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Review

Legitimation Code Theory's role in shaping nursing education: An integrative review

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ABSTRACT

Background: In response to the increasing diversity in nursing education, the Legitimation Code Theory (LCT) offers a transformative approach to understanding and addressing the unique learning needs of students from various backgrounds.
Objectives: To identify how Legitimation Code Theory has informed the design of professional education in biological and health sciences.
Design: An integrative review was conducted using the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) and guided by the five-step process by Whittemore and Knafl.
Data sources: A comprehensive search of eight databases was conducted (IEEEXplore, Scopus, Web of Science, ProQuest central, EBSCOHost, MEDLINE with full text, CINAHL and INFORMIT) using key concepts: Legitimation Code Theory and professional education from inception until November 2023.
Review methods: All studies were reviewed by two researchers independently. The same authors appraised the studies using the Mixed Methods Appraisal Tool with a third author providing consensus. The findings were coded and analysed using narrative synthesis.
Results: From the initial 518 records screened, 11 studies were identified where Legitimation Code Theory was used in biological and health science education. There were four themes identified in the review: a) Legitimation Code Theory as a framework for data analysis; b) Identifying and enhancing learning outcomes through Legitimation Code Theory; c) Pedagogy design informed by Legitimation Code Theory; and d) Legitimation Code Theory to contextualise disciplinary knowledge.
Conclusion: This review highlights the significant influence of Legitimation Code Theory on professional education, particularly in the biological and health sciences. The versatility and effectiveness of Legitimation Code Theory are evident across various disciplines, including nursing education. As a comprehensive framework, Legitimation Code Theory not only aids in pedagogy design but also facilitates the transfer of learning, thereby promoting critical thinking. This demonstrates its robustness as a tool in the realm of professional education.

1. Introduction

The global trend to widen higher education access for underrepresented groups has seen increased student diversity within the sector (Vignoles and Murray, 2016). This diversity is particularly pertinent in nursing education where the workforce reflects the diverse demographics of patients (Spencer, 2020). To achieve this goal, there is a need to focus on recruiting nursing students from across different ages, gender, and educational spectrums, as well as those from culturally and linguistically diverse (CALD) backgrounds (Christensen and Craft, 2021; Green, 2020). However, meeting the needs of students who have different life experiences and scholarly abilities presents significant challenges (Salamonson et al., 2012). One of these challenges is to tailor educational programs that address the unique requirements of every

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learner (Van Hoek et al., 2019), while also ensuring high-quality learning experiences, equity and retention of students (Green, 2020; Jeffreys, 2022). This context demands a re-evaluation of existing educational strategies to develop a more inclusive curriculum.

With these challenges, Legitimation Code Theory (LCT) emerges as a potentially transformative approach. LCT was developed by Karl Maton, drawing upon the foundational work of sociologists Basil Bernstein and Pierre Bourdieu (Maton, 2014a, 2016). LCT provides a framework that assists academics to understand the underlying principles of learning and teaching (Maton, 2014a). The framework can be used to explore the organising principles underlying different practices, knowledge domains and contexts (Maton, 2014a, 2014b). By applying the LCT framework, academics can identify and address the barriers or biases that may hinder learning by those in non-traditional student groups (Maton and Chen, 2015). For example, among students from diverse backgrounds, LCT could facilitate a deeper understanding of the body of knowledge in their discipline of study, and consequently, enhance learning outcomes and academic success.

2. Background

As a type of social realist framework and similar to some versions of constructivism, Legitimation Code Theory focuses on the perspective that knowledge is socially constructed, but has real, intrinsic qualities that are valuable for educational purposes (Maton, 2014a). Social realism posits that knowledge and truths about the world are not merely abstract concepts, but our understanding of the world is also influenced by social structures and contexts (Moore, 2013), and shaped by the social relations and conditions in which knowledge is applied in practice (Sayer, 2020). Put simply, knowledge is a product of social interactions (Maton, 2014a; Maton and Moore, 2010; Sayer, 2020).

Interactive and community-oriented aspects of learning have been leveraged by educational learning theorists to enhance learning and apply theoretical knowledge in collaborative learning environments (Chang and Do, 2024; Rojo et al., 2023). Some prominent frameworks used in nursing education include: a) social learning theory developed by Bandura (Bandura and Walters, 1977; Stanley et al., 2020); b) situated learning by Lave and Wenger (Lave and Wenger, 1991; O'Brien and Battista, 2020); c) transformative learning by Mezirow (Mezirow, 1997; Rojo et al., 2023); and constructivism by Vygostsky (Kantar et al., 2020; Vygotsky and Cole, 1978). Of these, perhaps the most commonly used framework is Constructivism (Thomas et al., 2014), emphasising the active role of the learner in creating knowledge (Abualhaija, 2019; Saylor, 2015). This approach encourages students to be engaged and self-directed, asking questions to build on their existing knowledge to build new understanding (Saylor, 2015). However, there has been some criticism of constructivist theory for its lack of structure and for students constructing their own subjective understandings rather than a shared understanding of core concepts (Alanazi, 2016; Moore, 2013). In contrast, a less common framework in nursing education is LCT, which focuses on the social and cultural dimensions of knowledge practices in education (Maton, 2014a). The theory assists in understanding how knowledge is constructed, legitimised and valued in different educational contexts (Maton, 2014a, 2016).

As an explanatory framework, LCT encompasses various dimensions related to how knowledge is structured. Key dimensions to date include Semantics, Specialization*, and Autonomy. Each dimension, distinct in focus, provides a structure to examine organising principles and practices within a discipline as legitimation codes (Maton, 2014a). A brief description of commonly used dimensions is outlined in Table 1. Within each dimension, there are codes that vary in strength relative to one another. The interaction of these codes creates a 'wave pattern'. For example, in the dimension of Semantics, the movement between codes, known as a 'semantic wave', facilitates cumulative knowledge building (Maton, 2013, 2014a).

In the context of LCT, knowledge practices include curriculum design and teaching methods, which communicate implicit cues for different disciplines. These cues can be interpreted as legitimation language, as outlined by Maton (2010). In short, LCT aims to explore how various forms of knowledge gain legitimacy, recognition, acceptance, and value within a specific social or academic context (Maton, 2014a). LCT is a versatile framework that is utilised by academics and teachers at all levels of education. In high-schools, LCT has been used to evaluate science lessons to visually demonstrate to teachers where they are able assist students in making sense of complex ideas and in turn help students transfer their learning to new experiences (Dankenbring et al., 2024). Various disciplines in higher education, such as engineering, use LCT to structure their lessons to assist in linking theory to practice (Wolff, 2018). LCT has also been used in pre-service teacher education (Rusznyak, 2020) to evaluate course design in terms of how content knowledge can be structured for a professional learning program. In view of the increasing adoption of LCT, it is timely to synthesise available empirical evidence on how LCT has been utilised to inform curriculum design and pedagogy in higher education.

Table 1
Description of most used LCT dimensions (Adapted from Maton, 2014).

LCT dimension	Brief description of the dimension
Semantics	Consists of codes that focus on the organisation of knowledge. The codes make visible how knowledge relates to contexts (semantic gravity) and the complexity of knowledge (semantic density). When these codes strengthen and weaken, for example, in the complexity/technicality of knowledge, a semantic wave is formed.
Specialization*	Consists of codes that enable the researcher to visualise the explicit knowledge required in a discipline and the disposition of the knower in the discipline. The codes focus on what is considered legitimate knowledge (epistemic relations) in the discipline and who is a legitimate knower (social relations).
Autonomy	Consists of codes that focus on knowledge practices of a discipline (positional autonomy) and how they relate to each other (relational autonomy).

* Although LCT originated in Australia, the 'z' is used to spell "Specialization", so this manuscript will remain consistent with this spelling within LCT.

The aim of this integrative review is to identify how LCT has informed the design of professional education in biological and health sciences. Biological and health sciences were selected due to their relevance to the nursing curriculum, sharing key content areas.

3. Methods

An integrative review of the use of Legitimation Code theory in biological and health sciences was conducted using the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement (Page et al., 2021). The five-step process by Whittemore and Knafl (2005) guided this review as it allows for the examination of different methodologies in the collected studies. The first step is the identification of the problem which is the need for a different approach to learning and teaching in higher education. The remaining steps of literature search, data evaluation and data analysis and the presentation of the findings are detailed in the following sections.

3.1. Search strategy

A search strategy was developed in conjunction with a university librarian and was reviewed by the research team. Upon team consensus, a comprehensive literature search of eight electronic databases was conducted using Medical Search Headings (MeSH) and Boolean operators on 17th April 2023. Databases included IEEEXplore, Scopus, Web of Science, ProQuest central, EBSCOHost, MEDLINE with full text, CINAHL and INFORMIT. The chosen databases were selected after the initial scoping of the literature identifying the key areas where LCT-related works are published. The search strategy included the keywords: Legitimation Code Theory, higher education, and professional

education, as outlined in Table 2.

3.2. Eligibility criteria

The review sought studies that were peer-reviewed and reflected empirical research. The date range was not limited as Legitimation Code Theory is a relatively new theory. All geographical areas were included but limited to English as suggested by Whittemore and Knafl (2005). The inclusion criteria were: Legitimation Code Theory, University-based education, biological and health sciences curriculum. The exclusion criteria were vocational education, secondary school, and conference papers.

3.3. Screening

Following the PRISMA guidelines (Page et al., 2021), all references from the primary search strategy ($n = 518$) were imported into EndNote Version 20. A total of 266 duplicates were excluded, and the remaining references screened and removed based on title ($n = 122$) or abstract ($n = 15$). Of the remaining 115 references, 106 were excluded as these were: not empirical research ($n = 27$), not higher education ($n = 20$), not biological science or health sciences ($n = 52$), not English ($n = 2$), not LCT ($n = 2$) or duplicate references of the same research ($n = 3$). The screening was completed independently by two authors (SB and AM) who came to a consensus of inclusion criteria after discussions of any discrepancies. A backward and forward search of the included references identified an additional doctoral thesis which was subsequently added ($n = 1$). The literature search was repeated again on the 7th November 2023 which identified an additional study that had recently been published ($n = 1$). In total, 11 studies were retained and are included in this review. An overview of the search strategy and results is presented in the PRISMA flow diagram (Fig. 1).

Table 2
Search strategy.

Database	Search terms	Result
IEEE	("All Metadata":"Legitimation code theory" OR "All Metadata":LCT) AND ("All Metadata":"higher education"OR "professional education"OR curriculum OR "All Metadata":pedagogy OR "All Metadata": teaching)	12
Scopus	(TITLE-ABS-KEY ([Legitimation code theory] OR lct) AND TITLE-ABS-KEY ([higher education] OR [professional education] OR curriculum OR pedagogy OR teaching))	183
WOS	"Legitimation code theory" OR LCT (Topic) and "higher education" OR "professional education" OR curriculum OR pedagogy OR teaching (Topic) and Preprint Citation Index (Exclude – Database)	166
ProQuest central	title("Legitimation code theory" OR LCT) AND title ("higher education" OR "professional education" OR curriculum OR pedagogy OR teaching) OR summary (“Legitimation code theory" OR LCT) AND summary ("higher education" OR "professional education" OR curriculum OR pedagogy OR teaching)	72
EBSCOHost	AB ("Legitimation code theory" OR LCT) AND AB ("higher education" OR "professional education" OR curriculum OR pedagogy OR teaching) OR TI (“Legitimation code theory" OR LCT) AND TI ("higher education" OR "professional education" OR curriculum OR pedagogy OR teaching)	69
Medline with full text	AB ("Legitimation code theory" OR LCT) AND AB ("higher education" OR "professional education" OR curriculum OR pedagogy OR teaching) OR TI (“Legitimation code theory" OR LCT) AND TI ("higher education" OR "professional education" OR curriculum OR pedagogy OR teaching)	9
CINAHL	AB ("Legitimation code theory" OR LCT) AND AB ("higher education" OR "professional education" OR curriculum OR pedagogy OR teaching) OR TI (“Legitimation code theory" OR LCT) AND TI ("higher education" OR "professional education" OR curriculum OR pedagogy OR teaching)	7
INFORMIT	AB ([Legitimation code theory] OR LCT) AND AB ([higher education] OR [professional education] OR curriculum OR pedagogy OR teaching) OR TI ([Legitimation code theory] OR LCT) AND TI ([higher education] OR [professional education] OR curriculum OR pedagogy OR teaching)	0

3.4. Data evaluation

The Mixed Methods Appraisal Tool (MATT) was used to assess the quality of the studies (Hong et al., 2018). Each paper was evaluated independently by two authors (SB and AM). A third author (YS) helped to resolve any disagreements. A quality assessment score was calculated for each paper, with scores ranging between 86 % and 100 %. The results of the quality scores are included in Table 3.

3.5. Data extraction

Data were extracted from all included studies and organised into a summary table developed by the research team (Table 3). Completing the summary table with all included studies was performed by one author (SB) and reviewed by all other authors (YS and AM) for accuracy and completeness. Consistent with the aims of the current study, data

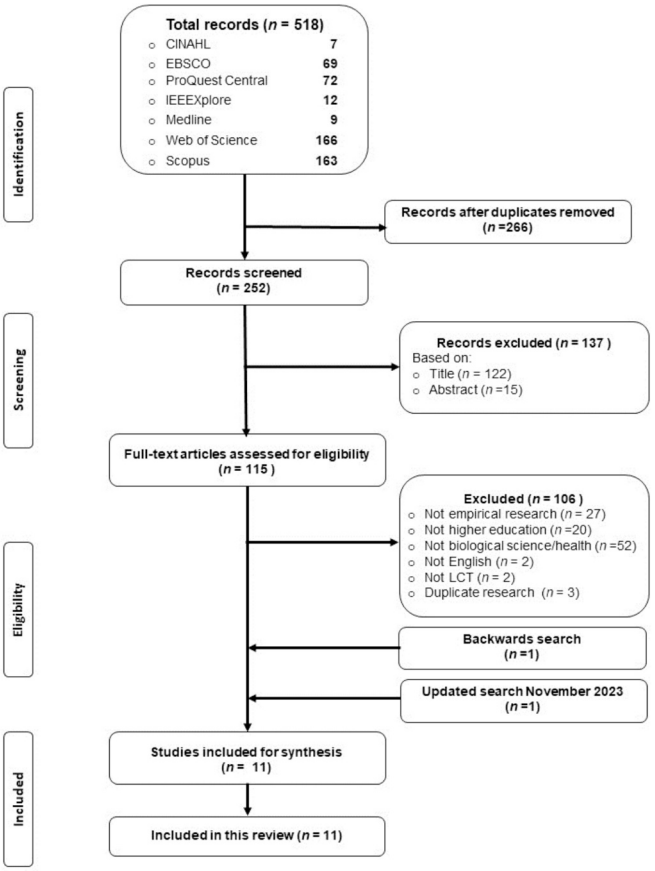

Fig. 1. PRISMA flow diagram of search and screening results (Page et al., 2021).

Table 3
Extracted data from included studies.

Author, year, Country Discipline	Category, Data source, Aim	LCT dimension/Use of LCT/Sample/ Duration/Analysis	Findings	Strengths and limitations	Quality score
Bowdler et al. (2023) **Australia** **Discipline:** Nursing (third year Bachelor of nursing)	**Qualitative** **Data Source:** Semi-structured interviews **Aim:** To use LCT to inform the design of nursing education	**LCT dimension:** Semantics **Use of LCT:** A framework to structure an online module **Sample:** Nine students semi-structured interviews **Duration:** One semester in 2021 and 2022 **Analysis:** Thematic analysis of interviews of student experience of module	o Students recognised links between concepts o Increased student engagement in modules o Students built on their existing knowledge	**Strengths:** o Ethics approval o One researcher conducted all the interviews **Limitations:** o Potential bias as researcher works within the faculty o Small number of participants	100 %
Boryczko (2022) **Poland** **Discipline:** Social work (undergraduate and postgraduate)	**Qualitative** **Data Source:** Student work as artifacts **Aim:** To investigate critical thinking for knowledge practice	**LCT dimension:** Semantic gravity (context-specific and theoretical) **Use of LCT:** Analyse data **Sample:** 22 students critical reflection essays **Duration:** Not identified **Analysis:** Mapped the movement of student critical reflections to semantic gravity plane	o High-scoring essays demonstrated a semantic wave within the critical reflection. o Demonstrated bridges between theory and practice	**Strengths:** o Use of a translation device **Limitations:** o Unclear who marked assessment tasks o Unclear if ethics was obtained	100 %
Brooke (2019) **Singapore** **Discipline:** Nursing (first year Bachelor of Nursing)	**Qualitative** **Data Source:** Student work as artifacts **Aim:** To analyse critical reflection of students	**LCT dimension:** Semantic gravity (context-specific and theoretical) **Use of LCT:** Analyse data **Sample:** 200 student's reflections 1200–1500 words **Duration:** 10 months in 2018–2019 **Analysis:** Mapped the movement of student critical reflections to semantic gravity plane	o High-scoring reflections demonstrated a semantic wave on several occasions linking theory to contextual practice o Low scoring paper was descriptive and depicted up escalators (not waves)	**Strengths:** o Analyst triangulation with experienced LCT researcher o Use of a translation device o Ethics approval o Faculty graded assessments semester prior to research **Limitations:** o Unclear if marks were blinded before analysis	100 %
de Bie (2017) **South Africa** **Discipline:** Physiotherapy & Occupational therapy (Interdisciplinary Human Biology)	**Qualitative** **Data Source:** Curriculum documents and interviews **Aim:** To determine how structuring curriculum can shape students access to professional knowledge	**LCT dimension:** o Specialization (legitimacy of knowledge) o Semantics (context dependence for meaning making) **Use of LCT:** Analyse data **Sample:** 20 years of anatomy and physiology faculty handbooks, lecture schedules and interviews of 4 academic staff **Duration:** 2013–2016	o Combining the disciplines in an integrated curriculum restricted cumulative knowledge. o Fragmented learning occurred from poor knowledge of the underpinning principles of the disciplines	**Strengths:** o Included the voice of the academic o Ethics approval o Purposeful selection of interview participants **Limitations:** o Potential bias as researcher works within the faculty o The student perceptions were not part of the study	100 %

(*continued on next page*)

Table 3 (*continued*)

Author, year, Country Discipline	Category, Data source, Aim	LCT dimension/Use of LCT/Sample/ Duration/Analysis	Findings	Strengths and limitations	Quality score
		Analysis: Used LCT dimensions specialization and semantics to analyse the curriculum documents and interviews			
Faadiel Essop and Adendorff (2022) **South Africa** **Discipline:** Physiology	**Qualitative** **Data Source:** Undergraduate problem-solving activities **Aim:** To investigate active teaching methods –problem-solving activities, to foster critical reasoning and problem-solving skills	**LCT dimension:** Autonomy (interaction of different knowledge areas) **Use of LCT:** Analyse data **Sample:** Three case studies **Duration:** One semester **Analysis:** Examined examples of problem-based learning activities to track the movement through the Autonomy cartesian plane	o Active learning can move students through different quadrants of the Autonomy Cartesian plane. o Problem-solving in real-life case studies draws on more than just physiology concepts	**Strengths:** o Use of a translation device **Limitations:** o The intended design only was analysed o The student perceptions were not part of the study o Unclear if ethics was obtained (student volunteers)	100 %
Georgiou (2020) **Australia** **Discipline:** Pharmacology	**Multi-method** **Data Source:** Qualitative: Student work as artifacts (language narration). Quantitative: Different word types were scored **Aim:** Development of a framework to assess complex assessment products such as student-generated digital products	**LCT dimension:** Semantic density (complex ideas) **Use of LCT:** Analyse data **Sample:** Two student artifacts **Duration:** One semester (for the two chosen works) **Analysis:** A Variety-Quality matrix was developed and used to identify key features in the product and the narration coded with semantic density	o Identified a method to conceptualise complexity in student-produced work o Improve communication in elements of assessment tasks and a resource for students to identify technicality and complexity.	**Strengths:** o Use of a translation device o Ethics approval o LCT specialists consulted **Limitations:** o Small sample size (n = 2) o Two examples selected from 41 tasks – Unclear if marks were blinded before analysis	88 %
Hood (2017) **Australia** **Discipline:** Health Science	**Qualitative** **Data Source:** Recorded lecture **Aim:** Explore the texturing of knowledge in live lectures and how it may scaffold students for written texts	**LCT dimension:** Semantic gravity (context dependency) **Use of LCT:** Analyse data **Duration:** One occurrence **Sample:** 60-min lecture **Analysis:** Lecturers' spoken language, body language, and slides coded on semantic gravity plane	o Using semantic gravity, a lecturer can scaffold students from their level of entry to a more decontextualised 'mastery' level of their discipline	**Strengths:** o Use of a translation device **Limitations:** o Only one recorded lecture used – no other pedagogy like face to face lectures	100 %
Jacobs and Van Schalkwyk (2022) **South Africa** **Discipline:** Medicine & Physiotherapy	**Qualitative** **Data Source:** Focus groups and interviews **Aim:** To identify what knowledge is valued by graduates in health professional education	**LCT dimension:** Specialization (legitimacy of knowledge) **Use of LCT:** Analyse data **Duration:** Not identified **Sample:** 34 health profession **Analysis:** Focus groups and interviews coded with both epistemic and social relations	o Dominant "Knowledge code". o Possession of specialised knowledge, procedures, and skills is valued (ER+, SR-) o Valued 'clinical competence' above 'critical consciousness	**Strengths:** o Ethics approval o Coded SR and ER individually first o Individuals coded independently and then had critical conversations with team for consensus **Limitations:**	100 %

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Table 3 (*continued*)

Author, year, Country Discipline	Category, Data source, Aim	LCT dimension/Use of LCT/Sample/ Duration/Analysis	Findings	Strengths and limitations	Quality score
				o Did not consider health professional student's perspective o Demographic of participants not included	
Johnson (2018) **United Kingdom** **Discipline:** Nursing	**Quantitative** **Data Source:** Likert scale survey **Aim:** To explore what approaches to learning allows success in information technology	**LCT dimension:** Specialization (legitimacy of knowledge) **Use of LCT:** Analyse data **Duration:** Not identified **Sample:** 310 nursing students responded **Analysis:** Subjects included were drug calculations, anatomy and physiology, sociology, information technology and clinical skills. Averages plotted on Cartesian plane	o The attitude of nursing students shifted from first-year to third-year. o First-year students focused on the knowledge theory and concepts of It while third-year students recognised success in IT included the individual	**Strengths:** o Large sample size with 40 % response rate **Limitations:** o Single cohort o Participants were familiar with the researcher o Unclear if ethics was obtained	100 %
Mouton and Archer (2019) **South Africa** **Discipline:** Biology	**Multi-method** **Data Source:** Qualitative: Focus groups Quantitative: Student results pre and post-intervention **Aim:** To explore the use of LCT in evaluating and changing pedagogy.	**LCT dimension:** Semantics (semantic wave - cumulative knowledge) **Use of LCT:** Analyse data **Duration:** 2016–2017 **Sample:** 84 students in 2016 and 59 in 2017 **Analysis:** Evaluations of learning designs (lesson plans and PowerPoint presentations). Redesign of the learning material using semantic waves. Conceptual understandings of students before and after intervention cohorts with focus groups and evaluated with assessment tasks	o Meet the students at their level of learning from the previous experience. o Improvement in student results pre and post-intervention. 2014 (n = 109) average mark 33.4 % and 2016 (n = 83) average mark 60.9 % o Developing the curriculum with a semantic wave will assist in achieving cumulative learning	**Strengths:** o Independent interviewer o Use of Translation device **Limitations:** o Unclear if ethics was obtained	94 %
Mouton (2020) **South Africa** **Discipline:** Biology	**Qualitative** **Data Source:** Student presentations Feedback questionnaire (qualitative) **Aim:** To develop deep content knowledge with the use of project-based learning	**LCT dimension:** Semantics (semantic wave - cumulative knowledge) **Use of LCT:** Analyse data **Duration:** Not identified **Sample:** o 30/62 students completed the qualitative questionnaire o 62 students completed group assessment task **Analysis:** o Student presentations and peer reviews were coded with the dimension of Semantics	o High school biology was not adequate preparation for first year university o Project-based learning demonstrated students moving through varied semantic profiles. The prevalence of semantic waves enabled students to build new knowledge.	**Strengths:** o Use of Translation device o Inclusion of peer review **Limitations:** o Unclear if ethics was obtained o Unclear who coded the data	86 %

extracted included: author, year of publication, country, discipline, category, data source, aim, LCT dimension used, sample size, duration, analysis, findings, strengths and limitations, and quality score.

3.6. Data analysis

This integrative review used the process to data analysis as outlined by Whittemore and Knafl (2005). Firstly, the data were categorised into their different methodologies – qualitative, quantitative or multi-method. The key findings were compiled and organised to explore how LCT had been used within the empirical studies in biological and health sciences. Focusing on the use of LCT, the key points were manually gathered and mapped by three researchers (SB, YS and AM) to understand how LCT has been used in the particular study. The extracted data were coded and organised to systematically compare the different studies. The data of the different variables were displayed in a table format and the data compared and grouped together to identify patterns and commonalities. Finally, a thematic synthesis was undertaken to develop an understanding on how LCT is used in learning and teaching in biological and health sciences.

4. Results

Of the 11 included studies, five are from South Africa (de Bie, 2016; Faadiel Essop and Adendorff, 2022; Jacobs and Van Schalkwyk, 2022; Mouton, 2020; Mouton and Archer, 2019), three from Australia (Bowdler et al., 2023; Georgiou, 2020; Hood, 2017) and the remaining three include one each from Poland (Boryczko, 2022), Singapore (Brooke, 2019) and the United Kingdom (Johnson, 2018). These studies span a range of science and health disciplines with two in biology (Mouton, 2020; Mouton and Archer, 2019), three in nursing (Bowdler et al., 2023; Brooke, 2019; Johnson, 2018), one in pharmacology (Georgiou, 2020), one in social work (Boryczko, 2022) and one in health science (Hood, 2017). Notably, two studies adopted an interdisciplinary approach, with (de Bie, 2016) focusing on the physiotherapy and occupational therapy disciplines within human biology and Jacobs and Van Schalkwyk (2022) focusing on medicine and physiotherapy.

The 11 studies varied in terms of which LCT dimensions they utilised. Seven studies used the Semantics dimension (Boryczko, 2022; Bowdler et al., 2023; Brooke, 2019; Georgiou, 2020; Hood, 2017; Mouton, 2020; Mouton and Archer, 2019), two studies used Specialization (Jacobs and Van Schalkwyk, 2022; Johnson, 2018), one used both Semantics and Specialization (de Bie, 2016), and one used the dimension of Autonomy (Faadiel Essop and Adendorff, 2022). Of the identified studies, eight focused on content knowledge (Bowdler et al., 2023; de Bie, 2016; Faadiel Essop and Adendorff, 2022; Hood, 2017; Jacobs and Van Schalkwyk, 2022; Johnson, 2018; Mouton, 2020; Mouton and Archer, 2019) while the remaining three studies focused on assessment tasks (Boryczko, 2022; Brooke, 2019; Georgiou, 2020).

This review identified four key themes in how LCT informed educational design in biological and health sciences: a) LCT as a framework for data analysis; b) Identifying and enhancing learning outcomes through LCT; c) Pedagogy design informed by LCT; and d) LCT to contextualise disciplinary knowledge.

4.1. LCT as a framework for data analysis

In ten of the 11 studies identified in this integrative review, LCT dimensions were used to inform data analysis (Boryczko, 2022; Brooke, 2019; de Bie, 2016; Faadiel Essop and Adendorff, 2022; Georgiou, 2020; Hood, 2017; Jacobs and Van Schalkwyk, 2022; Johnson, 2018; Mouton, 2020; Mouton and Archer, 2019). While data sources for these analyses may vary, student artefacts were used in five studies (Boryczko, 2022; Brooke, 2019; Faadiel Essop and Adendorff, 2022; Georgiou, 2020; Mouton, 2020) and the remaining one used students' problem-based learning activities (Faadiel Essop and Adendorff, 2022). A combination of data sources was used in three studies, with one using historical curriculum documents and interviews (de Bie, 2016), a second used focus groups and students' assessment results (Mouton and Archer, 2019) and the third conducted focus groups and interviews (Jacobs and Van Schalkwyk, 2022). Of the remaining two studies, one analysed a recorded lecture (Hood, 2017); and the other used a self-report survey on nursing student perspectives (Johnson, 2018).

4.2. Identifying and enhancing learning outcomes through LCT

The structure and the content of the teaching methods was the focus for five studies (Bowdler et al., 2023; Faadiel Essop and Adendorff, 2022; Hood, 2017; Mouton, 2020; Mouton and Archer, 2019). Two studies (Faadiel Essop and Adendorff, 2022; Mouton, 2020) evaluated active learning strategies and identified that using real-life scenarios enables students to draw on different concepts and increased integration of their new knowledge. Another two studies (Hood, 2017; Mouton and Archer, 2019) explored the design and presentation of their teaching methods. Mouton and Archer (2019) redesigned their lesson plans and PowerPoints to explicitly include a 'semantic wave' (See Semantics in Table 1). The students in the cohort after the redesign scored an average of 27.5 % higher in their assessment than the students who had studied prior to the redesign. An important conclusion was that Semantics was significant as an organising principle for curriculum and teaching methods enabling students to achieve cumulative learning when their curriculum is structured in such a way that teachers can meet the students at their entry level and scaffold their learning using semantic waves.

Bowdler et al. (2023) used semantic waves to structure an online breastfeeding module where they built onto any existing knowledge or experiences the students had. Thematic analysis was used to understand the students' experience, which identified increased student engagement with the learning materials compared to other subjects that students had previously completed.

4.3. Pedagogy design informed by LCT

The evaluation of students' critical reflection in assessment tasks was addressed in two studies and disciplines (Boryczko, 2022; Brooke, 2019). In both nursing (Brooke, 2019) and social work (Boryczko, 2022), the dimension of Semantics, in particular semantic gravity, was used to identify those students who scored high in their assessment tasks. Both studies demonstrated that a semantic wave served to illustrate the students critical thinking ability (Boryczko, 2022; Brooke, 2019). Both studies concluded that students who achieved the semantic wave within their reflections by decontextualising and then recontextualising an event were able to bridge between theory and practice.

In one study (Georgiou, 2020), semantic density from the dimension of Semantics was used to assess the narration in complex assessment tasks with student-produced digital explanations. The study used the semantic wave to analyse high-quality tasks, consider levels of technicality and complexity and how to better communicate these task demands to students.

4.4. LCT to contextualise disciplinary knowledge

Three studies (de Bie, 2016; Jacobs and Van Schalkwyk, 2022; Johnson, 2018) focused on the concept of legitimate knowledge within their respective disciplines of physiotherapy, occupational therapy, medicine and nursing, with specific emphasis on the knowledge that is valued by health professional academics in their discipline. The study by de Bie (2016) examined historical curricula in two distinct disciplines that were taught as an integrated subject. This integration led to fragmented learning experiences, primarily due to ineffective application of

human biology principles within the disciplines. In the study by Jacobs and Van Schalkwyk (2022), specialised knowledge and skills were more highly valued over personal attributes of individuals in health professions education, highlighting the emphasis of technical expertise in the field. Finally, in the study by Johnson (2018), the evolutionary changes in student attitudes in the health discipline over time was explored. It revealed a notable shift from a primary focus on knowledge and theory in the first year to a greater appreciation of individual contributions and effective use of discipline-specific information technology by the third year. This shift underscores the growing importance of personal involvement and practical application as students progress along their educational trajectories.

5. Discussion

This review provides new insight into how LCT has been effectively applied in the design and evaluation of professional education in biological and health sciences, highlighting its versatility as a tool and framework for: a) data analysis (Boryczko, 2022; Brooke, 2019; de Bie, 2016; Faadiel Essop and Adendorff, 2022; Georgiou, 2020; Hood, 2017; Jacobs and Van Schalkwyk, 2022; Johnson, 2018; Mouton, 2020; Mouton and Archer, 2019); b) highlighting and enhancing learning outcomes through LCT (Bowdler et al., 2023; Faadiel Essop and Adendorff, 2022; Mouton, 2020; Mouton and Archer, 2019); c) shaping pedagogy (Bowdler et al., 2023; Faadiel Essop and Adendorff, 2022; Hood, 2017; Mouton, 2020; Mouton and Archer, 2019); and, d) contextualising the knowledge that is valued or considered legitimate within disciplines (de Bie, 2016; Jacobs and Van Schalkwyk, 2022; Johnson, 2018). LCT is an extensive framework that considers both the knowledge and the learner (Maton, 2014a). Building upon these findings, we now discuss the multifaceted applications of LCT.

Most of the studies included in the current review utilised LCT for their data analysis (Boryczko, 2022; Brooke, 2019; de Bie, 2016; Faadiel Essop and Adendorff, 2022; Georgiou, 2020; Hood, 2017; Jacobs and Van Schalkwyk, 2022; Johnson, 2018; Mouton, 2020; Mouton and Archer, 2019). The analysis with LCT was used as a method to evaluate the curriculum, teaching practices, and assessment design. Evaluation and reflection are essential components of professional and academic development to gain insight into practices and identify strengths and areas of improvement (Hunt and Chalmers, 2021). In academia and professional education, LCT provides an opportunity to improve teaching methodologies and educational outcomes.

LCT can offer valuable insights for the design of assessment items in nursing education and improve student learning outcomes. Using the LCT framework, nursing academics can develop assessments that test students' depth of understanding and ability to integrate and apply concepts across various contexts. Nursing academics can use LCT to design comprehensive, equitable assessments that reflect the multifaceted nature of knowledge in the nursing discipline (Sakamoto, 2018). The integration of LCT principles thus not only reshapes assessment practices and knowledge construction but also aligns with the evolving needs of educational systems, emphasising a dynamic and integrative approach to learning.

Active learning strategies and student engagement are other pedagogical components that can be shaped using LCT. In contrast to passive learning approaches, LCT encourages pedagogical methods that promote critical thinking, problem-solving, and collaboration skills (Boryczko, 2022; Brooke, 2019; Faadiel Essop and Adendorff, 2022; Mouton, 2020). This aligns with contemporary educational paradigms that prioritise interactive and participatory learning experiences (Chu et al., 2019; Fields et al., 2021).

The semantic wave is a recurrent feature of the LCT framework within the included studies and assists in pedagogical design (Boryczko, 2022; Bowdler et al., 2023; Brooke, 2019; Mouton, 2020; Mouton and Archer, 2019). An application of the semantic wave offers substantial benefits in the field of education as this concept facilitates the process of connecting context specific understandings to more generalised or theoretical understandings (Maton, 2013, 2014a). This ebb and flow of the semantic wave supports the transfer of learning, enabling students to apply their knowledge across varied contexts and fostering a deeper understanding, by oscillating between complex ideas to more concrete and simplified concepts (Bowdler et al., 2023). This method not only helps to demystify complex ideas for students, but also makes concepts more accessible and relevant to students, regardless of their baseline levels of understanding (Clarence, 2021). As such, it is particularly useful in nursing education, where understanding the underlying principles is as important as applying them to practice (Kavanagh, 2021). The deeper connection of meanings between personal and disciplinary knowledges promotes the concept of cumulative knowledge building (Maton, 2013). An example of a semantic wave can be seen in Fig. 2.

The concept of cumulative knowledge building was also highlighted in several studies included in the current review and assists the learner in appreciating their developing disciplinary knowledge (Boryczko, 2022; Bowdler et al., 2023; Brooke, 2019; de Bie, 2016; Mouton, 2020; Mouton and Archer, 2019). Building cumulative knowledge, as defined by LCT, offers substantial benefits as this framework ensures that students are not focused on learning isolated facts or skills, but rather as integrated into a coherent and evolving body of knowledge and understanding of the subject matter (Maton, 2013). The progressive accumulation and integration of knowledge over time enables students to appreciate the interrelatedness of various aspects of their field of study (Bowdler et al., 2023; Walton and Rusznyak, 2020). In higher education, cumulative knowledge fosters critical thinking and analytical skills as students are encouraged to question, critique, and build upon their learning; aligning well with the goals of higher education and developing intellectual skills in the pursuit of lifelong learning (Jantzen, 2022). Guided by LCT, nursing education includes learning about clinical procedures and protocols but not in isolation as students are supported to understand how fundamental principles of evidence-based healthcare practices underpin the practices (Horntvedt et al., 2018). This holistic learning approach is crucial to prepare nursing graduates who can adapt to the range of new challenges they will encounter in clinical practice and then continue to integrate new knowledge into their existing knowledge frameworks.

Each discipline has knowledge that is accepted and highly regarded, often specialised to the profession's nuances (de Bie, 2016; Jacobs and Van Schalkwyk, 2022; Johnson, 2018). While LCT is ultimately about the importance of knowledge and how it is structured, it also acknowledges the knower within each discipline. This dual consideration enriches the understanding of professional expertise, recognising the practitioner's role in shaping and contributing to the broader knowledge landscape (Flening et al., 2022). This perspective is particularly relevant to today's rapidly changing professional conditions, where the ability to adapt, innovate and continuously learn is highly valued (Kavanagh, 2021). These strategies highlight the significance of an active learning environment.

5.1. Strengths and limitations

The strength of this review is the rigorous methodology employed, where multiple reviewers independently assessed the included studies. This approach enhances the reliability and robustness of the review process, reducing bias and providing a comprehensive evaluation of the literature. However, whilst an integrative review is valuable, there may be publication bias as studies with positive results are the ones that tend to be published. It is also possible that the rigid inclusion criteria may have led to the exclusion of relevant studies in other disciplines of professional education.

6. Conclusion

In conclusion, this comprehensive review underscores the significant

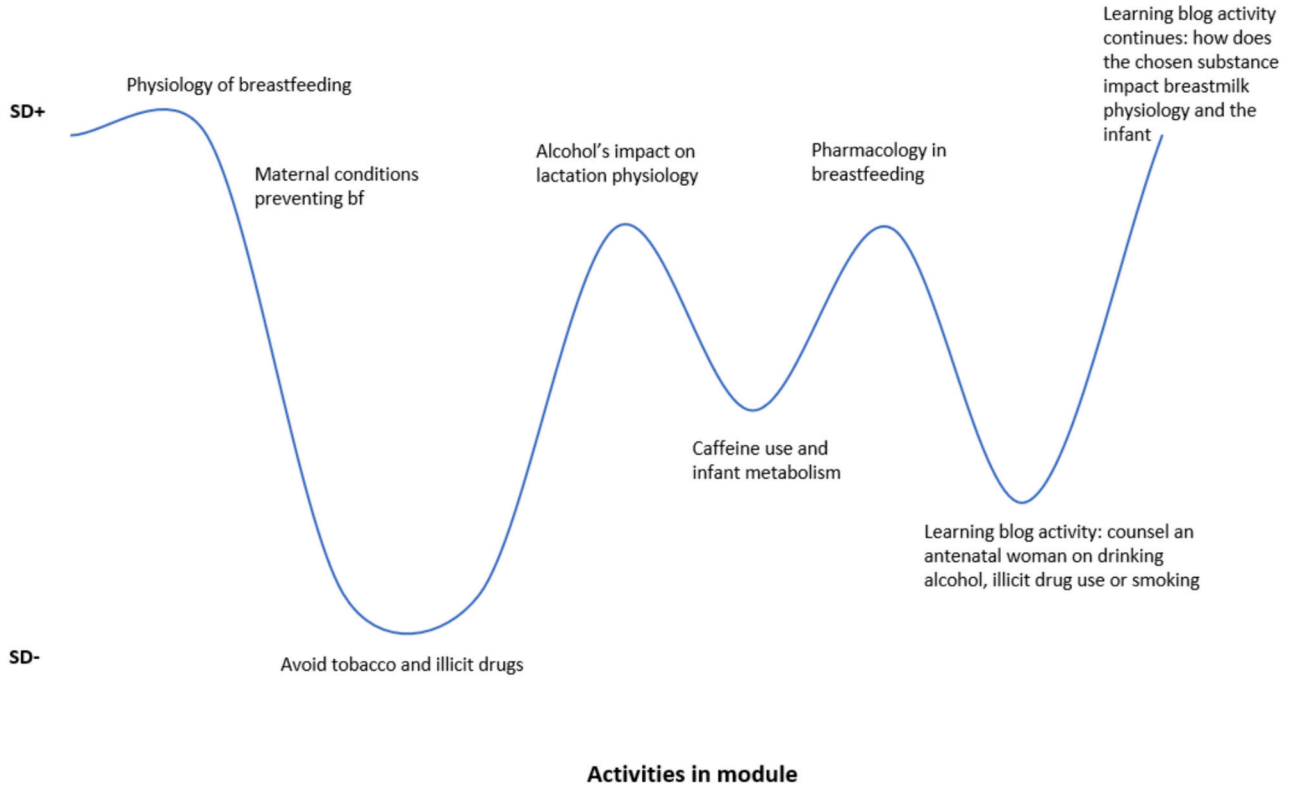

Fig. 2. Using the semantic wave (Bowdler et al., 2023).

impact of LCT on the design and evaluation of professional education within biological and health sciences. The versatility of LCT is evident across the various disciplines, as revealed through the synthesis of diverse studies, demonstrating its effectiveness as a robust tool and framework across its various dimensions.

The review also highlights the transformative potential of LCT in shaping pedagogy. By encouraging active learning strategies and student engagement, LCT supports pedagogical methods that align with contemporary educational paradigms, fostering critical thinking, problem-solving, and collaboration skills. The recurrent feature of the semantic wave within the LCT framework emerges as a particularly useful tool, facilitating the structuring of knowledge and pedagogical experiences and thus the transfer of learning to promote a deeper understanding of complex ideas in nursing education.

Cumulative knowledge building emerges as a key theme in the reviewed studies. This concept ensures that students not only learn critical facts and skills but also to develop a coherent and evolving body of knowledge over time. The integration of cumulative knowledge in nursing education aligns with the goals of higher education, fostering critical thinking and analytical skills crucial for adapting to challenges in clinical practice.

Beyond its focus on knowledge, LCT uniquely recognises the role of the practitioner within each profession. This adds depth to our understanding of professional expertise, acknowledging the practitioner's role in shaping and contributing to the broader knowledge landscape. In today's rapidly changing healthcare environment, where adaptability and continuous learning are highly valued, LCT's emphasis on the knower becomes especially relevant.

6.1. *Implications for practice*

The multifaceted application of LCT makes a compelling case for its adoption in nursing education. LCT is a comprehensive framework that enhances educational practices and aligns with the evolving needs of educational systems in the biological and health sciences. Building from the varying entry-levels of learners, educators can harness and optimise the previous knowledge of the students, meeting them at their current levels of knowledge and assisting them to develop their knowledge and meet learning outcomes.

CRediT authorship contribution statement

Suzanne Bowdler: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Wendy Nielsen:** Writing – review & editing, Writing – original draft, Supervision, Conceptualization. **Shahla Meedya:** Writing – review & editing, Writing – original draft, Conceptualization. **Ashley Matthews:** Writing – review & editing, Data curation. **Yenna Salamonson:** Writing – review & editing, Writing – original draft, Supervision, Data curation, Conceptualization.

Declaration of competing interest

No conflict of interest has been declared by the authors.

References

Abualhaija, N., 2019. Using constructivism and student-centered learning approaches in nursing education. Int. J. Nurs. Health Care Res. 5 (7), 1–6. https://doi.org/10.29011/IJNHR-093.100093.

Alanazi, A., 2016. A critical review of constructivist theory and the emergence of constructionism. Am. Res. J. Human. Soc. Sci. 2 (2016), 1–8.

Bandura, A., Walters, R.H., 1977. Social Learning Theory, vol. 1. Englewood cliffs Prentice Hall.

de Bie, G., 2016. *Analysis of a foundational biomedical curriculum: exploring cumulative knowledge-building in the rehabilitative health professions* Rhodes University. http://vital.seals.ac.za:8080/vital/access/manager/Repository/vital:22361?site_name=GlobalView&exact=sm_title%3A%22Analysis+of+a+foundational+biomedical+curriculum%3A+exploring+cumulative+knowledge-building+in+the+rehabilitative+health+professions%22.

Boryczko, M., 2022. Critical thinking in social work education. A case study of knowledge practices in students' reflective writings using semantic gravity profiling

[article]. Soc. Work. Educ. 41 (3), 317–332. https://doi.org/10.1080/02615479.2020.1836143.
Bowdler, S., Nielsen, W., Meedya, S., Salamonson, Y., 2023. Applying Legitimation Code Theory to teach breastfeeding in nurse education: a case study. Nurse Educ. Pract. 72, 103780 https://doi.org/10.1016/j.nepr.2023.103780.
Brooke, M., 2019. Using semantic gravity profiling to develop critical reflection [article]. Reflective Pract. 20 (6), 808–821. https://doi.org/10.1080/14623943.2019.1682986.
Chang, H., Do, Y.J., 2024. A spark of change: developing an innovative gerontological nursing intervention mapping initiative for training and education (IGNITE). BMC Med. Educ. 24 (1), 266. https://doi.org/10.1186/s12909-024-05240-5.
Christensen, M., Craft, J., 2021. "Gaining a new sense of me": mature students experiences of under-graduate nursing education. Nurse Educ. Today 96, 104617. https://doi.org/10.1016/j.nedt.2020.104617.
Chu, T.-L., Wang, J., Monrouxe, L., Sung, Y.-C., Kuo, C.-l., Ho, L.-H., Lin, Y.-E., 2019. The effects of the flipped classroom in teaching evidence based nursing: a quasi-experimental study. PLoS One 14 (1), e0210606. https://doi.org/10.1371/journal.pone.0210606.
Clarence, S., 2021. Turning Access into Success: Improving University Education with Legitimation Code Theory. Routledge.
Dankenbring, C.A., Guzey, S.S., Bryan, L.A., 2024. Legitimation code theory as an analytical framework for integrated STEM curriculum and its enactment. Res. Sci. Educ. 54 (1), 49–64. https://doi.org/10.1007/s11165-023-10103-y.
Faadiel Essop, M., Adendorff, H., 2022. Using autonomy to understand active teaching methods in undergraduate science classes. In: Enhancing Science Education: Exploring Knowledge Practices with Legitimation Code Theory. Taylor and Francis, pp. 169–190. https://doi.org/10.4324/9781003055549-12.
Fields, L., Trostian, B., Moroney, T., Dean, B.A., 2021. Active learning pedagogy transformation: a whole-of-school approach to person-centred teaching and nursing graduates. Nurse Educ. Pract. 53, 103051 https://doi.org/10.1016/j.nepr.2021.103051.
Flening, E., Asplund, F., Edin Grimheden, M., 2022. Measuring professional skills misalignment based on early-career engineers' perceptions of engineering expertise. Eur. J. Eng. Educ. 47 (1), 117–143. https://doi.org/10.1080/03043797.2021.1967883.
Georgiou, H., 2020. Characterising communication of scientific concepts in student-generated digital products [article]. Educ. Sci. 10 (1), 18 https://doi.org/10.3390/educsci10010018.
Green, C., 2020. Equity and diversity in nursing education. Teach. Learn. Nurs. 15 (4), 280–283. https://doi.org/10.1016/j.teln.2020.07.004.
Hong, Q.N., Fàbregues, S., Bartlett, G., Boardman, F., Cargo, M., Dagenais, P., Gagnon, M.-P., Griffiths, F., Nicolau, B., O'Cathain, A., 2018. The mixed methods appraisal tool (MMAT) version 2018 for information professionals and researchers. Educ. Inf. 34 (4), 285–291. https://doi.org/10.3233/EFI-180221.
Hood, S., 2017. Live lectures: the significance of presence in building disciplinary knowledge [article]. Onomazein 179-208. https://doi.org/10.7764/onomazein.sfl.07.
Horntvedt, M.-E.T., Nordsteien, A., Fermann, T., Severinsson, E., 2018. Strategies for teaching evidence-based practice in nursing education: a thematic literature review. BMC Med. Educ. 18, 1–11. https://doi.org/10.1186/s12909-018-1278-z.
Hunt, L., Chalmers, D., 2021. University Teaching in Focus: A Learning-Centred Approach. Routledge.
Jacobs, C., Van Schalkwyk, S., 2022. What knowledge matters in health professions education? [article]. Teach. High. Educ. 27 (8), 1068–1083. https://doi.org/10.1080/13562517.2022.2111207.
Jantzen, D., 2022. Getting grounded: educational foundations for nurses' lifelong learning. J. Prof. Nurs. 39, 34–40. https://doi.org/10.1016/j.profnurs.2021.12.009.
Jeffreys, M.R., 2022. Nursing student retention and success: action innovations and research matters. Teach. Learn. Nurs. 17 (1), 137–146. https://doi.org/10.1016/j.teln.2021.06.010.
Johnson, M., 2018. Success in information technology - what do student nurses think it takes? A quantitative study based on Legitimation Code Theory [article]. Res. Learn. Technol. 26, 2049 https://doi.org/10.25304/rlt.v26.2049.
Kantar, L.D., Ezzeddine, S., Rizk, U., 2020. Rethinking clinical instruction through the zone of proximal development. Nurse Educ. Today 95, 104595. https://doi.org/10.1016/j.nedt.2020.104595.
Kavanagh, J.M., 2021. Crisis in competency: a defining moment in nursing education. Online J. Issues Nurs. 26 (1) https://doi.org/10.3912/OJIN.Vol26No01Man02.
Lave, J., Wenger, E., 1991. Situated Learning: Legitimate Peripheral Participation. Cambridge university press. https://doi.org/10.1017/CBO9780511815355.
Maton, K., 2013. Making semantic waves: a key to cumulative knowledge-building. Linguist. Educ. 24 (1), 8–22. https://doi.org/10.1016/j.linged.2012.11.005.
Maton, K., 2014a. Knowledge and Knowers: Towards a Realist Sociology of Education. Routledge, Taylor and Francis Group.
Maton, K., 2014b. A TALL order? Legitimation Code Theory for academic language and learning. J. Acad. Lang. Learn. 8 (3), A34–A48.
Maton, K., 2016. Legitimation Code Theory: building knowledge about knowledge-building. In: Maton, K., Hood, S., Shay, S. (Eds.), Knowledge-building: Educational studies in Legitimation Code Theory.
Maton, K., Chen, R.T.-H., 2015. LCT in qualitative research: creating a translation device for studying constructivist pedagogy. In: Knowledge-Building: Educational Studies in Legitimation Code Theory. Taylor and Francis, pp. 27–48. https://doi.org/10.4324/9781315672342-11.
Maton, K., Moore, R., 2010. Coalitions of the mind. In: Maton, K., Moore, R. (Eds.), Social Realism, Knowledge and Sociology of Education: Coalitions of the Mind, vol. 1. Continuum International Publishing Group, pp. 1–13.
Mezirow, J., 1997. Transformative learning. In: New Directions for Adult and Continuing Education, 74(74), pp. 5–12. https://doi.org/10.1002/ace.7401.
Moore, R., 2013. Social realism and the problem of the problem of knowledge in the sociology of education. Br. J. Sociol. Educ. 34 (3), 333–353. https://doi.org/10.1080/01425692.2012.714251.
Mouton, M., 2020. A case for project based learning to enact semantic waves: towards cumulative knowledge building [article]. J. Biol. Educ. 54 (4), 363–380. https://doi.org/10.1080/00219266.2019.1585379.
Mouton, M., Archer, E., 2019. Legitimation Code Theory to facilitate transition from high school to first-year biology [article]. J. Biol. Educ. 53 (1), 2–20. https://doi.org/10.1080/00219266.2017.1420681.
O'Brien, B.C., Battista, A., 2020. Situated learning theory in health professions education research: a scoping review. Adv. Health Sci. Educ. 25, 483–509. https://doi.org/10.1007/s10459-019-09900-w.
Page, M.J., McKenzie, J.E., Bossuyt, P.M., Boutron, I., Hoffmann, T.C., Mulrow, C.D., Shamseer, L., Tetzlaff, J.M., Akl, E.A., Brennan, S.E., 2021. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. Int. J. Surg. 88, 105906 https://doi.org/10.1136/bmj.n71.
Rojo, J., Ramjan, L., George, A., Hunt, L., Heaton, L., Kaur, A., Salamonson, Y., 2023. Applying Mezirow's Transformative Learning Theory into nursing and health professional education programs: a scoping review. Teach. Learn. Nurs. 18 (1), 63–71. https://doi.org/10.1016/j.teln.2022.09.013.
Rusznyak, L., 2020. Supporting the academic success of students through making knowledge-building visible. In: Wilmot, K., Winberg, C., McKenna, S. (Eds.), Building Knowledge in Higher Education: Enhancing Teaching and Learning with Legitimation Code Theory. Routledge, Taylor & Francis Group, pp. 90–104.
Sakamoto, M.L., 2018. Nursing knowledge: a middle ground exploration. Nurs. Philos. 19 (3), e12209 https://doi.org/10.1111/nup.12209.
Salamonson, Y., Ramjan, L., Lombardo, L., Lanser, L., Fernandez, R., Griffiths, R., 2012. Diversity and demographic heterogeneity of Australian nursing students: a closer look. Int. Nurs. Rev. 59 (1), 59–65.
Sayer, A., 2020. Realism and Social Science. SAGE Publications. https://doi.org/10.4135/9781446218730.
Saylor, C., 2015. Learning theories applied to curriculum development. In: Keating, S. (Ed.), Curriculum Development and Evaluation in Nursing, Third ed. Springer Publishing Company, pp. 63–85.
Spencer, T.D., 2020. Improving diversity of the nursing workforce through evidence-based strategies. J. Nurs. Educ. 59 (7), 363–364. https://doi.org/10.3928/01484834-20200617-01.
Stanley, M.J., Banks, S., Matthew, W., Brown, S., 2020. Operationalization of Bandura's social learning theory to guide interprofessional simulation. J. Nurs. Educ. Pract. 10, 10–61. https://doi.org/10.5430/jnep.v10n10p61.
Thomas, A., Menon, A., Boruff, J., Rodriguez, A.M., Ahmed, S., 2014. Applications of social constructivist learning theories in knowledge translation for healthcare professionals: a scoping review. Implement. Sci. 9, 1–20. http://www.implementationscience.com/content/9/1/54.
Van Hoek, G., Portzky, M., Franck, E., 2019. The influence of socio-demographic factors, resilience and stress reducing activities on academic outcomes of undergraduate nursing students: a cross-sectional research study. Nurse Educ. Today 72, 90–96. https://doi.org/10.1016/j.nedt.2018.10.013.
Vignoles, A., Murray, N., 2016. Widening participation in higher education. Educ. Sci. 6 (2), 13. https://doi.org/10.3390/educsci6020013.
Vygotsky, L.S., Cole, M., 1978. Mind in Society: Development of Higher Psychological Processes. Harvard university press.
Walton, E., Rusznyak, L., 2020. Cumulative knowledge-building for inclusive education in initial teacher education. Eur. J. Teach. Educ. 43 (1), 18–37. https://doi.org/10.1080/02619768.2019.1686480.
Whittemore, R., Knafl, K., 2005. The integrative review: updated methodology. J. Adv. Nurs. 52 (5), 546–553. https://doi.org/10.1111/j.1365-2648.2005.03621.x.
Wolff, K., 2018. A language for the analysis of disciplinary boundary crossing: insights from engineering problem-solving practice. Teach. High. Educ. 23 (1), 104–119. https://doi.org/10.1080/13562517.2017.1359155.