0.000
Type of learning activity	0.36	0.000
Person $\times$ learning content	0.39	0.000
Person $\times$ type of learning activity	0.43	0.000
Learning content $\times$ type of learning activity	0.07	0.000

teaching, or peripheral hospitals) or different types of wards (nursing wards, emergency rooms, outpatient departments, and intensive care units).

### Added value of the situation–response design

To investigate the added value of the situation–response design of the questionnaire, we used univariate analysis of variance with random effects for the person factor and fixed effects for the factors learning content and type of learning activity to measure explained variances of these factors in the item scores. Table 3 shows the explained variance proportions in the frequency of learning activities by types of learning activities, learning content, and person. All contributions are statistically significant.

### Validity

To test the construct validity, we calculated the internal correlations between the scales, which were estimated to

range from 0.31 to 0.63, with an average of 0.46. To examine the criterion validity of the questionnaire, we conducted linear regression analyses with perceived professional competence, controlling for effects of gender, nursing education level, employment and nursing experience. To avoid multicollinearity with nursing experience, the effect of age was not captured in the model. We inspected main effects and the interaction effects for centred variables. A probability level of  $P < 0.05$  was used for all analyses. Table 4 presents estimated  $\beta$ 's, beta values and  $R^2$ 's of linear multiple regression analyses.

Higher levels of adding something new to one's task are related to higher levels of perceived development ( $\beta = 0.29$ ,  $P < 0.001$ ). Often going to information meetings or receiving coaching is related to high self-efficacy ( $\beta = 0.21$ ,  $P = 0.003$ ). Higher levels of reflecting by oneself are related to higher levels of self-efficacy ( $\beta = 0.19$ ,  $P = 0.011$ ). Learning by talking about putting things into perspective is positively related to self-efficacy ( $\beta = 0.14$ ,  $P = 0.036$ ) and learning by talking about organizing patient care is negatively related to perceived development ( $\beta = -0.18$ ,  $P = 0.021$ ).

## Discussion

### Study limitations

As the learning activities in the questionnaire are rather broad categories of activities, it might be possible that different respondents interpreted the statements in the scale differently. It should be noted that this might have influenced the results of this study.

**Table 4** Linear multiple regressions of nurses' on-the-job learning on their professional competence ( $n = 372$ )

	Self-efficacy		Perceived development	
	$\beta$	<i>beta</i>	$\beta$	<i>beta</i>
Gender (1 = female; 0 = male)	-0.24	-0.17**	-0.06	-0.03
Nursing education level				
Dummy (1 = higher nursing education; 0 = others <sup>†</sup> )	-0.07	-0.04	0.14	0.06
Dummy (1 = postgraduate education; 0 = others <sup>†</sup> )	0.08	0.07	0.08	0.06
Employment hours	0.00	-0.02	0.01	0.10
Years of nursing experience	0.01	0.26***	0.00	0.05
Learning by...				
Work experience	-0.01	-0.02	-0.02	-0.03
Adding something new	0.03	0.07	0.18	0.29***
Searching for information	-0.03	-0.06	0.02	0.03
Information meetings/coaching	0.11	0.21**	0.02	0.03
Reflecting by oneself	0.12	0.19*	0.10	0.12
Learning by talking together about...				
Technical nursing skills	-0.03	-0.05	0.04	0.05
Putting things into perspective	0.07	0.14*	0.05	0.08
Organizing patient care	-0.07	-0.14	-0.11	-0.18*
Finding information	0.00	0.01	-0.01	-0.02
Taking initiatives	0.05	0.09	0.00	0.01
Adjusted $R^2$	0.16		0.12	
$R^2$ Change <sup>‡</sup>	0.14		0.12	

\* $P \leq 0.05$ , \*\* $P \leq 0.01$  \*\*\* $P \leq 0.001$ .

<sup>†</sup>Three levels of nursing education were distinguished: vocational education (level 4), higher nursing education (level 5) and postgraduate education.

<sup>‡</sup>Tested against a model only including background characteristics: gender, nursing education level, employment and nursing experience.

All variables were measured using a self-report questionnaire. Because individuals strive to achieve consistency in their self-reported response pattern, it is probable that this explains the relationships we found between the variables. For example, nurses who claim to use many learning activities frequently might want to be consistent and provide positive answers to questions about their perceived competence (Kasl 1978, Perry 1995). We tried to avoid such deviant results by placing other items between these scales on the questionnaire.

The study sample was not completely representative of the entire population of nurses working in general hospitals in the Netherlands. Perhaps nurses who are more interested in continuous learning were more inclined to complete the questionnaire and receive their profiles. However, we think that this had only a negligible influence on the results, as the standard deviances of the item scores are reasonably large. We used nurses' background characteristics as control variables to reduce possible bias.

The content of the questionnaire, the learning activities and learning contents, were mostly based on an empirical study of nurses working in general hospitals in the Netherlands. However, comparisons with other profes-

sions and in other countries suggest broader applicability (Berings 2006).

### Factor structure and internal consistency

The factor solution that best matched the data yielded ten factors and structured the separate items on two different theoretical grounds. Five factors represented five learning activities for different learning contents and the five other factors represented five learning contents about which nurses learn by talking with their colleagues (e.g. a specific type of learning activity). The classification of 42 items into 10 factors and the deletion of 13 items resulted in small factors containing only a few items. This can negatively affect the robustness of the factors. However, the interpretation of the factor solutions was very clear and the reliability of the factors was satisfactory. Only one factor (learning by talking together about technical nursing skills,  $\alpha = 0.67$ ) did not exceed the generally accepted 0.70 criterion (Nunnally 1978). For valid inferences about groups of people, alphas of 0.60 and above are sufficient (Sijtsma & Molenaar 2002). For diagnostic purposes, however, higher reliability values are needed. All other Cronbach alphas were estimated to exceed



0.77 and are therefore satisfactory. As the final instrument is rather different from the total item pool, it is necessary to retest instrument reliability on a new sample in its current 29-item form (the items indicated in Tables 1 and 2).

### Added value of the situation–response design

First, the fact that some of the items in the questionnaire organized themselves into factors representing learning content is an indication of the importance of the situational aspect in the questionnaire. Secondly, the explained variance proportion of the learning content, the situational part of the design, and its interactions with the person and learning activity are important. The contribution of the learning activity type (measured in most learning style questionnaires) and the contribution of the person are greater, but the contribution of the learning content is substantial and unquestionably has added value for the design.

One of the reasons that the ‘state-or-trait’ debate in learning style literature has still not been solved is probably that learning behaviour, like other aspects of human behaviour, is highly complex. Our data show that all the factors we put into the model have an important impact. It is best to calculate not only the main sources of variance and two-way interactions, but also the three-way interaction effect (person  $\times$  learning content  $\times$  learning activity). Learning is a function of all these factors in combination (cf. Endler & Hunt 1966). It would thus also be possible to test empirically whether our assumption, that on-the-job learning behaviour should be regarded from an interactional approach, is plausible. In the current study, however, only one item for each learning activity per subject is available for each learning content, which makes it impossible to analyse the three-way interaction effect. If the learning activity were scored repeatedly within each learning content, respondents would become irritated by the repetition or would merely repeat their first response from memory (Endler & Hunt 1966). Therefore, it would be difficult to develop such a questionnaire and empirically test the interaction assumption and all factors in combination.

### Validity

For sound construct validity the final OLSQN subscales should correlate, as they should all measure on-the-job learning activities (convergent validity); however, the inter-correlations should not be too high as each scale should measure a different kind of on-the-job learning activity (divergent validity). The inter-correlations we found are considerable, but this is unsurprising as it is to be expected

that if nurses have invested effort in one way of learning, they will also invest effort in other ways of learning. The inter-correlations are not very high, which means that they are considerably lower than the scales’ reliability estimates; this indicates that the scales truly indicate separate scales. Therefore, the final OLSQN scales satisfy the norms for construct validity.

As expected, we found positive relationships between different nurses’ on-the-job learning activities and perceived professional competence. This confirms the criterion validity of the questionnaire. One relationship was negative: the relationship between learning by talking about organizing patient care and perceived development. This is contrary to our expectations, and we have no clear explanation for this. It could mean that nurses who discuss how better to plan care for their patients more frequently have lower esteem about their development as nurses. It could also mean that questions about organizing patient care were misinterpreted by the nurses. They may have thought that this was the job of their supervisor. For now, this scale should be interpreted with care. We did not find the expected relationships for all kinds of on-the-job learning. This strengthens the evidence for the criterion validity of the questionnaire, as it demonstrates the relevance of the distinction we made between the different learning activities. The criterion validity is further supported by the fact that some learning activities show statistically significant relationships with self-efficacy and other activities with perceived development. We must note, however, that the beta values we estimated are not very high. This is probably due to the fact that perceived professional competence is influenced by many other factors, such as job satisfaction and commitment (Schyns & von Collani 2002).

### Construct of on-the-job learning style

For this study, we used a conceptualization of learning style in terms of learning activities and learning strategies (Keefe 1979, Wierstra 2000). The construct of on-the-job learning style is very difficult to measure. The perceptible part of a person’s learning behaviour is their use of learning activities in different situations. In other learning style literature, where authors propose a more direct way of measurement (‘How do you usually learn?’), respondents obtain a label: ‘Jonathan has learning style X’. In our study, it takes more words to explain a person’s learning style: ‘Sandra uses X and Y activities for many learning contents, and Z activities for some learning contents’. We believe that this conceptualization of learning style fits better with on-the-job learning situations (as opposed to educational contexts) and provides

### What is already known about this topic

- Nurses need to develop learning skills to meet their responsibilities for continuous professional development.
- Awareness of their on-the-job learning styles can help nurses improve their on-the-job learning.
- There are many learning style instruments relevant for measuring learning styles in educational settings but none are adequate in on-the-job settings.

### What this paper adds

- The On-the-job Learning Styles Questionnaire for the Nursing Profession is a psychometrically sound instrument that provides a personal profile of the learning activities that nurses tend to use in different on-the-job learning situations.
- The instrument can be used by nurses, their supervisors and human resource professionals in hospitals to raise nurses' awareness of their on-the-job learning styles and thus to improve their on-the-job learning and work performance.
- Measuring people's tendency to employ particular learning activities using a situation–response design has added value over measuring this using traditional response designs.

nurses with better opportunities for personal and professional development in diverse work contexts.

### Conclusion

The OLSQN is well-suited to describing nurses' learning styles in on-the-job settings and has satisfactory psychometric properties. It describes nurses' learning styles by providing a profile of the different learning activities that they use in different learning situations.

The OLSQN can be used in future research to investigate the implications of nurses' on-the-job learning for several other output variables (e.g. work effectiveness, patient satisfaction). This questionnaire could also be used to investigate which factors affect which on-the-job learning activities, such as job autonomy, social support of colleagues and supervisors. In addition, it could be applied to determine which nurses, with which background characteristics, conduct which learning activities.

The questionnaire can be self-administered by nurses for personal development purposes, helping them reflect on what and how they (want to) learn in relation to their work (Riding

1994). The questionnaire could also be used by supervisors, mentors, coaches and human resources professionals to make nurses aware of their on-the-job learning styles. They could, for example, organize coaching sessions for nurses to reflect on their use of learning strategies in different learning situations. Alternative learning strategies can be discussed and new learning strategies besides their current personal preferences can be tried out and developed in the everyday working and learning process, leading to improvement of on-the-job learning and work performance (Berings *et al.* 2005). Furthermore, our instrument could be used to improve person-job fit, that is, finding a good fit between learning style and the learning demands of a job in order to promote effective learning (Hayes & Allinson 1998).

### Author contributions

MB, RP, RJS and MV were responsible for the study conception and design. MB was responsible for the drafting of the manuscript. MB performed the data collection. MB and MV performed the data analysis. RP, RJS and MV obtained funding and MB provided administrative support. MB, RP, RJS and MV made critical revisions to the paper. MB and MV provided statistical expertise. RP and RJS supervised the study.

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Appendix 1 On-the-job Learning Styles Questionnaire for the Nursing Profession (Reproduced from Berings 2006)

	Never	Almost never	Sometimes	Often	Almost always	Always
A) In the last two years I have improved my technical nursing skills by...						
1. experiencing relevant job situations	1	2	3	4	5	6
2. adopting new tasks in which these can be developed	1	2	3	4	5	6
3. searching for information in books, journals, on TV or the Internet	1	2	3	4	5	6
4. attending informative meetings or a coaching programme	1	2	3	4	5	6
5. reflecting about this by myself	1	2	3	4	5	6
6. asking my colleagues informative questions	1	2	3	4	5	6
7. reflecting about this with my colleagues	1	2	3	4	5	6
B) In the last two years I have developed myself in supporting patients and family by...						
8. experiencing relevant job situations	1	2	3	4	5	6
9. adopting new tasks in which this can be developed	1	2	3	4	5	6
10. searching for information in books, journals, on TV or the Internet	1	2	3	4	5	6
11. attending informative meetings or a coaching programme	1	2	3	4	5	6
12. reflecting about this by myself	1	2	3	4	5	6
13. asking my colleagues informative questions	1	2	3	4	5	6
14. reflecting about this with my colleagues	1	2	3	4	5	6
C) In the last two years I have developed myself in putting emotionally difficult situations into perspective by...						
15. experiencing relevant job situations	1	2	3	4	5	6
16. adopting new tasks in which this can be developed	1	2	3	4	5	6
17. searching for information in books, journals, on TV or the Internet	1	2	3	4	5	6
18. attending informative meetings or a coaching programme	1	2	3	4	5	6
19. reflecting about this by myself	1	2	3	4	5	6
20. asking my colleagues informative questions	1	2	3	4	5	6
21. reflecting about this with my colleagues	1	2	3	4	5	6
D) In the last two years I have developed myself in planning the care for my patients by...						
22. experiencing relevant job situations	1	2	3	4	5	6
23. adopting new tasks in which this can be developed	1	2	3	4	5	6
24. searching for information in books, journals, on TV or the Internet	1	2	3	4	5	6
25. attending informative meetings or a coaching programme	1	2	3	4	5	6
26. reflecting about this by myself	1	2	3	4	5	6
27. asking my colleagues informative questions	1	2	3	4	5	6
28. reflecting about this with my colleagues	1	2	3	4	5	6
E) In the last two years I have learned more about where I can find reliable information sources by...						
29. experiencing relevant job situations	1	2	3	4	5	6
30. adopting new tasks in which this can be developed	1	2	3	4	5	6

## Appendix 1 (Continued)

	Never	Almost never	Sometimes	Often	Almost always	Always
31. searching for information in books, journals, on TV or the Internet	1	2	3	4	5	6
32. attending informative meetings or a coaching programme	1	2	3	4	5	6
33. reflecting about this by myself	1	2	3	4	5	6
34. asking my colleagues informative questions	1	2	3	4	5	6
35. reflecting about this with my colleagues	1	2	3	4	5	6
F) In the last two years I have developed myself in taking initiatives at work by...						
36. experiencing relevant job situations	1	2	3	4	5	6
37. adopting new tasks in which this can be developed	1	2	3	4	5	6
38. searching for information in books, journals, on TV or the Internet	1	2	3	4	5	6
39. attending informative meetings or a coaching programme	1	2	3	4	5	6
40. reflecting about this by myself	1	2	3	4	5	6
41. asking my colleagues informative questions	1	2	3	4	5	6
42. reflecting about this with my colleagues	1	2	3	4	5	6