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Quality assurance of the clinical learning environment in Austria: Construct validity of the Clinical Learning Environment, Supervision and Nurse Teacher Scale (CLES + T scale)

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ABSTRACT

Background: Within nursing education, the clinical learning environment is of a high importance in regards to the development of competencies and abilities. The organization, atmosphere, and supervision in the clinical learning environment are only a few factors that influence this development. In Austria there is currently no valid instrument available for the evaluation of influencing factors.

Objectives: The aim of the study was to test the construct validity with principal component analysis as well as the internal consistency of the German Clinical Learning Environment, Supervision and Teacher Scale (CLES + T scale) in Austria.

Method: The present validation study has a descriptive-quantitative cross-sectional design. The sample consisted of 385 nursing students from thirteen training institutions in Austria. The data collection was carried out online between March and April 2016. Starting with a polychoric correlation matrix, a parallel analysis with principal component extraction and promax rotation was carried out due to the ordinal data.

Results: The exploratory ordinal factor analysis supported a four-component solution and explained 73% of the total variance. The internal consistency of all 25 items reached a Cronbach's α of 0.95 and the four components ranged between 0.83 and 0.95.

Conclusion: The German version of the CLES + T scale seems to be a useful instrument for identifying potential areas of improvement in clinical practice in order to derive specific quality measures for the practical learning environment.

1. Introduction

The reform measures implemented in the context of the European cooperative project Bologna process since 1999 (European Commission, 2017) have led to a homogenization of the academic education in Europe. In addition, student mobility was encouraged and a uniform graduation system and equalization of university degrees established. Nurse education programs have had dissimilar educational standards; and since the Bologna process, European countries have been striving to reform their higher education systems (Lovrić et al., 2016; Sahmel, 2018, p. 7; Vizcaya-Moreno et al., 2015). In 2016, the Austrian nursing law amendment has been the result of many efforts to transfer the existing hospital-based vocational nursing system to the tertiary higher education system at colleges and universities. However, due to a transitional period until 2024, it is still possible to complete the three-year nursing education program at hospital-based vocational nursing schools (Auböck et al., 2013; Them et al., 2018, p. 133). Thus, all graduates receive a diploma in nursing; however, a bachelor's degree can only be earned at colleges or universities. These reform measures also have helped to create transparency in the nursing education system (Vizcaya-Moreno et al., 2015).

Direct patient contact is an integral part of the three-year clinical training and takes place at various nursing institutions (Lovrić et al., 2016; Them et al., 2018, p. 135; Warne et al., 2010). Nursing students spent about half of their time in clinical practice (Foster et al., 2015; Lovrić et al., 2016), which amounts to about 2460 clinical placement hours in Austria (Auböck et al., 2013; Them et al., 2018, p. 135). The remaining time is spent at nursing school or at higher education institutions (Foster et al., 2015; Them et al., 2018, p. 135). This type of training distribution is common for practically oriented professions, such as the nursing profession, and is found in many parts of Europe (Foster et al., 2015; Lovrić et al., 2016; Papastavrou et al., 2015;

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Serçekuş and Başkale, 2016).

The clinical place of learning is of great importance for the competence development of future registered nurses (Bergjan and Hertel, 2013; Doyle et al., 2017; Grobecker, 2016). Based on the results of a survey conducted in nine European countries ($n = 1903$), nurses' vocational training requires the direct patient contact in clinical practice (Warne et al., 2010). In many European countries, the importance of learning in clinical practice is reflected in the sum of the practical hours to be completed (Bergjan and Hertel, 2013; Foster et al., 2015; Serçekuş and Başkale, 2016; Tomietto et al., 2012). In Austria, the mentorship system at the clinical practice placement is divided between nurse teachers from the education institutions and ward nurses. Students are accompanied by a nurse teacher for at least 50 h during their three-year training and receive instructions on planning nursing care, clinical skills, and communication with patients. They also get feedback from their teacher about their performance. For the remaining part of the clinical placement, nursing students are supervised by a ward nurse. The clinical placement promotes cognitive, affective, and psychomotor skills and is decisively involved in the development of competencies and professional identity (Papastavrou et al., 2015). The clinical practice environment needs to be conducive to learning in order to develop decision-making competencies (Bergjan and Hertel, 2013; Flott and Linden, 2016). Bergjan and Hertel (2013) and Flott and Linden (2016) acknowledge that competency and ability development during clinical training is influenced by the guidance and supervision of student nurses. In addition to these factors, a valuable approach to student nurses also has a positive effect on learning in clinical practice (Lamont et al., 2015). Equally important is the quality of nursing care experienced by student nurses (Hegenbarth et al., 2015; Papastavrou et al., 2010). Furthermore, a placement period of more than seven weeks supports the student's success in clinical practice (Warne et al., 2010). Also the cooperation between the school and practical environment may influence a positive clinical practice experience (Hooven, 2015). Indicators of a functioning cooperation are a common learning goal and a coordinated communication system (Chuan and Barnett, 2012). All of these factors are essential to foster a positive clinical placement experience and aid the growth of social capital to retain future registered nurses in the nursing workplace (Lamont et al., 2015; Materne et al., 2017). It is thus all the more important to understand that the clinical learning environment is subject to many influencing factors (Hooven, 2015). Flott and Linden (2016) as well as Salamonson et al. (2015) reported that the learning success depends on how the student nurses perceive the learning environment. Thus, it can be concluded that facility-specific quality assurance measures are needed to ensure the quality of nursing education programs (Lamont et al., 2015; Vizcaya-Moreno et al., 2015). In the context of transferring the existing Austrian hospital-based nursing education programs into a tertiary higher education system, the question arises as to how learning in the clinical practice placement can be measured and improved (Doyle et al., 2017; Vizcaya-Moreno et al., 2015).

2. Background

Skills development in the clinical learning environment is influenced by many factors. Bradbury-Jones et al. (2010) found in this context that certain related factors favored the acquisition of competencies in the clinical learning environment and were experienced by students in the sense of empowerment. In particular, the individual and professional support by nurse teachers was of value. Especially, the appreciation given to the students had a positive effect on self-awareness, the self-efficacy expectation, and the subsequent learning success. Also, the teacher's commitment had a positive impact on the nursing team (Bradbury-Jones et al., 2010). In addition, studies proved a correlation between the commitment of team members and a positive clinical experience by students (Tomietto et al., 2016) and students' success (Hegenbarth et al., 2015).

In order to identify the influencing factors and thus ensure the learning success of students in clinical practice requires the use of standardized instruments (Hooven, 2014). The Clinical Learning Environment, Supervision and Nurse Teacher (CLES + T) Evaluation Scale (Saarikoski et al., 2008) is regarded as gold standard for evaluating the quality of the clinical learning environment (Tomietto et al., 2012). The CLES + T scale almost replicates the described influencing factors. It can be concluded that the use of this instrument and the gained insights assess on the one hand the quality of the practical learning environment and also allows conclusions of the experienced supervision. The CLES + T scale also allows cross-cultural comparisons since it is available in several languages, which may further promote the homogenization of the academic education in Europe (Lovrić et al., 2016). A German version exists since 2010. The scale was validated by Bergjan and Hertel (2013) in Germany ($n = 167$) as well as Schaefer et al. (2012) in Switzerland ($n = 196$). However, no results are available regarding the psychometric properties of the CLES + T scale in Austria.

3. Methods

3.1. Aim

Aim of the study is to test the construct validity by principal component analysis and internal consistency of the German Clinical Learning Environment, Supervision and Teacher Scale (CLES + T scale) in Austria.

3.2. Design

The present validation study has a descriptive-quantitative cross-sectional design.

3.3. Participants and Setting

Data collection was carried out at hospital-based vocational nursing schools as well as colleges and universities. In eight out of nine Austrian states, a total of 385 nursing students from 13 nursing institutions participated. Data from nursing students who completed their clinical practice on a ward were included in the study. There was no restriction on the level of education of the nursing students (Bergjan and Hertel, 2013; Schaefer et al., 2012; Saarikoski et al., 2008). However, the minimum age requirement was 18 years old.

3.4. Ethical Considerations

The study was submitted to the Research Committee for Scientific and Ethical Questions (RCSEQ) at the principal investigator's university and received a positive voting (Ref.Nr:1607/2016). Nursing students received written information and signed the informed consent before voluntary participating in the study. Anonymity was ensured by the use of SoSci Survey generated access codes (SoSci Survey, 2017).

3.5. Research Instrument

The Clinical Learning Environment, Supervision and Nurse Teacher Evaluation Scale (CLES + T) (Saarikoski et al., 2008) represents the further development of the CLES scale (Saarikoski et al., 2002). Both instruments result from a comprehensive literature research. For the theoretical foundation of the CLES scale, 67 studies with the topics “clinical learning environment” and “supervisory relationship” were subjected to a thorough review (Saarikoski et al., 2005). For the extended version of the CLES scale, five reviews, 87 empirical studies, and five instruments for assessing the quality of clinical learning environment published between 1980 and 2006 were included in the analysis (Saarikoski et al., 2008). According to Saarikoski et al. (2013), the instrument is now available in over 29 languages.

The current version of the CLES + T scale consists of 34 items with five sub-dimensions (Johansson et al., 2010). The topic clinical learning environment is represented by the sub-dimensions “Pedagogical atmosphere on the ward” (9 items), “Leadership style of the ward manager” (4 items), and “Premises of nursing on the ward” (4 items). The sub-dimension “Pedagogical atmosphere on the ward” is the result of merging the original sub-dimensions “Ward atmosphere” and “Premises of nursing on the ward”. The sub-dimension “Supervisory relationship” consists of eight items and is supplemented by questions concerning the accompanying teacher (Schaefer et al., 2012). The last sub-dimension “Role of nurse teacher in clinical practice” has nine items. In addition, the instrument contains a further sub-dimension, which is intended to reflect the overall satisfaction with the clinical learning environment. It contains three items “The ward can be regarded as a good learning environment”, “Overall I am satisfied with the supervision I received”, and “I am satisfied with the just completed clinical placement” (Bergjan and Hertel, 2013; Johansson et al., 2010). All items are rated by using a 5-point rating scale (1 = fully disagree, 2 = disagree to some extent, 3 neither agree nor disagree, 4 = agree to some extent, and 5 = fully agree) (Bergjan and Hertel, 2013; Johansson et al., 2010; Saarikoski et al., 2008; Schaefer et al., 2012).

The CLES + T scale has been tested for its statistical quality several times in Europe. Thereby the content validity, construct validity, and concurrent validity as well as a high internal consistency ($\alpha = 0.86–0.95$) was established (Bergjan and Hertel, 2013; Saarikoski et al., 2008; Warne et al., 2010). The results of the investigations confirmed the underlying factor model of the CLES and the CLES + T scale. The original CLES scale was able to explain 64% of the total variance by means of principal factor analysis and varimax rotation (Saarikoski et al., 2005). For the German version of the CLES + T scale ($n = 167$), 73% of the total variance could be explained by using principal factor analysis (Bergjan and Hertel, 2013). Additional international construct validity results are displayed in Table 1.

Permission for testing and linguistically adapting the instrument was obtained by the author of the original CLES + T. The instrument had to be linguistically adapted in order to implement it in Austria. The items 1, 3, 4, 5, 7, 8, 10, 11, 12, 14, 15, 19, 20, 21, 22, 23, and 25, did not need to be adapted. The nine items of the Teacher scale were not included in the present study since the students are not accompanied by a nurse teacher on each clinical practice day in Austria. Minor linguistic and cultural adaptations were made to items 3, 13, 16, and 17. Items 6, 9, and 24 of the German CLES + T scale did not reflect the content of the original scale items. Therefore, a forward translation based on the translation process by the International Society for Pharmacoeconomics and Outcomes Research (ISPOR) (Wild et al., 2005) was carried out for these items by two independent English teachers with German as native language. The updated German translation was presented to five nursing students. They evaluated the new version as understandable, so no further changes were made.

3.6. Procedure

A pretest was carried out in order to exclude sources of error during the actual investigation. For this purpose, the instrument was distributed to six nursing students. The students' suggestions were taken into account if possible and included in the questionnaire.

Schools, colleges, and universities were asked in writing or by telephone for approval of the planned study. In order to enable informed consent, the principals received a copy of the information sheet and the instrument. In this context, the number of possible participants was determined as well as the best possible time for conducting the study. The online survey took place between March and April 2016. For this purpose, the instrument was digitally recorded in SoSci Survey (SoSci Survey, 2017). In order to allow only one-time access to the online survey, serial numbers were issued for access restrictions. These consisted of four characters (20 BIT, letters and numbers mixed) and were automatically generated via the management site of the project. In addition, a number for each institution was recorded. These prepared codes were forwarded to the contact persons of the participating institutions and passed on to potential nursing students. At the end of the questionnaire, the sociodemographic data of the participants was collected.

3.7. Data Analysis

Data analysis was performed using IBM SPSS Statistics 22 for Windows and using SPSS R-Menu for ordinal factor analysis by Basto and Pereira (2012) (Version 2.15.3). Data generated in the online survey were converted and then analyzed. Sociodemographic data were analyzed by the use of descriptive statistic.

The construct validity was tested in accordance with Saarikoski et al. (2008) by using principal component analysis and promax rotation. The correlation matrix was calculated with polychoric correlations since the data was ordinal scaled and a polychoric correlation estimates the correlation between the latent variables and not their ordinal expressions more accurately (Gadermann et al., 2012). Data adequacy was analyzed with the Kaiser-Meyer-Olkin coefficient (KMO) and Bartlett-Test. The number of components was determined by interpretation of the scree plot and the eigenvalue criteria greater than one. In addition, parallel analysis (PA-PCApm) with principal component extraction was carried out because of the ordinal data (Courtney and Gordon, 2013). Also the comparison data analysis (CD) using Spearman correlation (Ruscio and Roche, 2012) was assessed as well as the minimum average partial test (MAP-Test). Three-, four-, and five-component models were analyzed in a pattern and structure matrix. In order to obtain information on the correlation strength between the individual items with the remaining items of the sub-dimension, an item analysis was carried out based on the study by Johansson et al. (2010). Item difficulty (P_i) and item discriminatory power (r_{it}) was analyzed for each

Table 1
Overview of international study results with CLES + T.

Author(s), publication year	Country	Nursing students (*n*)	Education level	Internal consistency[a]	Construct validity[b]
Lovrić et al., 2016	Croatia	136	1st–3rd	0.77–0.97	PCA (71.5)
Papastavrou et al., 2015	Greece	463	–	0.79–0.95	EFA, PCA (67.4)
Vizcaya-Moreno et al., 2015	Spain	370	3rd	0.80–0.97	EFA, CFA (66.4)
Bergjan and Hertel, 2013	Germany	240	1st–3rd	0.82–0.96	EFA, PCA (73)
Henriksen et al., 2012	Norway	407	1st–3rd	0.85–0.96	PCA (64)
Tomietto et al., 2012	Italy	855	1st–3rd	0.80–0.96	EFA, CFA (67)
Johansson et al., 2010	Sweden	324	1st–3rd	0.75–0.96	EFA (60.2)
Saarikoski et al., 2008	Finland	549	–	0.77–0.96	EFA,PCA (64)
Saarikoski et al., 2002[c]	Finland	416	2nd–3rd	0.73–0.94	EFA (64)

[a] Cronbach's alpha (α).
[b] Methods and explained variance (%): exploratory factor analysis (EFA), confirmatory factor analysis (CFA), principal component analysis (PCA).
[c] CLES.

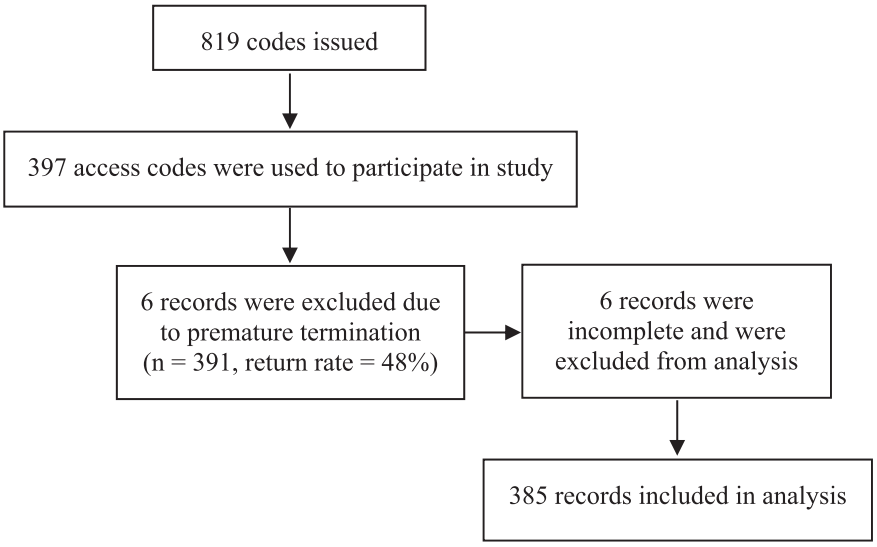

Fig. 1. Flowchart of study participation.

individual item. Internal consistency was determined for each sub-dimension with Cronbach's alpha, which is theoretically equivalent to ordinal alpha (Gadermann et al., 2012).

4. Results

4.1. Participants and Clinical Placement

A total of 819 access codes were issued for the online study. Of these, 397 access codes were used by nursing students to participate in the study and overall 385 records were included for the analysis (Fig. 1).

The participating 77.3% (n = 296) female and 22.7% (n = 87) male nursing students were aged between 18 and 50 years. The mean age was 25.58 (SD ± 6.662) years. Further sociodemographic data are presented in Table 2.

4.2. Principal component analysis

The polychoric correlation matrix showed linear relationships between the items (Table 3). The data adequacy for carrying out a principal component analysis could be confirmed with the Bartlett test for sphericity ($\chi^2_{(df\ 300)} = 9590.732$, $p < .001$) and the verification of the existence of substantial correlations (KMO = 0.941).

The scree plot (Fig. 2) was not explicit with regard to component selection. Based on the results of the criterion eigenvalue greater than one, the CD analysis by Spearman correlation, and the MAP, five components should be extracted. The parallel analysis resulted in three components.

Since the results did not agree on the number of extracted components, the goodness-of-fit was calculated for each model (Tables 4, 5). Due to the FIT indices (GFI, RMSR, RMSP), the ratio of the residuals > 0.05 as well as theoretical considerations, the model with four principal components was chosen since it represented the original data best.

The results of the main component analysis with promax rotation for four components showed item communality (h^2) of over 0.6. Exceptions are items 3 and 6 ($h^2 = 0.393$; $h^2 = 0.494$). The average communality of all items was 0.733. The analysis of the pattern and structure matrix (Table 6) showed that the items clearly loaded on the four components. The number of items in the first, second, and fourth components correspond to those of (Saarikoski et al., 2008). Only the items 7 and 8 loaded higher on the third component and additionally had a relatively high secondary load on the fourth component.

Table 2
Sociodemographic data of participants.

	n	%
Gender		
Female	296	76.9
Male	87	22.6
Not specified	2	0.5
Age		
18–22	153	39.7
23–27	132	34.3
28–32	42	10.9
33–37	22	5.7
≥38	30	7.8
Not specified	6	1.6
Form of training		
Nursing school	342	88.8
College or university	42	10.9
Not specified	1	0.3
Education level		
1st training year 1st and 2nd semester	52	13.5
2nd training year 3rd and 4th semester	127	33.0
3rd training year 5th and 6th semester	205	53.2
Not specified	1	0.3
Ward		
Surgery	167	43.4
Internal medicine	209	54.3
Not specified	9	2.3
Duration of clinical placement		
4–6 weeks	232	60.3
7–9 weeks	122	31.7
≥10 weeks	27	7.0
Not specified	3	0.8
Excluded	1	0.3

The four-component model had a strong first component and explained 73.3% of the total variance. Before rotation, the first component explained 55.7% of the total variance. The three remaining components explained 17.6% (Table 7).

The name of the components one, two, and four were not changed (Saarikoski et al., 2008). Only component three was changed to "Competence-based requirements" due to the allocation of item 7 and 8.

Table 3
Polychoric correlation matrix (two step).

	I1[a]	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	I14	I15	I16	I17	I18	I19	I20	I21	I22	I23	I24	I25
I1[a]	1.000																								
I2	0.776	1.000																							
I3	0.552	0.421	1.000																						
I4	0.660	0.792	0.452	1.000																					
I5	0.656	0.686	0.483	0.647	1.000																				
I6	0.563	0.488	0.329	0.498	0.591	1.000																			
I7	0.425	0.515	0.369	0.449	0.597	0.518	1.000																		
I8	0.420	0.514	0.246	0.459	0.564	0.460	0.842	1.000																	
I9	0.564	0.691	0.416	0.632	0.753	0.521	0.713	0.716	1.000																
I10	0.410	0.464	0.337	0.585	0.543	0.446	0.494	0.490	0.522	1.000															
I11	0.452	0.552	0.291	0.610	0.549	0.512	0.424	0.420	0.484	0.729	1.000														
I12	0.522	0.553	0.426	0.563	0.547	0.514	0.470	0.469	0.489	0.699	0.696	1.000													
I13	0.378	0.417	0.312	0.491	0.447	0.432	0.372	0.364	0.400	0.650	0.597	0.734	1.000												
I14	0.487	0.535	0.430	0.527	0.524	0.422	0.478	0.412	0.528	0.587	0.556	0.508	0.426	1.000											
I15	0.398	0.451	0.374	0.437	0.480	0.408	0.470	0.414	0.487	0.479	0.470	0.445	0.352	0.697	1.000										
I16	0.256	0.366	0.250	0.284	0.398	0.390	0.486	0.414	0.471	0.391	0.415	0.302	0.264	0.532	0.593	1.000									
I17	0.438	0.497	0.432	0.461	0.599	0.487	0.520	0.468	0.598	0.485	0.442	0.442	0.374	0.611	0.641	0.670	1.000								
I18	0.584	0.603	0.395	0.531	0.671	0.452	0.533	0.524	0.613	0.478	0.417	0.430	0.332	0.496	0.460	0.461	0.537	1.000							
I19	0.495	0.544	0.420	0.462	0.630	0.408	0.512	0.497	0.597	0.467	0.454	0.438	0.343	0.459	0.485	0.383	0.501	0.811	1.000						
I20	0.533	0.542	0.382	0.497	0.635	0.497	0.550	0.512	0.600	0.449	0.448	0.521	0.370	0.425	0.454	0.401	0.487	0.754	0.759	1.000					
I21	0.596	0.683	0.419	0.642	0.720	0.467	0.604	0.573	0.700	0.551	0.537	0.566	0.408	0.512	0.506	0.387	0.526	0.838	0.802	0.832	1.000				
I22	0.590	0.632	0.497	0.579	0.738	0.502	0.551	0.506	0.646	0.513	0.517	0.572	0.427	0.485	0.455	0.392	0.520	0.809	0.743	0.782	0.869	1.000			
I23	0.549	0.565	0.458	0.528	0.645	0.489	0.549	0.492	0.619	0.483	0.491	0.527	0.405	0.486	0.485	0.445	0.504	0.803	0.762	0.786	0.838	0.884	1.000		
I24	0.593	0.626	0.398	0.590	0.612	0.494	0.523	0.470	0.578	0.547	0.533	0.535	0.444	0.479	0.429	0.369	0.436	0.759	0.672	0.709	0.808	0.823	0.807	1.000	
I25	0.616	0.640	0.404	0.592	0.651	0.495	0.514	0.470	0.627	0.498	0.526	0.518	0.426	0.443	0.405	0.376	0.457	0.769	0.717	0.738	0.827	0.849	0.836	0.879	1.000

[a] Item 1 - Item 25.

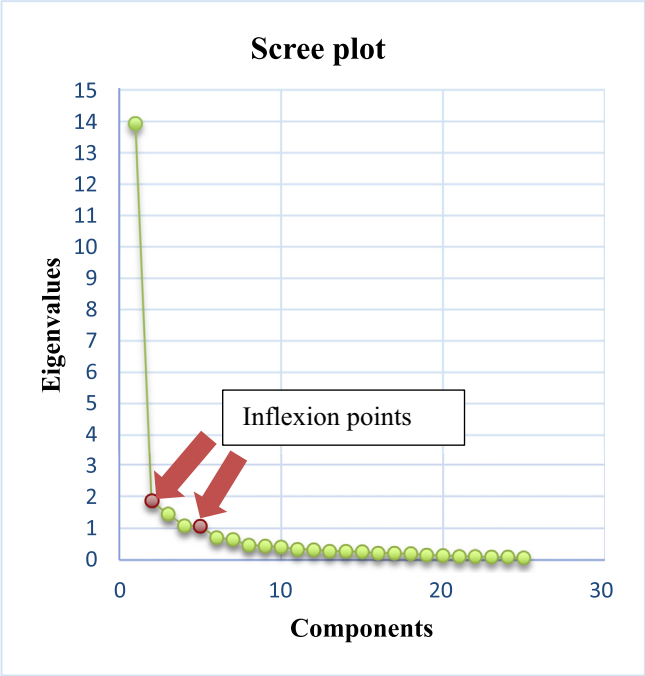

Fig. 2. Scree plot with points of Inflexions.

Table 4
Goodness-of-fit/comparison of data.

	PCA 3[a]	PCA 4	PCA 5
GFI[b]	0.978	0.984	0.989
RMSR[c]	0.054	0.045	0.350
RMSP[d]	0.168	0.158	0.153

[a] Principal component analysis.
[b] Comparative fit index.
[c] Root mean square of the residuals.
[d] Root-mean-square of partial correlations among the variables.

Table 5
Number and proportion of residues > 0.05 for each model.

	PCA 3	PCA 4	PCA 5
Residues > 0.05 (%)	83 (27.667%)	66 (22%)	37 (12.333%)

4.3. Item Difficulty, Item Discriminatory Power, and Internal Consistency

The check of the distribution of the individual items showed a negative skew (−0.693 to −1.431, SE = 0.124) for all items. On average the skewness was −0.98. The kurtosis was platykurtic for ten items (−0.112 to −0.674) and the other 15 items were leptokurtic (0.364 to 1.605). On average the kurtosis was 0.33. The standard error of the kurtosis was 0.248. The item difficulty (P_i) ranged between P_i = 69.0 and 83.5 (25 items). This showed that the majority of the nursing students agreed with the statements in the sense of the criterion. Also the item discriminatory power was above the lower limit of 0.4. The lowest discriminatory power (r_{it}) had item 16 (r_{it} = 0.473), the highest item 21 (r_{it} = 0.812). The component "Supervisory relationship" had the highest discriminatory power (r_{it} = 0.711 to 0.812).

Each of the four components showed an average internal consistency of Cronbach's α > 0.88 (Table 8). The internal consistency for the whole scale amounted to α = 0.95.

5. Discussion

The development of competences in the clinical setting depends on both knowledge and experience. In Austria, no valid assessment instrument, such as the CLES + T scale, is used to ensure the quality of the clinical placement, which may reveal the social capital in the workplace and aids to commence quality improvement measures (Materne et al., 2017). This is cause for concern since the clinical place of learning is decisively involved in competence development (Bergjan and Hertel, 2013) and influences student's learning, confidence, and feelings of belonging (Grobecker, 2016). Thus, student satisfaction with the clinical placement also reflects the quality of the clinical learning experience (Materne et al., 2017), which is imperative for future employment intentions (Lamont et al., 2015). Therefore, the aim of the present study was to test the construct validity of the CLES + T scale with regards to its application in Austria.

For this purpose, a principal component analysis was carried out instead of a confirmatory factor analysis since no data was available in Austria at the time of the study. A factor analysis was omitted because of the available data structure. The available data did not fulfill the basic conditions of normal distribution, interval scaling, and undistorted correlations (Bühner, 2011, p. 343). Thus carrying out a principal component analysis offered the best option for a first description of the data. The four-component model explained > 73% of the total variance. However, the total variance determined by the principal component analysis exceeds the actual overall variance by three to five percentage points (Saarikoski et al., 2008). Analogous to the German study (Bergjan and Hertel, 2013), the "Nurse teacher scale" (+T) of the CLES + T was omitted since nurse teachers only accompany students for about 50 h during their three-year training. The German study also explained 72,85% of the total variance (Bergjan and Hertel, 2013). In line with international studies, the component "Supervisory relationship" was the most important in this study and explained 40% of the total variance. International results revealed similar high total explanation percentages of 40% (Saarikoski et al., 2008), 48% (Bergjan and Hertel, 2013), and 38% (Papastavrou et al., 2015) with a five factor model. Also the component "Pedagogical atmosphere on the ward" explained 35% of the total variance. The structure matrix showed high item correlation in the component "Supervisory relationship" ($0.853 \leq r \geq 0.913$) and moderate to high item correlation in the component "Pedagogical atmosphere on the ward" ($0.612 \leq r \geq 0.865$). The confirmatory factor analysis by Vizcaya-Moreno et al. (2015) demonstrated moderate correlation (r_ϕ = 0.65) between these two components. Possible explanations offer the results by Tomietto et al. (2016) and Bradbury-Jones et al. (2010). They found out that a positive attitude of the supervisor did not only affect the students, but also the team and thus the learning atmosphere. Furthermore, it became clear that the remaining components "Leadership style of the ward manager" and "Competence-based requirements" were far less stable since each component explained < 30% of the total variance. The reason might be the different general conditions for selecting the sample as well as the country-specific nursing education programs being offered at hospital-based vocational schools instead of at university level (Foster et al., 2015; Lovrić et al., 2016; Papastavrou et al., 2015). In the present study, almost all items loaded onto the components intended by Saarikoski et al. (2008). Only the two items "There were sufficient meaningful learning situations on the ward" (Item 7) and "The learning situations were multidimensional in terms of content" (Item 8) loaded onto the third and fourth components. Normally, an item is assigned to the component with the highest load. However, a stricter allocation rule is the Fuerntratt criterion (Bühner, 2011, p. 203). An item can be assigned to a component if the item square load on that component constitutes at least 50% of the item communality. Therefore, both items should be reworded for the Austrian version and added to the third component.

Furthermore, the instrument has high internal consistency. This

Table 6
CLES + T pattern- and structure matrix of component loadings (Promax, initial Varimax).

Items on components (C)		Pattern matrix				Structure matrix			
		C1	C2	C3	C4	C1	C2	C3	C4
Component 1: Supervisory relationship									
I23	There was a mutual interaction in the supervisory relationship	**0.810**	0.084	0.118	0.061	**0.913**	0.421	0.487	0.517
I25	The supervisory relationship was characterized by a sense of trust	**0.776**	0.131	−0.037	0.186	**0.892**	0.455	0.382	0.586
I18	My supervisor showed a positive attitude towards supervision	**0.768**	−0.052	0.184	0.133	**0.885**	0.321	0.519	0.541
I22	The supervision was based on a relationship of equality and promoted my learning	**0.767**	0.105	0.043	0.187	**0.907**	0.453	0.451	0.603
I19	I felt that I received individual supervision	**0.757**	0.002	0.184	0.049	**0.853**	0.339	0.501	0.473
I20	I continuously received feedback from my supervisor	**0.756**	0.037	0.133	0.089	**0.862**	0.372	0.476	0.507
I21	Overall I am satisfied with the supervision I received	**0.743**	0.081	0.099	0.207	**0.906**	0.447	0.496	0.624
I24	Mutual respect and approval prevailed in the supervisory relationship	**0.739**	0.203	−0.026	0.143	**0.864**	0.500	0.386	0.558
Component 2: Leadership style of the ward manager (WM)									
I13	The effort of individual employees was appreciated	0.024	**0.820**	0.004	0.060	0.331	**0.853**	0.308	0.396
I12	Feedback from the WM could easily be considered a learning situation	0.108	**0.731**	0.025	0.193	0.455	**0.852**	0.384	0.541
I11	The WM was a team member	0.088	**0.721**	0.144	0.093	0.431	**0.835**	0.453	0.472
I10	The WM regarded the staff on her/his ward as a key resource	0.101	**0.717**	0.221	0.024	0.442	**0.834**	0.508	0.438
Component 3: Competence-based requirements									
I16	Documentation of nursing (e.g. nursing plans, daily recording of nursing procedures, etc.) was clear	0.081	0.035	**0.860**	−0.147	0.362	0.290	**0.847**	0.231
I17	There were no problems in the information flow related to patients' care	0.056	0.064	**0.716**	0.158	0.432	0.383	**0.819**	0.481
I15	Patients received individual nursing care	0.056	0.189	**0.703**	0.004	0.398	0.443	**0.789**	0.372
I14	The wards nursing philosophy was clearly defined	−0.006	**0.319**	**0.552**	0.151	0.389	0.560	**0.713**	0.484
I7	There were sufficient meaningful learning situations on the ward	0.139	−0.057	**0.537**	**0.359**	0.499	0.310	**0.710**	0.606
I8	The learning situations were multidimensional in terms of content	0.112	−0.042	**0.474**	**0.381**	0.462	0.303	**0.649**	0.597
Component 4: Pedagogical atmosphere on the ward									
I1	The staffs were easy to approach	0.155	0.066	−0.080	**0.797**	0.518	0.406	0.305	**0.865**
I2	I felt comfortable going to the ward at the start of my shift	0.156	0.103	0.044	**0.731**	0.549	0.459	0.417	**0.861**
I4	There was a positive atmosphere on the ward	0.078	**0.311**	−0.029	**0.661**	0.481	0.589	0.356	**0.809**
I9	The ward can be regarded as a good learning environment	0.197	−0.048	**0.382**	**0.540**	0.583	0.358	0.649	**0.758**
I5	The staffs were generally interested in student supervision	0.283	0.079	0.199	**0.537**	0.638	0.452	0.540	**0.776**
I3	During staff meetings (e.g. before shifts) I felt comfortable taking part in the discussions	0.078	0.050	0.079	**0.526**	0.372	0.310	0.327	**0.612**
I6	The staff learned to know the students by their personal names	0.053	0.214	0.222	**0.427**	0.412	0.474	0.476	**0.621**

The bolded numbers represent the allocation to the main component.

applies to the entire instrument as well as the individual components. Similar results are presented in international studies (Lovrić et al., 2016; Papastavrou et al., 2015; Vizcaya-Moreno et al., 2015; Bergjan and Hertel, 2013; Henriksen et al., 2012; Johansson et al., 2010; Tomietto et al., 2012; Saarikoski et al., 2008, 2005).

Overall, the results of the PCA described the multi-dimensional structure of the CLES + T scale to a great extent by four components, while also differentiating the complex characteristic features in homogeneous sections. The homogeneity of the Austrian CLES + T scale is supported by comparable international results (Lovrić et al., 2016; Papastavrou et al., 2015; Vizcaya-Moreno et al., 2015), except for the teacher scale part.

5.1. Limitations

With regards to the transferability of the results it needs to be considered that the majority of participants came only from two out of eight Austrian states and received their training at hospital-based vocational nursing schools and not at colleges or universities. Therefore, a homogeneous sample could not be achieved. The participating nursing students had different levels of knowledge, experiences, conceptions, and interpretation patterns, leading to distortions of results.

Table 8
Results of internal consistency.

Components	Number of items	Cronbach's alpha
(1) Supervisory relationship	8	0.952
(2) Leadership style of the ward manager	4	0.855
(3) Competence-based requirements	6	0.838
(4) Pedagogical atmosphere on the ward	7	0.872

6. Conclusions

Based on the results obtained, an implementation of the Austrian version of the CLES + T scale can be recommended, assuming that items 7 and 8 are depicted in component three and linguistically adapted.

The use of the instrument allows the assessment of the quality of the

Table 7
Explained variance.

Before rotation				After rotation	
Components[a]	Eigenvalue	% variance	Accumulated %	Rotation - total squared loadings	% variance
1	13.935	55.741	55.741	9.916	39.665
2	1.859	7.435	63.176	6.544	26.177
3	1.450	5.801	68.976	7.319	29.274
4	1.092	4.369	73.345	8.775	35.100

[a] Component 1: Supervisory relationship. Component 2: Leadership style of the ward manager. Component 3: Competence-based requirements. Component 4: Pedagogical atmosphere on the ward.

clinical learning environment, taking into account the factors experienced by the nursing students in the sense of empowerment. Furthermore, the Austrian CLES + T scale can be used by executives as well as by school principals in order to define suitable clinical training locations and to develop appropriate quality management.

Hitherto, there are no studies available as to when a need for action needs to be evaluated. In addition, the effectiveness of steps taken to improve the clinical learning environment could be evaluated by the scale and should be compared to international findings. Based on the results generated by the present study, further studies such as a confirmatory factor analysis should be conducted to evaluate the theoretical or empirical model quality of the scale. The test-retest reliability of the scale should also be tested.

Statement of Authors' Roles

All authors have made substantial contribution to the manuscript. E

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Conflicts of Interest

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References

Auböck, U., Them, C., Haselwanter-Schneider, A., 2013. Die Zukunft der praktischen Ausbildung von Pflegestudierenden. [The future of the clinical placement of nursing students]. Pflegewissenschaft 15, 197.

Basto, M., Pereira, J.M., 2012. An SPSS R-menu for ordinal factor analysis. J. Stat. Softw. 46, 1–29.

Bergjan, M., Hertel, F., 2013. Evaluating students' perception of their clinical placements - testing the clinical learning environment and supervision and nurse teacher scale (CLES + T scale) in Germany. Nurse Educ. Today 33, 1393–1398. http://dx.doi.org/10.1016/j.nedt.2012.11.002.

Bradbury-Jones, C., Irvine, F., Sambrook, S., 2010. Empowerment of nursing students in clinical practice: spheres of influence. J. Adv. Nurs. 66, 2061–2070. http://dx.doi.org/10.1111/j.1365-2648.2010.05351.x.

Bühner, M., 2011. Einführung in die Test-und Fragebogenkonstruktion (Introduction to the instrument and questionnaire design). Pearson Deutschland GmbH.

Chuan, O.L., Barnett, T., 2012. Student, tutor and staff nurse perceptions of the clinical learning environment. Nurse Educ. Pract. 12, 192–197. http://dx.doi.org/10.1016/j.nepr.2012.01.003.

Courtney, M.G.R., Gordon, M., 2013. Determining the number of factors to retain in EFA: using the SPSS R-Menu v2. 0 to make more judicious estimations. Pract. Assess. Res. Eval. 18, 1–14.

Doyle, K., Sainsbury, K., Cleary, S., Parkinson, L., Vindigni, D., McGrath, I., Cruickshank, M., 2017. Happy to help/happy to be here: identifying components of successful clinical placements for undergraduate nursing students. Nurse Educ. Today 49, 27–32. http://dx.doi.org/10.1016/j.nedt.2016.11.001.

European Commission, 2017. Bologna Process Brochure.

Flott, E.A., Linden, L., 2016. The clinical learning environment in nursing education: a concept analysis. J. Adv. Nurs. 72, 501–513. http://dx.doi.org/10.1111/jan.12861.

Foster, H., Ooms, A., Marks-Maran, D., 2015. Nursing students' expectations and experiences of mentorship. Nurse Educ. Today 35, 18–24. http://dx.doi.org/10.1016/j.nedt.2014.04.019.

Gadermann, A.M., Guhn, M., Zumbo, B.D., 2012. Estimating ordinal reliability for Likert-type and ordinal item response data: a conceptual, empirical, and practical guide. Pract. Assess. Res. Eval. 17, 1–13.

Grobecker, P.A., 2016. A sense of belonging and perceived stress among baccalaureate nursing students in clinical placements. Nurse Educ. Today 36, 178–183. http://dx.doi.org/10.1016/j.nedt.2015.09.015.

Hegenbarth, M., Rawe, S., Murray, L., Arnaert, A., Chambers-Evans, J., 2015. Establishing and maintaining the clinical learning environment for nursing students: a qualitative study. Nurse Educ. Today 35, 304–309. http://dx.doi.org/10.1016/j.nedt.2014.10.002.

Henriksen, N., Normann, H.K., Skaalvik, M.W., 2012. Development and testing of the Norwegian version of the Clinical Learning Environment, Supervision and Nurse Teacher (CLES + T) evaluation scale. Int. J. Nurs. Educ. Scholarsh. 9. http://dx.doi.org/10.1515/1548-923X.2239.

Hooven, K., 2014. Evaluation of instruments developed to measure the clinical learning environment: an integrative review. Nurse Educ. 39, 316–320. http://dx.doi.org/10.1097/NNE.0000000000000076.

Hooven, K., 2015. Nursing students' qualitative experiences in the medical-surgical clinical learning environment: a cross-cultural integrative review. J. Nurs. Educ. 54, 421–429. http://dx.doi.org/10.3928/01484834-20150717-01.

Johansson, U.-B., Kaila, P., Ahlner-Elmqvist, M., Leksell, J., Isoaho, H., Saarikoski, M., 2010. Clinical learning environment, supervision and nurse teacher evaluation scale: psychometric evaluation of the Swedish version. J. Adv. Nurs. 66, 2085–2093. http://dx.doi.org/10.1111/j.1365-2648.2010.05370.x.

Lamont, S., Brunero, S., Woods, K.P., 2015. Satisfaction with clinical placement–the perspective of nursing students from multiple universities. Coll. R. Coll. Nurs. Aust. 22, 125–133.

Lovrić, R., Piškorjanac, S., Pekić, V., Vujanić, J., Ratković, K.K., Luketić, S., Plužarić, J., Matijašić-Bodalec, D., Barać, I., Žvanut, B., 2016. Translation and validation of the clinical learning environment, supervision and nurse teacher scale (CLES + T) in Croatian language. Nurse Educ. Pract. 19, 48–53. http://dx.doi.org/10.1016/j.nepr.2016.05.001.

Materne, M., Henderson, A., Eaton, E., 2017. Building workplace social capital: a longitudinal study of student nurses' clinical placement experiences. Nurse Educ. Pract. 26, 109–114. http://dx.doi.org/10.1016/j.nepr.2017.07.007.

Papastavrou, E., Lambrinou, E., Tsangari, H., Saarikoski, M., Leino-Kilpi, H., 2010. Student nurses experience of learning in the clinical environment. Nurse Educ. Pract. 10, 176–182. http://dx.doi.org/10.1016/j.nepr.2009.07.003.

Papastavrou, E., Dimitriadou, M., Tsangari, H., 2015. Psychometric testing of the Greek version of the clinical learning environment-teacher (CLES + T). Glob. J. Health Sci. 8, 59–71. http://dx.doi.org/10.5539/gjhs.v8n5p59.

Ruscio, J., Roche, B., 2012. Determining the number of factors to retain in an exploratory factor analysis using comparison data of known factorial structure. Psychol. Assess. 24, 282–292. http://dx.doi.org/10.1037/a0025697.

Saarikoski, M., Leino-Kilpi, H., Warne, T., 2002. Clinical learning environment and supervision: testing a research instrument in an international comparative study. Nurse Educ. Today 22, 340–349. http://dx.doi.org/10.1054/nedt.2001.0715.

Saarikoski, M., Isoaho, H., Leino-Kilpi, H., Warne, T., 2005. Validation of the clinical learning environment and supervision scale. Int. J. Nurs. Educ. Scholarsh. 2 (9). http://dx.doi.org/10.2202/1548-923x.1081.

Saarikoski, M., Isoaho, H., Warne, T., Leino-Kilpi, H., 2008. The nurse teacher in clinical practice: developing the new sub-dimension to the clinical learning environment and supervision (CLES) scale. Int. J. Nurs. Stud. 45, 1233–1237. http://dx.doi.org/10.1016/j.ijnurstu.2007.07.009.

Saarikoski, M., Kaila, P., Lambrinou, E., Pérez Cañaveras, R.M., Tichelaar, E., Tomietto, M., Warne, T., 2013. Students' experiences of cooperation with nurse teacher during their clinical placements: an empirical study in a western European context. Nurse Educ. Pract. 13, 78–82. http://dx.doi.org/10.1016/j.nepr.2012.07.013.

Sahmel, K.-H., 2018. Hochschuldidaktik der Pflege und Gesundheitsfachberufe (Higher Education Didactics of Nursing and Health Professions). Springer.

Salamonson, Y., Everett, B., Halcomb, E., Hutchinson, M., Jackson, D., Mannix, J., Peters, K., Weaver, R., 2015. Unravelling the complexities of nursing students' feedback on the clinical learning environment: a mixed methods approach. Nurse Educ. Today 35, 206–211. http://dx.doi.org/10.1016/j.nedt.2014.08.005.

Schaefer, P., Scheidegger, M., Conca, A., Vossler, G., Reutlinger, B., 2012. Qualitätsinstrument für die klinische Lernumgebung, Praxisbegleitung und Berufsschullehrerin/Berufsbildnerin (CLES + T): Überprüfung der Messzuverlässigkeit. (Jahresbericht) (Quality instrument for Clincial Learning Environment, Supervision and Nurse Teacher Scale (CLES + T): verification of measurement reliability. (Annual report)). Kantonspital Aarau, Aarau, Schweiz.

Serçekuş, P., Başkale, H., 2016. Nursing students' perceptions about clinical learning environment in Turkey. Nurse Educ. Pract. 17, 134–138. http://dx.doi.org/10.1016/j.nepr.2015.12.008.

SoSci Survey, 2017. SoSci Survey (oFb - der onlineFragebogen) → Fragebogen online erstellen, Befragung im Internet durchführen. [Create a questionnaire online, conduct a survey on the Internet]. [WWW Document]. https://www.soscisurvey.de/, Accessed date: 8 August 2017.

Them, C., Wetzlmair, J., Schulc, E., 2018. Die Bildungspyramide der Pflegeberufe in Österreich. [The educational pyramid of nursing professions in Austria]. In: Hochschuldidaktik Der Pflege Und Gesundheitsfachberufe. [Higher Education Didactics of Nursing and Health Professions]. Springer, pp. 131–140.

Tomietto, M., Saiani, L., Palese, A., Cunico, L., Cicolini, G., Watson, P., Saarikoski, M., 2012. Clinical learning environment and supervision plus nurse teacher (CLES + T) scale: testing the psychometric characteristics of the Italian version. G. Ital. Med. Lav. Ergon. 34, B72–80.

Tomietto, M., Comparcini, D., Simonetti, V., Pelusi, G., Troiani, S., Saarikoski, M., Cicolini, G., 2016. Work-engaged nurses for a better clinical learning environment: a ward-level analysis. J. Nurs. Manag. 24, 475–482. http://dx.doi.org/10.1111/jonm.12346.

Vizcaya-Moreno, M.F., Pérez-Cañaveras, R.M., De Juan, J., Saarikoski, M., 2015. Development and psychometric testing of the Clinical Learning Environment, Supervision and Nurse Teacher evaluation scale (CLES + T): the Spanish version. Int. J. Nurs. Stud. 52, 361–367. http://dx.doi.org/10.1016/j.ijnurstu.2014.08.008.

Warne, T., Johansson, U.-B., Papastavrou, E., Tichelaar, E., Tomietto, M., Van den Bossche, K., Moreno, M.F.V., Saarikoski, M., 2010. An exploration of the clinical learning experience of nursing students in nine European countries. Nurse Educ. Today 30, 809–815. http://dx.doi.org/10.1016/j.nedt.2010.03.003.

Wild, D., Grove, A., Martin, M., Eremenco, S., McElroy, S., Verjee-Lorenz, A., Erikson, P., ISPOR Task Force for Translation and Cultural Adaptation, 2005. Principles of good practice for the translation and cultural adaptation process for patient-reported outcomes (PRO) measures: report of the ISPOR task force for translation and cultural adaptation. Value Health J. Int. Soc. Pharmacoecon. Outcomes Res. 8, 94–104. http://dx.doi.org/10.1111/j.1524-4733.2005.04054.x.