

# Instruments evaluating the quality of the clinical learning environment in nursing education: An updated systematic review<sup>☆</sup>

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## ABSTRACT

**Objectives:** The clinical learning environment offers meaningful learning opportunities for nursing students to apply theoretical knowledge to practice on actual or simulated patients. A previous systematic review assessed the quality of several instruments that evaluated the quality of clinical learning environments. This updated systematic review aimed to identify: any additional instruments that have been researched in the last 5 years, ii) the psychometric properties of available instruments and iii) the estimated comparable psychometric properties of the available instruments.

**Data sources:** Medline, CINAHL and Cochrane databases

**Review methods:** Databases were searched from January 2016 to January 2023. Studies were included if they: a) validated instruments evaluating the experience and quality of clinical learning environments; b) assessed the pre-licensure nursing student experience; c) were published in English; and d) were published after April 2016. Two independent reviewers conducted title and abstract screening, full text screening, data extraction and methodological quality assessment. Any disagreements were resolved by consensus. A summary of the findings was tabulated using the same format as the initial review.

**Results:** An additional 18 studies were found, which used seven different clinical learning environment evaluation instruments. Internal consistency and structural validity were the most frequently reported psychometric properties. In almost all studies, methodology for these properties were of sufficient quality according to the Consensus-based Standards for the selection of health status Measurement INstruments (COSMIN) tool evaluation. Other properties were inconsistently reported, with differing qualities in the methodology. Clinical Learning Environment, Supervision and Nurse Teacher (CLES + T) remains the most translated and validated instrument across several countries.

**Conclusions:** Instruments developed and validated using a systematic, transparent and high-quality methodology assist in accurately assessing the skills, attitudes and decision-making abilities of the preregistration level nursing student. These tools can be used in clinical placement accreditation and quality improvement of nursing education. The methodology for evaluation of the psychometric properties of instruments should be clearly described.

## 1. Introduction

With revolutionary advances and the constantly increasing specialization and complexity of health care (Institute of Medicine US, 2008;

Salmond and Echevarria, 2017), it is essential health care professionals are competent to deliver safe and quality care. Quality education plays a major role in developing competent health care professionals including nurses, who are adequately equipped with the knowledge, attitudes and

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skills that are essential to deliver quality care (World Health Organization, 2016).

Nursing education programmes including clinical teaching and learning have evolved to ensure students are adequately prepared to meet the needs of health care delivery (Flott and Linden, 2016; World Health Organization, 2016). The clinical learning environment aims to provide meaningful learning opportunities for nursing students to allow them to “apply theory to practice by conducting actual or simulated patient care to gain the skills, attitudes and decision-making abilities required to become a competent, entry-level nurse” (Mansutti et al., 2017). However, the achievement of clinical learning outcomes of the nursing student can be affected by the clinical learning environment. Negative clinical learning environments can have an impact on students’ satisfaction with the nursing profession and can ultimately contribute to nursing workforce retention and the global nursing shortage (Flott and Linden, 2016; Mansutti et al., 2017). Therefore, there is a need to systematically evaluate the quality of clinical learning environments.

Several instruments have been developed that evaluate clinical learning environments in nursing education. These instruments and evidence of their psychometric properties was collated by a systematic review in 2016 (Mansutti et al., 2017). Eight instruments evaluating clinical learning environments were identified and assessed for their psychometric properties (Mansutti et al., 2017). To explore current evidence on instruments assessing the quality of the clinical learning environment in nursing education and reveal any additional studies published in the last 7 years, the systematic review needed to be updated. A refined search strategy added more databases and made the searches more specific and efficient (Garner et al., 2016).

Since the clinical learning environment is one of the key strategies in educating the future nursing workforce (Mansutti et al., 2017), updating evidence on instruments that assess the quality of the clinical learning environment is essential. The aims of this updated systematic review were to update knowledge of i) the instruments available to measure nursing student experience and quality in the clinical learning environment, ii) the psychometric properties of available instruments and iii) the estimated comparable psychometric properties of the instruments available.

## 2. Methods

The search strategy applied in the first review was further developed to incorporate more keywords. In addition to the keywords used in the first systematic review, we used keywords to filter the “instruments”. The final search was conducted across Medline, CINAHL and Cochrane databases (Supplementary File 1). Keywords and MeSH terms related to “clinical learning environment”, “psychometric properties” and “pre-licensure nursing student” were combined appropriately with ‘AND’ and ‘OR’ Boolean operators. The additional keywords made the search of the updated systematic review more comprehensive. The database search was adapted and modified by two researchers and an academic librarian (IW, DK & YM). One researcher (IW) conducted the search and exported it to Covidence (Covidence systematic review software, Veritas Health Innovation, Melbourne, Australia).

The eligibility criteria of the initial review was adapted to only include studies published in English. Studies were included if they: a) were published between January 2016 to January 2023; b) assessed the validation of instrument/s evaluating the quality of clinical learning environment/s; c) pertained to pre-licensure nursing education; and d) were published in English. Studies were excluded if they: a) did not provide instrument data on validation processes (e.g., investigating students’ perceptions); b) involved students enrolled in healthcare programmes other than nursing (e.g., medical students) without differentiating data on nursing students; and/or c) measured different educational settings (e.g., classrooms).

Two researchers (IW, MH) independently screened the titles and abstracts of the retrieved studies in Covidence. The same reviewers

independently screened the full texts of eligible studies and identified the final included papers. At any stage, any discrepancies were resolved by consensus (IW, MH). The reference lists of the included studies were searched for additional references. The process of study eligibility is shown in Fig. 1 (Page et al., 2021).

Data extraction was performed by two researchers (IW, MH) in Covidence and any discrepancies were resolved by discussion. The extracted data included the publication details (author, year of publication), country where the study was carried out, study design, setting (e.g., hospital) and details of the instrument (name, information on validation/re-validation, any modification, number of items and psychometric properties). A narrative synthesis was undertaken and the characteristics of the included studies and summary of the findings, including the comparisons, were tabulated.

The methodological quality of the included studies were evaluated using the Consensus-based Standards for the selection of health Measurement instruments (COSMIN) (Mokkink et al., 2016). Two researchers (IW, MH) independently conducted critical evaluation of the methodological quality using the COSMIN tool and any disagreements were resolved by consensus.

## 3. Results

In total, 1552 records were retrieved from the three databases. Following review of titles and abstracts 1489 studies were identified as not meeting the inclusion criteria. In total, 77 studies were retained for full text-screening. A total of 18 articles were considered eligible for final inclusion following the updated search (Fig. 1). The characteristics of the studies included were tabulated (Table 1).

### 3.1. Clinical learning environment instruments

Within the included 18 studies, 10 instruments were assessed for their psychometric properties. Those instruments were clinical learning environment inventory (CLEI), modified CLEI short version (CLEI-19), Clinical Learning Environment Scale (CLES), Clinical Learning Environment, Supervision and Nurse Teacher (CLES + T), Supplementary questionnaire to CLES+T (Swedish version), Clinical Practice Questionnaire for Nursing Students, Practice Environment Scale of the Nursing Work Index (PES-NW), Placement Evaluation Tool (PET), Structured Clinical Learning Environment Scale and Student Nurse Subjective Evaluation of Completed Clinical Practice Placement Instrument (SNEP) (Table 1).

In addition to the eight instruments found in the initial review, there were seven newly identified instruments by the updated search: CLEI-19, Supplementary questionnaire to CLES+T (Swedish version), Clinical Practice Questionnaire for Nursing Students, Practice Environment Scale of the Nursing Work Index (PES-NW), Placement Evaluation Tool (PET), Structured Clinical Learning Environment Scale and Student Nurse Subjective Evaluation of Completed Clinical Practice Placement Instrument (SNEP).

Developed in 2001, the Clinical Learning Environment Inventory (CLEI) assesses six domains of clinical experience of the nursing student including decision making, productive clinical experiences, learning activities, involvement in the clinical unit, satisfaction and interactions with academic faculty and nurse clinicians. It was validated on Australian students (Chan, 2001). This comprised of 42 items on a 4-point Likert scale (1 =strongly disagree to 5 =strongly agree). A short version of the CLEI with 19 items on a 5-point Likert scale (CLEI-19) was formed assessing two domains, namely satisfaction and personalisation and validated on Australian students (Salamonson et al., 2011). Table 1 reports the characteristics of the CLEI validated on USA students particularly for structural validity (Hudacek et al., 2019), the Vietnamese version of the CLEI (Truong et al., 2019) and Polish version of the CLEI-19 (Bodys-Cupak, 2021).

The Clinical Learning Environment Scale (CLE Scale) was developed

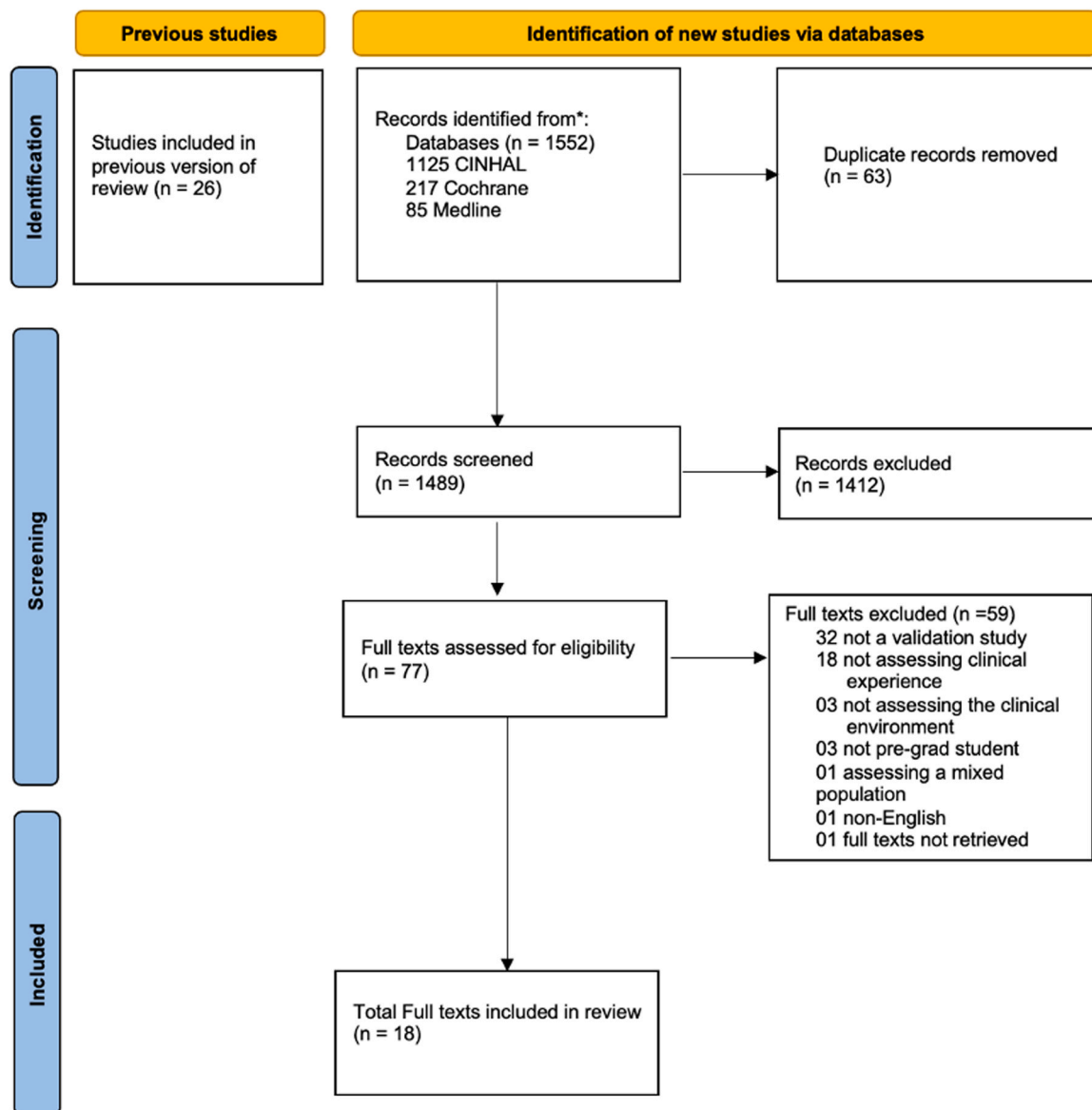


Fig. 1. Study flow diagram.

in Australia by Dunn & Burnett (Dunn & Burnett, 1995). The scale consists of 22 items on a 5-point Likert scale assessing five domains including staff student relations, instructor responsibilities, patient relations, student satisfaction, hierarchy and routines. A Turkish study assessed the CLE's validity and reliability (Aksoy et al., 2022).

The Clinical Learning Environment and Supervision (CLES) instrument was developed and validated in Finland (Saarikoski, 2002). It consisted of 27 statements that assessed ward atmosphere, leadership style of the ward manager, premises of nursing care on the ward, premises of learning on the ward and the supervisory relationship, using a 5-point Likert scale (1 fully disagree to 5 fully agree) (Saarikoski and Leino-Kilpi, 2002). This version was revised to include an additional sub-dimension to evaluate the quality of the nurse-teachers' cooperation with clinical practice and developed into the 34 itemed Clinical Learning Environment, Supervision and Nurse Teacher scale (CLES + T) (Saarikoski et al., 2008). The CLES + T was translated and validated across several countries. Since 2016, it was translated and validated in Austria (Mueller et al., 2018), China (Zhao et al., 2021), Croatia (Lovrić et al., 2016; Žvanut et al., 2018), Czech (Mazalová et al., 2022), Indonesia (Sommers et al., 2021), Nepal (Nepal et al., 2016) and Turkey (Atay et al., 2018) (Table 1). Ekstedt et al. (2019) validated a supplementary

questionnaire to CLES + T with 20 items on the preparedness of the student and the ward for supervision, the preceptor's role and the student's professional progress using a 4-point Likert scale (1 not at all, to 4 to a very high degree) (Ekstedt et al., 2019) (Table 1).

The Clinical Practice Questionnaire for Nursing Students was developed in Iran and has 36 items on a 5-point Likert scale (1 = never to 5 = always). It assessed 6 sub-domains including professional competence, internal sources of motivation, challenging situational clinical settings, dynamic organizational atmosphere, reflection-based self-management and dynamic professional growth (Bijani et al., 2021) (Table 1).

The Practice Environment Scale of the Nursing Work Index (PES-NW) has 31 items on a four-point Likert scale (1 = strongly disagree to 4 = strongly agree). This was developed in Spain and assessed five sub-domains: staffing and resource adequacy; nurse-physician relationships; nursing manager ability, leadership and support of nurses; nursing foundations for quality of care, nurse participation in hospital affairs (Rodríguez-García et al., 2021) (Table 1).

The Placement Evaluation Tool (PET) was developed and validated in Australia. It assessed the clinical environment and learning support with 31 items on a 4-point Likert scale (1 = strongly disagree to

**Table 1**  
Characteristics of the included studies.

Instrument validated	Author, publication year	Country data collection year	Study design	Sample characteristics (N = total sample size; n = number of females; age=mean±SD [years]; degree program; course year)	Settings	Instrument characteristics (sub-domains; items; scale)
CLEI	Hudacek 2019	USA, 2016	Validation study	N = 354 n = 315 NS Bachelors NS	hospital (medical and surgical setting)	6 sub-domains; nursing student decision making, productive clinical experiences, learning activities, involvement in the clinical unit, satisfaction, interactions with academic faculty and nurse clinicians 42 items 4-point Likert scale (1 =strongly disagree to 5 =strongly agree)
(Vietnamese version) (V-CLEI)	Truong 2019	Vietnam, 2014	Validation study	N = 209 n = 185 21.0 ± 0.7 3-year nursing program 3rd years	hospital	6 sub-domains; affordances and engagement, student centeredness, enabling individual engagement, valuing nurses' work, fostering workplace learning, innovative and adaptive workplace culture 50 items 4-point Likert scale
CLEI-19, modified CLEI short version (Polish version)	Bodys-Cupak (2021)	Poland, 2019	Validation study	N = 307 n = 295 20.8 ± 1.5 University students 1st-3rd years	NS	2 sub-domains; clinical facilitator support of learning, satisfaction with clinical placement 19 items 5-point Likert scale (1 = strongly disagree to 5 = strongly agree)
CLES	Aksoy 2022	Turkey, 2018	Descriptive cross-sectional study	N = 552 n = 448 20.4 ± 1.6 University students 1st-4th years	hospital	5 sub-domains; staff-student relations, instructor responsibilities, patient relations, student satisfaction, hierarchy and routines 22 items 5-point Likert scale
CLES + T	Mazalov 2022	Czech, 2017–2021	Cross-sectional correlation study	N = 155 n = NS NS Bachelors 1st-3rd years	hospital (basic and specialized nursing care in internal and surgical specialties)	5 sub-domains; pedagogical atmosphere in the ward, leadership style of the ward manager, premises of nursing on the ward, mentorship relationship, role of nurse teacher 34 items 5-point Likert scale (1 =fully disagree to 5 =fully agree)
(English version)	Nepal 2016	Nepal, 2014	Validation study	N = 263 n = 263 NS Bachelors 2nd- 3rd years	hospital (public and private settings)	5 sub-domains; pedagogical atmosphere on the ward, leadership style of the ward manager, premises of nursing on the ward, supervisory relationship, role of nurse teacher 34 items 5-point Likert scale (1 =fully disagree to 5 =fully agree)
(Slovenian version)	Žvanut 2018	Croatia, 2015	Validation study	N = 232 n = 190 23.0 ± 6.2 Bachelors All years	NS	5 sub-domains; supervisory relationship, pedagogical atmosphere on the ward, role of nurse teacher, leadership style of the ward manager, premises of nursing on the ward factor 34 items scales NS
(China version)	Zhao 2021	China, 2018	Validation study	N = 558 n = 542 19.9 ± SD Masters + Bachelors + Associate degree + 3 years Diploma final years	hospitals	4 sub-domains; pedagogical atmosphere, leadership style of the ward manager, premises of nursing on the ward, supervisory relationship 27 items 5 -point Likert scale (1 =strongly disagree to 5 =strongly agree)
(Croatian version)	Lovrić 2016	Croatia, 2014	Validation study	N = 136 n = 116	hospital (internal, surgery, infectious diseases, neurology,	5 sub-domains; supervisory relationship, pedagogical

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Table 1 (continued)

Instrument validated	Author, publication year	Country data collection year	Study design	Sample characteristics (N = total sample size; n = number of females; age=mean±SD [years]; degree program; course year)	Settings	Instrument characteristics (sub-domains; items; scale)
				22.0 ± 4.4 Bachelors 1st-3rd years	psychiatry, pediatrics, gynecology, urology and anesthesiology with intensive care settings)	atmosphere on the ward, role of nurse teacher, leadership style of the ward manager, premises of nursing on the ward 33 items 5-point Likert scale (1 =strongly disagree to 5 =strongly agree)
(German version)	Mueller 2018	Austria, 2016	Validation study	N = 385 n = 296 25.6 ± 6.7 NS 1st-3rd years	hospital (surgical, internal medicine and non-specified settings)	5 sub-domains; pedagogical atmosphere on the ward, leadership style of the ward manager, premises of nursing on the ward, supervisory relationship, role of nurse teacher in clinical practice 34 items scales NS
(Indonesian version)	Sommers 2021	Indonesia, 2018	Validation study	N = 292 n = NS 20.0 ± NS Bachelors 2nd- 3rd years	hospital (medical and surgical settings)	4 sub-domains; supervisory relationship, role of the nurse teacher, pedagogical atmosphere, culture of the ward 34 items 4-point Likert scale (1 =fully disagree to 5 = fully agree)
(Turkish version)	Atay 2018	Turkey, 2016	Validation study	N = 481 n = 121 20.5 ± 1.5 University students 3rd years	hospital	5 sub-domains; supervisory relationship, pedagogical atmosphere on the ward, role of the nurse teacher, leadership style of the ward manager, premises of nursing on the ward 34 items 5-point Likert scale (1 = completely disagree to 5 =completely agree)
supplementary questionnaire to (CLES+T (Swedish version))	Ekstedt 2019	Sweden, 2012	Comparative cross-sectional study	N = 244 n = 219 28.0 ± NS (range = 21 and 51) University students 2nd years	hospital (medical and surgical setting)	3 sub-domains; preparedness of student and ward for supervision, the preceptor's role, the student's professional progress 20 items 4-point Likert scale (1 =not at all to 4 = to a very high degree)
Clinical Practice Questionnaire for Nursing Students	Bijani 2021	Iran, 2019	Validation study	N = 360 n = NS NS Bachelors NS	NS	6 sub-domains; professional competence, internal sources of motivation, challenging situational clinical setting, dynamic organizational atmosphere, reflection-based self-management, dynamic professional growth 36 items 5-point Likert scale (1 =never to 5 =always)
PES-NW	Rodríguez-García 2021	Spain, 2018	Validation study	N = 180 n = 140 23.2 ± 5.6 Bachelors 3rd-4th years	hospital (medical-surgical and Specialized units in both public and private settings)	5 sub-domains; staffing and resource adequacy, nurse-physician relationships, nursing manager ability, leadership and support of nurses; nursing foundations for quality of care, nurse participation in hospital affairs 31 items 4-point Likert scale (1 = strongly disagree to 4 =strongly agree)
PET	Cooper 2020	Australia, 2020	Validation study	N = 1263 n = 1133 19.0–55.0 * Bachelors 1st-4th years	hospital (acute, mental health, aged care, rehabilitation service, primary care/ community, other)	2 sub-domains; clinical environment, learning support 19 items 5-point Likert scale (agreement

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Table 1 (continued)

Instrument validated	Author, publication year	Country data collection year	Study design	Sample characteristics (N = total sample size; n = number of females; age=mean±SD [years]; degree program; course year)	Settings	Instrument characteristics (sub-domains; items; scale)
Structured Clinical Learning Environment Scale	Dillu 2021	India, NS	Descriptive cross-sectional study	N = 160 n = NS NS Bachelors 4th years	hospital	scale) and a 10-point global satisfaction rating scale 6 sub-domains; pedagogical environment, work culture, supervision, teaching learning process, clinical assignments, method of clinical evaluation items NS scales NS
Student Nurse Subjective Evaluation of Completed Clinical Practice Placement Instrument (SNEP)	Kavanagh 2022	Ireland 2017–2019	Development and validation study	N = 166 (phase 1), 306 (phase 2) n = NS NS Bachelors 1st–4th years	inpatient mental health care	7 sub-domains; orientation to the practice placement, preceptors and mentors, exposure and inclusion, reflective practice, completion process, assessment process, school support 40 items 5-point Likert scale (1 = strongly disagree to 5 = strongly agree)

Abbreviations: NS, not specified; CLES, Clinical Learning Environment Scale; CLES+T, Clinical Learning Environment Supervision and Nurse Teacher; CLEI, Clinical Learning Environment Inventory; PET, Placement Evaluation Tool; PES-NW, Practice Environment Scale of the Nursing Work Index; SNEP, Student Nurse Subjective Evaluation of Completed Clinical Practice Placement; V-CLEI, Vietnamese version of the modified Clinical Learning Environment Inventory.

\*age range was reported instead on mean±SD.

4 =strongly agree (Cooper et al., 2020) (Table 1). The Structured Clinical Learning Environment Scale was validated in India (Dillu and Soren, 2021). It consisted of six areas related to the clinical learning environment: the pedagogical environment, work culture, supervision, teaching learning process, clinical assignments and method of clinical evaluation (Dillu and Soren, 2021) (Table 1).

The Student Nurse Subjective Evaluation of Completed Clinical Practice Placement Instrument (SNEP) was developed in Ireland (Kavanagh et al., 2022). Based on the systematic review of Mansutti et al. they aimed to develop an evaluation instrument addressing nursing students in all 4 years of their education program (Mansutti et al., 2017). This instrument looked at seven areas including orientation to the practice placement, preceptors and mentors, exposure and inclusion, reflective practice, completion process, assessment process and school support (Kavanagh et al., 2022). This comprised 40 items on a 5-point Likert scale (1 =strongly disagree to 5 =strongly agree) (Kavanagh et al., 2022) (Table 1).

### 3.2. Context of the validation processes

In total, 6603 nursing students were involved in all the included studies. Most students were females (>60 %). Five studies (Bijani et al., 2021; Dillu and Soren, 2021; Kavanagh et al., 2022; Mazalová et al., 2022; Sommers et al., 2021) failed to clearly indicate the number of females in their study. Most participants were Bachelor degree students (n < 13, 72.0 %) and in the final years of their degree. The average age of students was between 19.9 (Zhao et al., 2021) and 28.0 years (Ekstedt et al., 2019) and the age range was 19.0–55.0 years (Cooper et al., 2020). Most studies carried out their validation in the hospital setting, apart from one study that used a combined setting including hospital, aged care, rehabilitation service and primary care/ community (Cooper et al., 2020).

### 3.3. Methodological quality evaluation

Not all included studies assessed all the psychometric properties outlined in the COSMIN guidelines (Mokkink et al., 2016). Internal consistency was reported in all included studies and structural validity was the second most reported component. Measurement error was not

evaluated in any of the studies. The quality of methodologies used to evaluate the psychometric properties in the included studies ranged from sufficient (+) to indeterminate (?) (Table 2).

### 3.4. Comparison of the psychometric properties

A summary and comparison of the psychometric properties of the identified instruments are presented in Table 2.

#### 3.4.1. Content validity

Content validity was estimated in six studies and the quality of methodology ranged from sufficient (+) to indetermined (?) (Table 2) (Bijani et al., 2021; Cooper et al., 2020; Dillu and Soren, 2021; Ekstedt et al., 2019; Kavanagh et al., 2022; Mueller et al., 2018; Sommers et al., 2021; Truong et al., 2019).

#### 3.4.2. Internal consistency

Internal consistency was estimated in all included studies. The methodological quality of most studies was reported as sufficient (+) but two studies insufficiently described their methodology (Aksoy et al., 2022; Dillu and Soren, 2021) (Table 2). The CLES + T Croatian version reported the highest Cronbach's  $\alpha$  of 0.97 with sufficient quality (+) (Lovrić et al., 2016) and the Cronbach's  $\alpha$  value for all instruments ranged from 0.71 to 0.97 (Table 2).

#### 3.4.3. Reliability

Five studies reported ICC values (Atay et al., 2018; Bijani et al., 2021; Cooper et al., 2020; Nepal et al., 2016; Truong et al., 2019) and two studies reported the Spearman Correlation Coefficient (Lovrić et al., 2016; Žvanut et al., 2018). The CLES + T Turkish version reported the highest ICC as 0.93–0.96 with an indetermined methodological quality (Atay et al., 2018) (Table 2).

#### 3.4.4. Measurement error

None of the studies reported SEM values, therefore no studies are available there for quality assessment.

#### 3.4.5. Structural validity

All studies apart from four (Aksoy et al., 2022; Bodys-Cupak, 2021;



**Table 2**  
Summary and comparison of the psychometric properties of the identified instruments.

Instrument	Translation	Instrument Authors, year	Internal Consistency	Reliability	Measurement Error	Content Validity	Structural Validity	Hypotheses Testing	Convergent Validity, <i>r</i> Pearson	Criterion Validity	Cross-cultural Validity
			a Cronbach total score and/or range across factors	ICC	SEM, SDC	Yes	Variance explained%, method			Tool, <i>r</i> Pearson, <i>p</i> value	
CLEI		Hudacek 2019	0.89 +	NS	NS	NS	57 EFA	NS	NS	NS	NS
	(Vietnamese version) (V-CLEI)	Truong 2019	0.88 +	0.30–0.67 -	NS	Yes ±	CFA +	NS	NS	NS	forward backward translation ±
CLEI-19, modified CLEI short version (Polish version)		Bodys-Cupak (2021)	clinical placement scale - 0.95; satisfaction with clinical placement scale - 0.90 +	NS	NS	NS	NS	Yes ±	Yes ?	NS	forward backward translation ±
CLES		Aksoy 2022	0.71 -	NS	NS	NS	NS	NS	NS	NS	NS
CLES + T	(Czech version)	Mazalov 2022	0.95 +	NS	NS	NS	72.5 PCA +	NS	NS	NS	forward backward translation -
	(English version)	Nepal 2016	0.93 +	0.27–0.68 ?	NS	NS	86 EFA +	Yes -	NS	NS	NS
	(Slovenian version)	Žvanut 2018	0.96 +	0.28–0.80 * -	NS	NS	68 PCA +	Yes -	NS	NS	back translation ±
	(China version)	Zhao 2021	0.82 +	NS	NS	NS	60 EFA +	NS	NS	NS	NS (done elsewhere)
	(Croatian version)	Lovrić 2016	0.97 +	0.28–0.71 * -	NS	NS -	72 FA -	NS	NS	NS	back translation -
	German CLES	Mueller 2018	0.95 +	NS	NS	Yes -	73 CFA +	NS	NS	NS	forward translation ±
	(Indonesian version)	Sommers 2021	range 0.86–0.94 +	NS	NS	Yes ?	58 PCA +	NS	NS	NS	backward forward translation ±
	(Turkish version)	Atay 2018	0.93 +	0.93–0.96 ?	NS	NS	64 EFA +	NS	NS	NS	forward backward translation ±
supplementary questionnaire to (CLES+T (Swedish version))		Ekstedt 2019	0.86 +	NS	NS	Yes -	FA ±	Yes +	NS	NS	NS
Clinical Practice Questionnaire for Nursing Students		Bijani 2021	0.90 +	0.94 -	NS	Yes -	63 EFA+	NS	NS	NS	NS
PES-NW		Rodríguez-García 2021	0.88 +	NS	NS	NS	PCA +	Yes ±	NS	NS	NS

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Table 2 (continued)

Instrument	Translation	Instrument Authors, year	Internal Consistency a Cronbach total score and/or range across factors	Reliability ICC	Measurement Error SEM, SDC	Content Validity Yes	Structural Validity Variance explained%, method	Hypotheses Testing	Convergent Validity, r Pearson	Criterion Validity		Cross-cultural Validity
										Tool, r	Pearson, p value	
PET		Cooper 2020	clinical environment - 0.94; learning support - +	0.71	NS	Yes +	67 PCA ±	NS	NS	Clinical Learning Environment and Supervision Scale r = 0.83 p = 0.01		NS
Structured Clinical Learning Environment Scale		Dillu 2021	0.82	NS	NS	Yes	NS	Yes	NS			NS
Student Nurse Subjective Evaluation of Completed Clinical Practice Placement (SNEP)		Kavanagh 2022	0.96 +	NS	NS	Yes +	50.72–70.48 EFA +	NS	Yes 0.22 – 0.71 ?			NS

Quality of studies as assessed by the COSMIN tool (sufficient (+) / insufficient (-) / inconsistent (±) / indeterminate (?));

\* Spearman correlation coefficient.

Abbreviations= GSES, Generalized Self Efficacy Scale; LOT-R, Life Orientation Test – Revised; PCA, Principal Component Analysis; FA, Factor Analysis; EFA, Exploratory Factor Analysis; CFA, Confirmatory Factor Analysis; ICC, Intraclass correlation coefficient.

Dillu and Soren, 2021; Mazalová et al., 2022), evaluated structural validity. Methodological quality was assessed from sufficient (+) to insufficient (-) (Table 2). The highest variance reported was 86 for the CLES+ T Nepalian study (Nepal et al., 2016) and the variance for the other studies ranged from 57 to 73. To evaluate structural validity (Ekstedt et al., 2019; Lovrić et al., 2016), most authors used exploratory factor analysis (EFA) (Atay et al., 2018; Bijani et al., 2021; Hudacek et al., 2019; Kavanagh et al., 2022; Nepal et al., 2016; Sommers et al., 2021; Zhao et al., 2021) and confirmatory factor analysis (CFA) (Mueller et al., 2018; Truong et al., 2019), while some authors reported Principal Component Analysis (PCA) (Mazalová et al., 2022; Rodríguez-García et al., 2021; Žvanut et al., 2018) and factor analysis (FA).

#### 3.4.6. Hypothesis testing

Six studies reported mean differences between groups, between instrument scores, or other variables, with sufficient (+), inconsistent (±), or insufficient (-) methodological quality (Table 2). Comparisons during hypothesis testing included private and government sectors (Dillu and Soren, 2021; Nepal et al., 2016), the year of nursing studies (Bodys-Cupak, 2021; Rodríguez-García et al., 2021), units of the hospital placement (Rodríguez-García et al., 2021), different supervisory models (Ekstedt et al., 2019) and different versions of CLES + T between two countries (Žvanut et al., 2018).

#### 3.4.7. Convergent validity

Convergent validity was estimated in two studies (Bodys-Cupak, 2021; Kavanagh et al., 2022) with an indetermined methodological quality. Hypothesis testing was performed against Generalized Self Efficacy Scale (GSES) and dispositional optimism of Life Orientation Test (LOT-R) (Table 2). Satisfaction with clinical placement is negatively related with GSES score, while it is positively related with LOT-R (Table 2).

#### 3.4.8. Criterion validity

Criterion validity was assessed in one study (Cooper et al., 2020). In the initial systematic review the CLES was used as the comparison (Mansutti et al., 2017) and similarly in the current review. The PET was validated against the CLES with a sufficient methodological quality (Cooper et al., 2020) (Table 2).

#### 3.4.9. Cross-cultural validity

Ten studies were found that translated instruments to another language (Atay et al., 2018; Bodys-Cupak, 2021; Lovrić et al., 2016; Mazalová et al., 2022; Mueller et al., 2018; Nepal et al., 2016; Sommers et al., 2021; Truong et al., 2019; Zhao et al., 2021; Žvanut et al., 2018). Cross-cultural validity was reported in eight studies for three instruments: CLEI (Truong et al., 2019), CLEI-19 (Bodys-Cupak, 2021) and CLES + T (Atay et al., 2018; Lovrić et al., 2016; Mueller et al., 2018; Nepal et al., 2016; Sommers et al., 2021; Žvanut et al., 2018). One study was found to have insufficient (-) methodology (Lovrić et al., 2016), while the rest had inconsistent methodological quality.

## 4. Discussion

### 4.1. Clinical learning environment instruments

This systematic review updated a previous systematic review that collated the psychometric properties of instruments which evaluated the experience and quality of the clinical learning environment in nursing education (Mansutti et al., 2017). The current systematic review included 18 studies and assessed 10 instruments, published in 16 different countries, mainly across Europe and Asia. However, we could not find any specific patterns of differences or similarities of the instruments across countries. Since the first systematic review was published, seven additional instruments were developed. The initial review found eight instruments published between 1995 and 2015. The current



review found ten instruments validated between 2016 and 2022. Of these new studies, seven instruments were found (Bijani et al., 2021; Bodys-Cupak, 2021; Cooper et al., 2020; Dillu and Soren, 2021; Ekstedt et al., 2019; Rodríguez-García et al., 2021),

Students' clinical experiences were invariably assessed based on their decision making, learning activities, clinical placement learning, interactions between academic faculty and nurse clinicians, patient relations within these sub-domains. Most of those domains were from extended versions of the CLES. This updated review revealed that the newer domains have an increased focus on, for example, staffing and resource adequacy, the nurse–physician relationships, nursing manager ability, leadership and support of nurses, nursing foundations for quality of care, nurse participation in hospital affairs, the clinical environment and learning support. Similar to the initial review (Mansutti et al., 2017), the CLES + T scale remains the mostly validated and assessed instrument for reliability (Atay et al., 2018; Lovrić et al., 2016; Mueller et al., 2018; Nepal et al., 2016; Sommers et al., 2021; Zhao et al., 2021; Žvanut et al., 2018). A supplementary questionnaire to the CLES + T scale was also developed and published in 2019 (Ekstedt et al., 2019). The SNEP was the most recent instrument published (Kavanagh et al., 2022). It addressed several concerns raised by the initial review (Mansutti et al., 2017). These included developing and validating an instrument capable of assessing throughout placements (before, during, or after), capable of evaluating placements across different settings and inclusion of all years of Nursing training in the development of tools to evaluate quality of clinical learning environment (Kavanagh et al., 2022; Mansutti et al., 2017). This study added domains of orientation to the practice placement, preceptors and mentors, exposure and inclusion, reflective practice, completion process, assessment process and school support (Kavanagh et al., 2022).

In the initial review, the shortest instrument was found to be the CLEI-19 (Mansutti et al., 2017). This review found a new shortened instrument, the PET (Cooper et al., 2020), with 19 items and two sub-domains, along with a global satisfaction rating scale. In general, the distribution of factors, number of items and the Likert scale spread of the included instruments remained the same over the years. Only the PET deviated from this by using a Likert scale to assess the clinical learning environment and a global satisfaction rating scale (Bodys-Cupak, 2021).

The total sample of the included studies represented more female nursing students, which reflects a similar picture to the initial review (Mansutti et al., 2017). The initial review claimed that this may have introduced a gender bias, however this reflects the actual percentage of female nurses in the global workforce (Boniol et al., 2019).

Another limitation identified in the initial review was a lack of studies that involved final year students who tend to have a concentrated experience on clinical practice. The current review found that whilst students in their final years (3rd and 4th years) were captured more, all other years of education were also included. Therefore, the findings can be generalised to the clinical experience of all years. However, nursing students' experience can vary according to the years of education and therefore further research is suggested to explore how each year of the degree programme influences experiences of the clinical environment. Whilst students aged between 19 and 51 years were included in the current review, most of the students were in their twenties. Between 2011 and 2015, there was an observed increase in the number of employed nurses and midwives in the 25–34 years age group (Boniol et al., 2019). However, ageing of the nursing workforce reflected global trends (Ryan et al., 2019), with the average age of the nursing workforce e.g. in Australia found to be 44.4 (Australian Institute of Health and Welfare, 2015). Perceived experience also can be related to the age of the nursing student, therefore further research is recommended.

Like the initial review, most studies indicated that participation was voluntary. However not all the studies reported information on participation. Even though the initial review advised that when the students completed the instrument (before or after their clinical competence

evaluation) should be specified, there was a lack of reporting of this information (Mansutti et al., 2017). In addition, like the initial review almost all the included instruments were validated in hospitals, except one study that used the community setting to validate the PET (Cooper et al., 2020). Several studies suggested the different settings of the clinical learning environment should be reported, such as the different wards (Ekstedt et al., 2019; Hudacek et al., 2019; Lovrić et al., 2016; Mueller et al., 2018; Rodríguez-García et al., 2021; Sommers et al., 2021), mental health (Cooper et al., 2020; Kavanagh et al., 2022), aged care (Cooper et al., 2020), rehabilitation services (Cooper et al., 2020), internal and surgical specialties (Mazalová et al., 2022) and primary care (Cooper et al., 2020). This could enable the findings to be generalised across the range of clinical environment nursing students' experience.

#### 4.2. Methodological quality evaluation and comparison of the psychometric properties

Methodological quality varied from sufficient (+), insufficient (-), inconsistent ( $\pm$ ) to indetermined for the reported psychometric properties. In almost all studies, methodology for internal consistency and structural validity were of insufficient quality. Most of the translated versions had inconsistent quality for their cross-cultural validity.

Almost all studies reported sufficient methodology for reporting internal consistency with Cronbach's alpha. Structural validity was assessed by CFA (Mueller et al., 2018; Najafi Kalyani et al., 2019), EFA (Atay et al., 2018; Bijani et al., 2021; Hudacek et al., 2019; Kavanagh et al., 2022; Nepal et al., 2016; Sommers et al., 2021; Zhao et al., 2021) and PCA (Cooper et al., 2020; Mazalová et al., 2022; Rodríguez-García et al., 2021; Žvanut et al., 2018). Statistical methods were not always explicitly explained. For example, some studies did not specify if the factor analysis was confirmatory or exploratory (Ekstedt et al., 2019; Lovrić et al., 2016). Convergent validity (Bodys-Cupak, 2021; Kavanagh et al., 2022) and criterion validity (Bodys-Cupak, 2021; Cooper et al., 2020) was assessed in very few studies.

Content validity methodology was flawed in some studies, mainly related to poor descriptions of whether two researchers were involved in the analysis. In future work, an appropriate approach to analyse the data should include professionals from all relevant disciplines, should be considered. This was also stressed in the initial systematic review (Mansutti et al., 2017).

Test-retest reliability was evaluated using ICC or Spearman correlation coefficient in a few studies (Atay et al., 2018; Bijani et al., 2021; Cooper et al., 2020; Lovrić et al., 2016; Nepal et al., 2016; Truong et al., 2019; Žvanut et al., 2018). How stable the participant was within the interim period on the construct to be measured, how appropriate the time interval was and whether the test conditions were similar for the measurements, were inadequately described in most of the studies.

#### 4.3. Strengths and Limitations

We addressed several limitations of the initial systematic review to improve the quality of the current review. We extended the databases by adding Cochrane in addition to Medline and CINAHL. Additional key words not listed were added to ensure the search was comprehensive. The Boolean operators OR and AND were used appropriately to combine the Population, Intervention and Outcome elements. The quality assessment of the included studies was based on the version of COSMIN guidelines published in 2018 (Mokkink et al., 2018) over the version of COSMIN guidelines published in 2010 (Mokkink et al., 2010) used by the initial systematic review (Mansutti et al., 2017).

In this review, the language was restricted to English and there may be other instruments developed and assessed for their psychometrics in other languages. Future trials should be based on high methodological quality and all the components of psychometric properties should be given consideration to report and explain the statistics clearly.

## 5. Conclusion

Since 2016, seven new instruments evaluating the experience and quality of the clinical learning environment in nursing education were revealed, indicating changes in the pedagogical impact of the clinical environment and work culture in nursing programmes globally. Previously developed instruments continued to be revised and improved. Like the initial review, this review found not all the relevant psychometric properties were estimated. However, the quality of methods for the mostly commonly reported psychometrics (internal consistency and structural validity) were rated as sufficient. Future research should consider systematic and transparent reporting of psychometric properties of the instruments and should clearly describe the methods including the statistical analysis.

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## Declaration of Competing Interest

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

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## Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.nepr.2023.103732](https://doi.org/10.1016/j.nepr.2023.103732).

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