Applying Legitimation Code Theory to teach breastfeeding in nurse education: A case study

Suzanne Bowdler [a,*], Wendy Nielsen [b], Shahla Meedya [a,1], Yenna Salamonson [a]

[a] School of Nursing, University of Wollongong, Northfields Avenue, Wollongong, NSW 2522 Australia
[b] School of Education, University of Wollongong, Northfields Avenue, Wollongong, NSW 2522 Australia

A B S T R A C T

Aim: To use Legitimation Code Theory as a framework to inform the design of nursing education and gain insights into student perspectives of this design.
Background: Internationally, the World Health Organization's breastfeeding recommendations are not being met. One contributing factor is that healthcare providers including registered nurses lack the knowledge to support breastfeeding women on an ongoing basis and rely on their personal experiences to inform the care they provide. Undergraduate nursing students should receive education to assist breastfeeding women in practice.
Design: The study is underpinned by case-study methodology. The Legitimation Code Theory (LCT) dimension of Semantics and the concepts of semantic gravity and semantic density were used to theoretically frame and develop an intervention module to teach undergraduate nurses about breastfeeding.
Methods: This module was part of an elective seven-week paediatric nursing course. University Human Research Ethics Committee (HREC201/203) reviewed the study. Participants ($n = 9$) completed semi-structured interviews and thematic analysis helped us to understand their experiences of the module. The Template for Intervention and Description and Replication (TIDeR) framework was used to report the intervention.
Results: The breastfeeding module was positively received by participants who noted the module's structure differed from previous courses. Three main themes were identified in the student experience. These are: a) threads and links; b) engaging structure; and c) seedlings.
Conclusion: Legitimation Code Theory is an effective course development framework to harness the learners' prior informal knowledge and weave learning activities between theory and contextual practice to develop cumulative knowledge.
Impact: With an increased understanding of how undergraduate nursing students develop knowledge, the LCT dimension of Semantics can be used to structure content knowledge in instructional design. This approach builds explicit bridges between knowledge development in the nursing curriculum and learners' informal knowledge and contextual practice in clinical settings.

1. Introduction

'Breast is best' and breastfeeding benefits nursing mothers and population health (Azad et al., 2021). Health benefits include reduced infant morbidity and mortality and the World Health Organization (WHO) recommends exclusive breastfeeding for the first six months and continuing for up to two years (World Health Organization, 2021). Despite this, fewer than 40% of children in Australia were breastfed beyond one year (Netting et al., 2022). Early cessation is multifactorial, however, lack of support from health professionals is influential on

women's decisions to change feeding methods (Matriano et al., 2021). In a systematic review, Meedya et al. (2017) demonstrated the importance of ongoing education and support by health professionals for a successful long-term breastfeeding outcome.

Promoting breastfeeding, providing advice and supporting women to achieve their breastfeeding goals following hospital discharge is the nurse's role in the community and paediatric hospital settings (Busch et al., 2014). The World Health Organization (2020) recognises the important work of nurses to support breastfeeding women, but to develop capacity for this support, breastfeeding education needs to start

with undergraduate nursing education, which, remains inconsistent or inadequate (Prokop et al., 2021; Yang et al., 2018). Currently, breast-feeding education in undergraduate degrees varies from 3 min to 300 h, if included (Campbell et al., 2022). A lack of standardisation in breast-feeding education means that graduate nurses are often unprepared to support breastfeeding women. Rather than rely on evidence-based approaches, they may instead rely on their own experiences (Moukarzel et al., 2020). Nursing education on breastfeeding needs improvement by incorporating students' prior knowledge and contemporary evidence-base information into undergraduate curriculum.

2. Background

The World Health Organization (2020) developed the 10 Steps to Successful Breastfeeding as part of the Baby-Friendly Hospital Initiative (BFHI) to improve breastfeeding rates. BFHI's toolkit guides ongoing breastfeeding support beyond initiation in the maternity facility (World Health Organization, 2020), contextualised into national health guidelines across different countries. For example, the Australian Infant Feeding Guidelines (National Health and Medical Research Council, 2012) have incorporated BFHI guidelines to direct healthcare delivery. Thus, embedding breastfeeding into nursing education could improve nurses' knowledge to better support women during healthcare delivery.

Findings of the integrative review by Bowdler et al. (2022) showed that although undergraduate nursing students across different countries have sufficient knowledge of the physiology of lactation (Khriesat and Ismaile, 2017; Lopez-Peña et al., 2020; Rhodes and Burgess, 2018), they were not/ equipped with knowledge in the management of the practical aspects of supporting breastfeeding women (Ahmed and El Guindy, 2011; Cervera-Gasch et al., 2021; Spear, 2006). Given the inadequate theoretical or formal knowledge that provides structure and coherence to deliver practical care, nurses rely on their personal experiences (Prokop et al., 2021), which could lead to incorrect advice being given. Nursing students, like other adult learners, rely on their previous experiences as a foundation to build their knowledge (Knowles et al., 2015). Importantly, a dependence on everyday knowledge could also mean that nursing students learn or acquire skills in isolation in a context and are unable to integrate, progressively construct, apply or transfer evidence-based knowledge into practice (Maton, 2013). As seen in many professional education programs, these are aspects of the theory-practice divide (Ord and Nuttall, 2016).

While a theory/practice divide commonly occurs in nurse education, Greenway et al. (2019) emphasised that building connections between theory and practice for nursing students is critical. Using a formal theory of knowledge development to connect theory and practice could effectively enhance nursing students' knowledge of breastfeeding and its clinical application. Legitimation Code Theory (LCT) is a theoretical framework (Maton, 2014) that recognises knowledge as its own entity and can be produced socially through collective experiences over time while leveraging and recognising the learners' prior experiences, which is an important principle in adult learning. Furthermore, student perspectives and how they engage during their learning provides opportunities for educators to refine and improve courses (Kahu et al., 2020). Hence, student experiences and perspectives are key to course success when introducing a new pedagogical approach.

The aim of our project is to develop nursing students' knowledge in breastfeeding [DESTINI] that used LCT in conceptualising an education module for nursing students in an Australian university. The Template for Intervention and Description and Replication (TIDieR) reporting checklist was used to guide the reporting of the intervention (Hoffmann et al., 2014).

3. Theoretical perspectives used in module design

The module development involved two theoretical perspectives: adult learning principles and Legitimation Code Theory. Adult learning

principles include relevance, active learning, collaboration and respect for prior knowledge and experience (Knowles et al., 2015). Leveraging learners existing experience and knowledge aligns well with LCT as a knowledge-building framework.

Legitimation Code Theory is a sociological framework that makes visible the structure of knowledge. In course design, visible knowledge entails exploring the links between theory and practice, to assist learners develop knowledge in the field (Maton, 2014). LCT has often been used in non-nursing educational disciplines, but its application in nursing is emerging. For example, Hartnett and McNamara (2020) used LCT to assist nurse preceptors support nursing students link theory to their clinical placements.

Legitimation Code Theory comprises multiple dimensions related to aspects of how knowledge is structured. The dimensions within the LCT framework can be used independently since each has a different focus (Maton, 2014). In the current study, the dimension of Semantics is most relevant for the module because it relates to conditions where cumulative knowledge is built. The two components of Semantics are: a) semantic gravity (SG); and b) semantic density (SD). SG refers the strength of connection between concepts and context, or the level of abstraction to help the content to make sense. SD refers to the complexity of the concept that is being learnt. SG and SD can be classified as either relatively stronger or weaker. Stronger semantic gravity (SG+) means that the concept is highly context-specific, while stronger semantic density (SD+) means that the knowledge is more complex, in relation to a novice learner (Maton, 2014).

The constructs of SG (abstraction) and SD (complexity) exist on their own continua but also in relation to each other and can be plotted on a continuum or a Cartesian plane (Maton, 2014, 2020). An image of the Cartesian plane with the semantic profiles can be seen in Fig. 1. Educators can use these relationships to structure learning activities, supporting students to move between more abstract (SG-) and contextualised meanings (SG+) or from more common-sense information (SD-) to more complex information (SD+), which is the nature of more specialised knowledge (Clarence, 2016; Maton, 2013, 2014). Used intentionally, the ranges of SG- to SG+ and SD- to SD+ provide a guiding framework to structure the target knowledge and enable learners to build cumulative knowledge (Clarence, 2017; Hassan, 2017; Maton, 2013). For example, using real-life examples to contextualise ideas is helpful as part of a pattern of moving between higher (SG+) and lower (SG-) contextualised meanings. The lower abstract nature of SG-
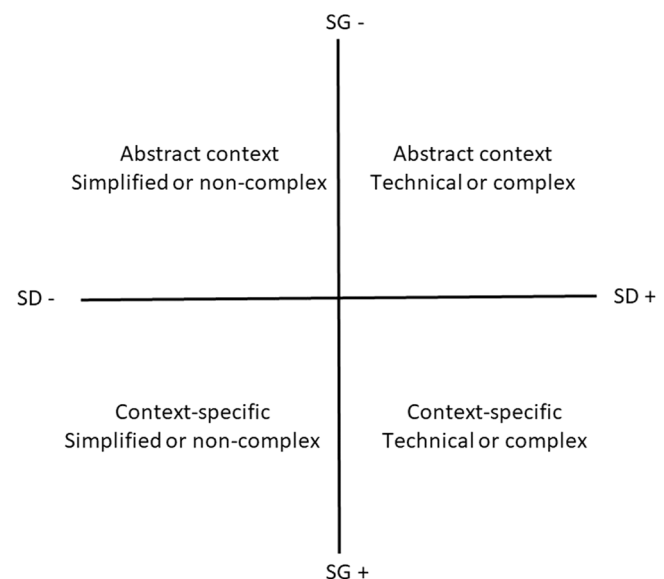

Fig. 1. The Cartesian plane for semantics (adapted from Maton, 2014).

knowledge can serve to bridge learners' developing understandings from the more common-sense meanings and experiences (SD-) that learners typically bring to formal studies, which typically become more complex and technical (SD+) as a subject or degree program progresses. The bridging can be represented as moving up and down the two continua (SG, SD) and has been called a 'semantic wave' (Maton, 2020). The waving pattern was used as a conceptual guide to structure the breastfeeding module that is the focus of the current research (see Fig. 2).

3.1. Conceptual underpinning of module design

As a concept, the semantic wave is a useful framework for constructing knowledge within courses. The semantic wave used to design the breastfeeding module included case-study scenarios interwoven with problem-solving activities where the nursing students learned to assess, plan, implement and evaluate the care and support of a breastfeeding woman. Throughout the module design and using the constructs of SG and SD, both the context-dependence and complexity of the module activities was planned. A translation device was created to identify the module's different levels of semantic density with an example seen in Table 1. It is common in LCT to independently use either SG or SD to display the semantic wave (Maton and Doran, 2017). An example of the semantic wave is depicted in Fig. 2 indicating the waving pattern for presenting more complex (SD+) and less complex (SD-) concepts across the module.

4. Content development

The seven-week breastfeeding module was part of an elective paediatric subject for final year nursing students at the University ___. The seven-week module was presented online through the subject Moodleä site where students completed prescribed learning activities independently. Content for the module was based on the 10 Steps to Successful Breastfeeding (World Health Organization, 2020) and the Australian

Table 1
Semantic code categories used in the wave development.

Stronger

Code categories	Description	Example
SD+	Technical or complex. Technical language used or broad focus on breastfeeding as a whole entity.	• Health recommendations • Physiology of breastfeeding
SD	Intermediate. Some knowledge of breastfeeding or simple technical language required	• Contraindications to breastfeeding • Expressing
SD-	Simplified or non-complex. Everyday language or concepts	• Preparation of formula • Tobacco use

Weaker

Infant Feeding Guidelines (National Health and Medical Research Council, 2012). The plan for the module is detailed in Table 2 and includes specific content with links to the BFHI 10 Steps and the Australian Infant Feeding Guidelines.

The module content was designed by a registered nurse and lecturer with over 20 years' experience working in neonatal and paediatric units. A content expert with 30 years' experience as a registered nurse, registered midwife, lactation consultant and senior researcher who is an Australian BFHI advisory board member reviewed and contributed to the content.
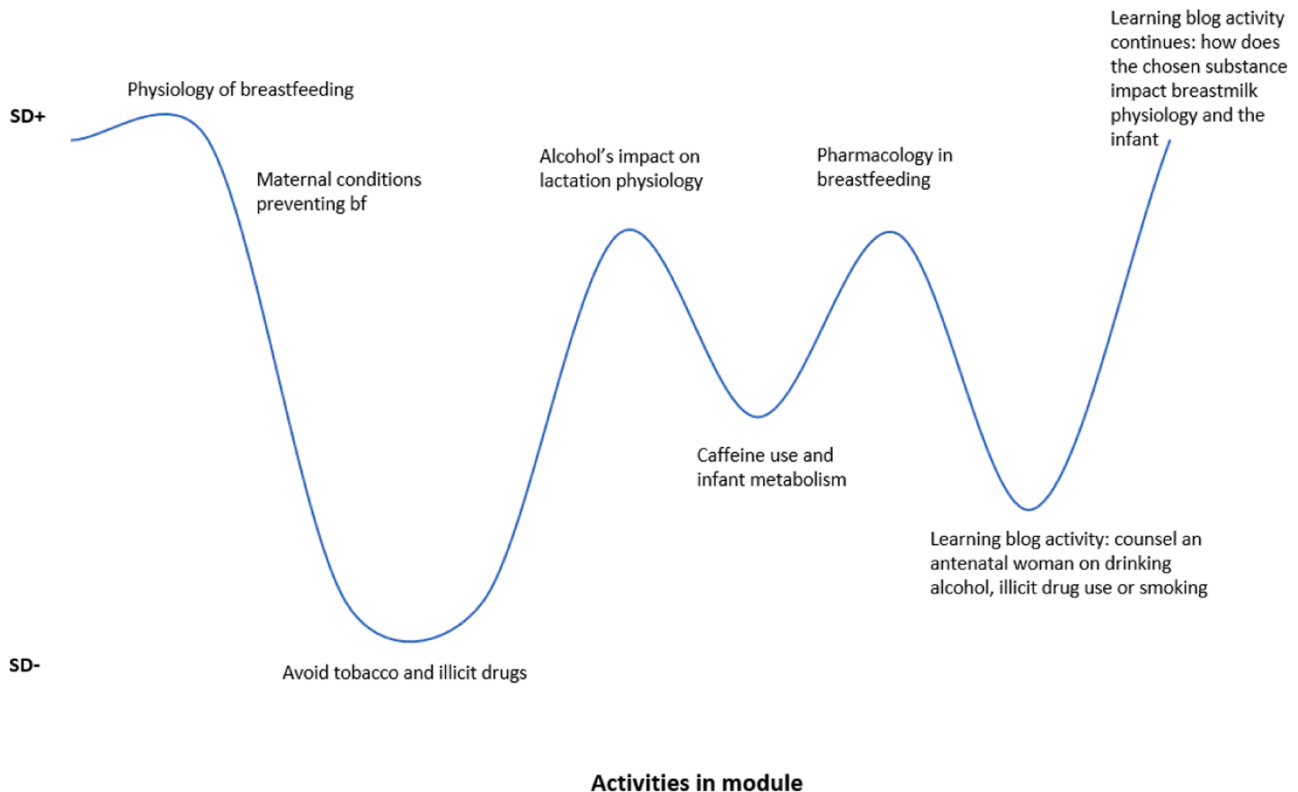

Fig. 2. Using the semantic wave to plan content for Week 6.

Table 2
Mapping of module content.

Week	Content of module	BFHI 10 Steps to Breastfeeding	Australian Infant Feeding Guidelines
One*	• Benefits of breastfeeding • The 10 Steps to Successful Breastfeeding (BFHI) • Anatomy and physiology of the breast • Colostrum and breastmilk	2. Staff competency 5. Support mothers with breastfeeding	• Principles of the Baby Friendly Hospital Initiative • Encourage, support, and promote exclusive breastfeeding to around 6 months of age
Two	• Feeding cues • Positioning baby at the breast and latching • The behaviour of a newborn • The Registered Nurses role to support breastfeeding including NSW Health policy	1. Hospital policies 2. Staff competency 3. Antenatal care 4. Care right after birth 5. Support mothers with breastfeeding 7. Rooming-in 8. Responsive feeding	• Benefits and practical aspects of breastfeeding • Provide postnatal breastfeeding support • Correct positioning and attachment when breastfeeding
Three	• Breast anatomy • Management of common breastfeeding issues • Engorgement • Grazed and cracked nipples • Flat and inverted nipples • Blocked ducts • Mastitis	5. Support mothers with breastfeeding	• Identify breastfeeding difficulties • Manage those difficulties
Four	• Small and sick neonates • Skin to skin • Expressing colostrum and breastmilk • Storage of breastmilk • Supplementation methods • Infant conditions requiring supplementation • Human milk bank	4. Care right after birth 6. Supplementing 7. Rooming-in	• Encourage the mother to use expressed breast milk when away from the infant • Supplementary feeding should only be used in specific medical indications and with the mother's consent
Five	• Infant formula • Preparing infant formula • Sterilising equipment • Using a dummy or pacifier	3. Antenatal care 5. Support mothers with breastfeeding 9. Bottles, teats, and pacifiers 10. Discharge	• Benefits of breastfeeding • Correct preparation of formula • Implement the WHO Code and the MAIF Agreement (Marketing in Australia of Infant Formulas) • A pacifier (dummy) may be offered after breastfeeding has been established
Six*	• Maternal conditions preventing breastfeeding • Tobacco • Illicit drugs • Alcohol • Caffeinated beverages • Maternal medications	3. Antenatal care	• Breastfeeding is contraindicated when a mother is known to be HIV positive • Most prescription drugs and medicines are compatible with breastfeeding • Statins should not generally be used during pregnancy or breastfeeding.

Table 2 (*continued*)

Week	Content of module	BFHI 10 Steps to Breastfeeding	Australian Infant Feeding Guidelines
			• Encourage smoking cessation or reduce smoking and to avoid exposing the infant to tobacco smoke. Even if parents persist with smoking, breastfeeding remains the best choice. • Advise mothers that not drinking alcohol is the safest option • Encourage and support mothers to avoid illicit drugs
Seven	• Discharge from hospital • Role of the community registered nurses • Other support in the community	5. Support mothers with breastfeeding 10. Discharge	• Encourage community-based services supporting breastfeeding

* Indicates weeks discussed in detail within paper

For brevity in this paper, two weeks of the module will be highlighted in more detail. The first week of the module is used as the starting point to draw on previous knowledge and experiences. The content of the later week (Week 6, as illustrated in Fig. 2) contains many common issues that nurses need to support women. A summary of the learning resources used in the two highlighted weeks are shown in Table 3.

The module commenced with revision of assumed knowledge of the endocrine system covered in an earlier pathophysiology subject, serving a key purpose of reviewing prior knowledge. In relation to SD, the review was higher than what followed: a breastfeeding overview detailing maternal and neonatal health benefits in text format (SG-). BFHI (SG-) was introduced to the students with visual images of each of the Ten Steps to Successful Breastfeeding (World Health Organization, 2020). These images were then used as linking points throughout each section of the module for students to make the specific connections between the policy document of the BFHI and the practice of breastfeeding (SG+). A short video developed by the breastfeeding content expert outlined the anatomy and physiology of breast development and breastfeeding. As a bridge between higher and lower SD, the video showed images (SD-) and presented terminology (SD+). An infographic provided a summary of

Table 3
Outline of the teaching approach and learning activities Summary of learning resources used.

Module Week 1	Module Week 6
Text only -assumed entry knowledge -Maternal, neonatal benefits Text with supporting images -Baby Friendly Hospital Initiative -10 steps illustrated Short video lectures -anatomy and physiology of breast development and breastfeeding Infographic diagram -visual summary physiology of breastfeeding Discussion forum - Previous experience/exposure to breastfeeding	Infographic diagram -visual summary physiology of breastfeeding Text only - Maternal conditions preventing breastfeeding Text with supporting images Tobacco Illicit drugs Alcohol - Caffeinated beverages - maternal medications Individual learning blog - Counselling a breastfeeding woman using a substance and impact on milk supply and infant

the key aspects of the physiology. This image was also used each week to link to the upcoming topics, while text compared colostrum and mature milk (SG+, SD-). Finally, the first week concluded with students identifying their previous exposure or experience with breastfeeding in a discussion forum. Personal experience is context dependant and therefore SG+ .

In Week 6, the focus changed to conditions that prevented or indicated a temporary pause of breastfeeding. The infographic was used to remind students what had been covered previously. Text detailed on conditions where breastfeeding is contraindicated, for example, if the mother is HIV-positive, or avoided temporarily, if she has Herpes Simplex Virus lesions on the breast. Simple text was then provided on common substances and their impact on breastmilk, for example, tobacco, illicit drugs, alcohol, caffeinated beverages and maternal medications. The learning blog activity asked students to write in their own words how they would counsel a breastfeeding woman who used any of these substances and the impact on their milk supply and the baby. The semantic density wave for this week is visualised in Fig. 1.

Another learning activity involved The Milky Way Breastfeeding app (University of Wollongong, 2021). The app is an evidence-based education resource for both health professionals and breastfeeding women (Meedya et al., 2021). Nursing students used the app several times across the module as they worked on case-studies (SG+). Students also interviewed a woman with breastfeeding experience, including their difficulties. After this interview students searched the Milky Way app, to find information to support the breastfeeding woman. Using the app in this way helped the students to link theory being learnt to practical scenarios.

Throughout the module, the content waved between abstract concepts (SG-) such as BFHI and linked the students' personal experiences or of others known to them (SG+). Interwoven with this was complex technical language (SD+) and common everyday language (SD-). Using the semantic wave within the module's design helped the students link theory to practice.

5. Methodology

A single case study design was used for this project (Yin, 2018). A case study approach allows for an in-depth understanding of a particular phenomenon (Yin, 2018). In this study the phenomenon is how undergraduate nursing students develop knowledge in an online breastfeeding module at the University of Wollongong. The students' development of knowledge is a common phenomenon and hence, what is gained from this study can be transferable to designing other curricula that aims to develop knowledge building contexts (Yin, 2018).

5.1. Setting and participants

The study is based at one Australian university with students in both metropolitan and regional campuses. It involves a final-year elective paediatric subject for nursing undergraduate students in Spring semester 2021 and 2022 (n = 204) who completed the breastfeeding module as part of the subject learning outcomes. All enrolled students received email invitations along with participant information sheets and study details. Student participants volunteered (n = 9) to be part of the research and provided written consent for their participation. Data collection was conducted in December 2021 and 2022 after the students' results had been released. Pseudonyms are used throughout.

5.2. Ethical considerations

The University Human Research Ethics Committee (HREC201/203) reviewed the study at the University of Wollongong. The first author was the instructor and Subject Coordinator and to avoid a possible conflict of interest, students were recruited for the study by Author two who is based outside the School of Nursing.

5.3. Data collection and data analysis

Semi-structured interview questions asked about the breastfeeding module specifically and how students' experiences with the module compared with other experiences and strategies they had used in other courses. While we would expect that students would have developed their learning strategies during their university level studies, module work specifically enabled them to access their prior knowledge while raising awareness of the significance of prior knowledge and experience in professional practice. The extent to which this happened is part of our interest in how the students experienced the learning activities throughout the module. Individual interviews were audio recorded, lasted about 40 min and were transcribed verbatim.

A thematic analysis was undertaken by becoming familiar with the interview data and coding the data (Braun and Clarke, 2021) using NVIVOä 12 software (Lumivero, 2017). The initial coded data were reviewed, and student experience data organised in relation to each other. The codes were iteratively refined until they were grouped into themes to understand the students' experiences with the module content. Table 4 provides examples on how the themes were developed.

Table 4
Example of codes in Thematic analysis.

Theme	Node	Code (Selected examples)
Engaging students	Learning preferences	"I like that there was the written explanation interspersed with the video lectures and then consolidated with the logbook." (Daisy)
	Learning styles	"I think if anything it just really appealed to how I have learned which is through visuals, minimal visuals is how I best learn it kind of allows me sort of the less words that are there I can then think about." (Zoe)
	Engagement in content	"The information was so like, concise and engaging and interesting that it didn't feel like work". (Lindsay)
Seedlings	Reflection	"Those reflections they just helped to tie in and do that end consolidation and you might think that you know but then the question that you'd have to reflect on your like oh no, I actually hadn't thought about that yet and you may know that information, but it's a different way to apply it, so I found that was really nice." (Lindsay)
	Module structure	"It was definitely different because there was a lot more extra, not extra activities, but you could delve into other avenues of like supports and stuff and how it was laid out was you could go to different areas." (Samuel)
	Identify gaps in knowledge	"It helps me start to think about how to put the theory into practice and how to be person-centered in doing that, it just gives me an idea of like examples of how I could come across the situation in the future rather than just having this straight knowledge about it just helps me to relate it to the practice." (Louise)
Threads and links	Linkage of topics	"Kept reminding us of the pathway that we've looked at like what have we looked at so far, the reminders and how it all links together all the content". (Samuel)
	Sequential/logical	"I found it I'm really logical and um, it was nice doing it over to the semester, rather than just one week on it 'cause it come, I guess like you're including that more long-term learning and memory as opposed to just one week on a subject" (Louise)
	Knowledge	"All the way through to like you know, you may already have a knowledge but like let's build on that." (Lindsay)

6. Results

This section explores the participating nursing students' experiences of the LCT based module. Students' experiences represent the second aim of the current study: to better understand how undergraduate nursing students develop knowledge about breastfeeding through the specifically designed module. Their experiences with the module form part of our evaluation of the utility of the LCT-informed design.

6.1. Participant experience of the module content

Thematic analysis sought to elaborate the students experience of the module. Three main themes in the participants' experience of the module content were generated from the data: a) threads and links; b) engaging structure; and c) seedlings.

6.2. Threads and links

Participants could identify the module structure, follow the threads of ideas and make links to concepts. The structure of the module enabled participants to observe the overarching view of breastfeeding and develop a comprehensive perspective of the topic:

"I liked them in the module because I think sometimes it's difficult to see what when what you are learning not in the breastfeeding content in other courses it is difficult to see what you are learning how it is fits in with the bigger picture, so having this is the you know the WHO and then the breastfeeding friendly initiative and then actually have that impacts a woman who's had the baby and is trying to feed it. I liked that and I made that connection, I thought it was good". (Daisy)

During the interviews, participants reported that the structure of the module was different from other subjects within their degree. Participants identified the wave pattern of the module describing it as a "thread" that ran throughout the module:

"I liked that it was linked, there was a thread running through it all. So other subjects tend to have subject, subject, subject, subject and it's not really linked. So, I did like that there was a common thread running through it, like linked it to the last one or the next one". (Bree)

Students were not aware that the module was underpinned with LCT. However, Bree noted the difference and had a feel of the wave within the module's structure. She noted the linkage between the ideas within the module that assisted with her learning.

6.3. Engaging structure

Participants reported that the module structure and activities promoted their engagement with the content. Utilising different learning activities within the module assisted the participants to develop an understanding of the content and then apply it to case-studies or reflective activities:

"The information was so like, concise and engaging and interesting that it didn't feel like work if that makes sense. So, it yeah, I don't know the way that it's presented was really, really well done". (Joanna)

Not only did the students find the content of the module enjoyable, the felt like the structure and activities assisted them to learn the content:

"The range of ways that the information was delivered really helps and I think you know myself like I'm mainly like a visual learner, but there was still text that was important supported the visuals, whether it was a video or photo or whatever and so it was really, really great

and I think even, I mentioned before, those reflections they just helped to tie in and do that end consolidation and you might think that you know but then the question that you'd have to reflect on your like oh no, I actually hadn't thought about that yet and you may know that information, but it's a different way to apply it". (Lindsay)

Lindsay picked up on the patterning and saw connections across the module. Even though she would not have been aware of the LCT structure underpinning the module, she seems aware: a) that there was an underlying structure; and b) that the pieces of module content were connected in a coherent way.

6.4. Seedlings

Building on existing knowledge and real-world experiences can assist with student motivation and the metaphor of seedlings or growth helped the students to reflect on their learning. Participants identified their own previous experience as valuable. However, they recognised their knowledge and experience could have an impact on the care they delivered. This awareness further enhanced their engagement with the module, as noted by Julia:

"[It] made me kind of click into that sort of nurse role of what would I do and yes, I've got my own personal experiences and in a way is gold but at the same time I also don't want that to affect how I deliver care as well and so I thought it was good how it engaged us a bit more, than other subjects would". (Julia)

Julia has recognised the importance of the nurse's awareness of their own experience as a potential bias to more thoughtful care. Having the students engage in learning activities and reflections linked to previous experiences allowed for the recognition of personal bias and therefore, how it could have an impact on their practice.

The metaphor of growth was productive for one student who used it to describe her experience with learning:

"That module was a pot and a little seedling, ok so now you can grow you can think about things and you can go and do your research and it will help grow your little plant, whereas the others are here is your tree here you go just trim it". (Zoe)

Again, Zoe identified that the module was different to previous learning experiences. Using the metaphor as she has suggested that the learning was cumulative and encouraged students to be motivated to continue engaging with the subject content.

Overall, the interviews provided valuable insights into the module and what the students found engaging and helpful for their learning. Students described positive learning experiences in the breastfeeding module. The students identified that the module design differed from previous subjects they had completed earlier in their course and expressed their eagerness to engage and learn.

7. Discussion

This study demonstrates the utility of LCT as a tool in promoting student learning on breastfeeding in nursing education. The linkage of individual and contextual perspectives to new knowledge is pivotal to success in adult learning. With the structure and guidance from LCT, the resulting module and student experience with it demonstrate its fruitfulness. Key structural elements are: a) recognition of students' prior experiences and using strategies to integrate new learning; and b) contextualising the learning environment to students' prior experiences.

The findings in this study highlighted participants recognised that their learning experience differed from other learning experiences. LCT was used to design the breastfeeding module, link and harness students' prior learning to connect formal knowledge to everyday or practical knowledge (Maton, 2014). Using the semantic wave to structure learning connected students' prior knowledge to new information

(Maton, 2013), but also facilitated integration of new knowledge. There is an emerging understanding about the importance of memory integration, the process of building new learning on prior knowledge and its association with academic success (Varga et al., 2022). Contextualising learning is an important underpinning principle in adult education. In contrast to children, adults have an accumulated reservoir of life experiences that could be leveraged as a rich source for learning (Eddy et al., 2019). Utilising the semantic wave to structure the modules assisted students to build on the reservoir of their previous experience. Waving between theory and practical experience, as done in the breastfeeding module, can create cumulative learning for the learner (Maton, 2013).

Aligning with adult principles of configuring learning experiences that are well-structured and practical is essential to achieve best learning outcomes (McCall et al., 2018). Students can interact with their learning environment through multiple modalities including visual, auditory, reading and kinesthetics (Yaw Obeng, 2023). James et al. (2011) identified that students rely on several modes to gain knowledge thus accommodating adult learners with different learning preferences.

Utilising different learning materials and structuring the content in a certain way can assist the learner to connect theory with practice. The theory-practice divide commences during undergraduate nurse education but can continue through to registered nurses (Greenway et al., 2019). Using the semantic wave to help the learners to connect abstract or complex ideas to more contextualised experiences and everyday language could assist in reducing this theory-practice divide.

8. Strengths and limitations

Strengths of this study including having only one researcher conducting all the interviews, facilitating a consistent approach in data collection. Furthermore, researchers who are experienced qualitative researchers listened to the recording to provide ongoing feedback to the interviewer. The interviews were conducted after the students had their results, enabling participants to speak freely without fear that this could have an impact on their results. The one-to-one interviews also enabled each participant to be heard without being influenced by opinions of others. The subject coordinator who was part of the research team was not involved in the recruitment process to maintain an " arm's length" process in recruitment to avoid reduce coercion and power imbalance. The participants had various life experiences, capturing diversity in the student experience.

There are several limitations to this study. Firstly, the subject coordinator who developed the module also conducted the interviews, which potentially could risk the participants having less candour in their responses. There was a risk of bias in the analysis of the results for the same reason, however, other members of the research team did not develop the module which reduces the bias. There was only a small number of student participants who volunteered to participate. The semantic wave was utilised only in one module of the paediatric course. LCT consists of different dimensions with only Semantics used in this study. LCT has not been used in structuring course design in nursing before; therefore, there are no comparative studies.

9. Conclusion

Educators need to rethink how curriculum is organised, including using students' informal knowledge. Using LCT to structure content, specifically, Semantics, allows the educator to harness students' previous experiences and knowledge in planning for instruction. Moving the learning activities through a waving pattern between higher and lower semantic density and higher and lower semantic gravity enables the students to weave between theory and contextual practice and build integrated knowledge. Using the semantic wave to move between a theory or evidence-based research and then to apply it in a personal context allows the learner to consider how theory and practice relate which may enable undergraduate nursing students to be better practitioners when working with breastfeeding women in clinical settings.

Implications for practice

LCT is not limited to use only in breastfeeding knowledge development. With an increased understanding of how students develop knowledge during nursing education, LCT has broader utility across curriculum and clinical settings.

Funding

Author statement

We confirm that the manuscript has been read and approved by all named authors and that there are no other persons who satisfied the criteria for authorship but are not listed. We further confirm that the order of authors listed in the manuscript has been approved by all of us.

Declaration of Competing Interest

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

References

Ahmed, A., El Guindy, S.R., 2011. Breastfeeding knowledge and attitudes among Egyptian baccalaureate students. Int. Nurs. Rev. 58 (3), 372–378. https://doi.org/10.1111/j.1466-7657.2011.00885.x.

Azad, M.B., Nickel, N.C., Bode, L., Brockway, M., Brown, A., Chambers, C., Goldhammer, C., Hinde, K., McGuire, M., Munblit, D., Patel, A.L., Pérez-Escamilla, R., Rasmussen, K.M., Shenker, N., Young, B.E., Zuccolo, L., 2021. Breastfeeding and the origins of health: Interdisciplinary perspectives and priorities. Matern. Child Nutr. 17 (2), e13109 https://doi.org/10.1111/mcn.13109.

Bowdler, S., Nielsen, W., Moroney, T., Meedya, S., 2022. What knowledge of breastfeeding do nursing students hold and what are the factors influencing this knowledge: an integrative literature review. Nurse Educ. Pract. 64 https://doi.org/10.1016/j.nepr.2022.103423.

Braun, V., Clarke, V., 2021. Thematic Analysis: A practical Guide. Sage Publication Ltd.

Busch, D.W., Logan, K., Wilkinson, A., 2014. Clinical practice breastfeeding recommendations for primary care: applying a tri-core breastfeeding conceptual model. J. Pediatr. Health Care 28 (6), 486–496. https://doi.org/10.1016/j.pedhc.2014.02.007.

Campbell, S.H., de Oliveira Bernardes, N., Tharmaratnam, T., Mendonca Vieira, F.V., 2022. Educational resources and curriculum on lactation for health undergraduate students: a scoping review. J. Hum. Lact. 38 (1), 89–99. https://doi.org/10.1177/0890334420980693.

Cervera-Gasch, A., andreu-Pejó, L., González-Chordá, V.M., Lopez-Peña, N., Valero-Chilleron, M.J., Roman, P., León-Larios, F., Mena-Tudela, D., 2021. Breastfeeding knowledge in university nursing students. A multicentre study in Spain. Nurse Educ. Today 103, 104945. https://doi.org/10.1016/j.nedt.2021.104945.

Clarence, S., 2016. Exploring the nature of disciplinary teaching and learning using legitimation code theory semantics. Teach. High. Educ. 21 (2), 123–137. https://doi.org/10.1080/13562517.2015.1115972.

Clarence, S., 2017. Surfing the waves of learning: enacting a Semantics analysis of teaching in a first-year Law course. High. Educ. Res. Dev. 36 (5), 920–933.

Eddy, P.L., Hao, Y., Markiewicz, C., Iverson, E., 2019. Faculty change agents as adult learners: the power of situated learning. Community Coll. J. Res. Pract. 43 (8), 539–555. https://doi.org/10.1080/10668926.2018.1507848.

Greenway, K., Butt, G., Walthall, H., 2019. What is a theory-practice gap? An exploration of the concept. Nurse Educ. Pract. 34, 1–6. https://doi.org/10.1016/j.nepr.2018.10.005.

Hartnett, L., McNamara, M., 2020. Using the semantic wave to support intellectual disability nursing students to apply theory and evidence in practice. Learn. Disabil. Pract. 25 (3) https://doi.org/10.7748/ldp.2020.e2101.

Hassan, S.L., 2017. Tutors' role in tutorials:'unpacking'and 'repacking'during the semantic journey. South Afr. J. High. Educ. 31 (3), 99–115. https://doi.org/10.208535/31-3-626.

Hoffmann, T.C., Glasziou, P.P., Boutron, I., Milne, R., Perera, R., Moher, D., Altman, D.G., Barbour, V., Macdonald, H., Johnston, M., 2014. Better reporting of interventions: template for intervention description and replication (TIDieR) checklist and guide. Bmj 348. https://doi.org/10.1136/bmj.g1687.

James, S., D'Amore, A., Thomas, T., 2011. Learning preferences of first year nursing and midwifery students: utilising VARK. Nurse Educ. Today 31 (4), 417–423. https://doi.org/10.1016/j.nedt.2010.08.008.

Kahu, E.R., Picton, C., Nelson, K., 2020. Pathways to engagement: a longitudinal study of the first-year student experience in the educational interface. High. Educ. 79, 657–673. https://doi.org/10.1007/s10734-019-00429-w.

Khriesat, W., Ismaile, S., 2017. Negative attitudes and misinformation to breastfeeding among young generation in a nursing program. Australas. Med. J. 10 (11), 934–940. https://doi.org/10.21767/AMJ.2017.3177.

Knowles, M.S., Holton, I.E.F., Swanson, R.A., 2015. The Adult Learner: The Definitive Classic in Adult Education and Human Resource Development. Taylor & Francis.

Lopez-Peña, N., Cervera-Gasch, A., Valero-Chilleron, M.J., González-Chordá, V.M., Suarez-Alcazar, M.P., Mena-Tudela, D., 2020. Nursing student's knowledge about breastfeeding: design and validation of the AprendeLact questionnaire. Nurse Educ. Today 93, 104539. https://doi.org/10.1016/j.nedt.2020.104539.

Lumivero. (2017). NVivo (Version 12). ⟨https://lumivero.com/products/nvivo/⟩.

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., 2014. Knowledge and Knowers: Towards a Realist Sociology of Education. Routledge, Taylor & Francis Group.

Maton, K., 2020. Semantic waves: Context, complexity and academic discourse. In: Martin, J.R., Maton, K., Doran, Y.J. (Eds.), Accessing Academic Discourse. Accessing Academic Discourse, pp. 59–86.

Maton, K., Doran, Y.J., 2017. Semantic density: a translation device for revealing complexity of knowledge practices in discourse, part 1—wording. Onomázein 46–76. https://doi.org/10.7764/onomazein.ne2.03.

Matriano, M.G., Ivers, R., Meedya, S., 2021. Factors that influence women's decision on infant feeding: an integrative review. Women Birth. https://doi.org/10.1016/j.wombi.2021.10.005.

McCall, R.C., Padron, K., Andrews, C., 2018. Evidence-based instructional strategies for adult learners: a review of the literature. City Univ. N. Y. Acad. Works 4 (4), 29–47. ⟨https://academicworks.cuny.edu/bx_pubs/43⟩.

Meedya, S., Fernandez, R., Fahy, K., 2017. Effect of educational and support interventions on long-term breastfeeding rates in primiparous women: a systematic review and meta-analysis. JBI Evid. Synth. 15 (9), 2307–2332. https://doi.org/10.11124/jbisrir-2016-002955.

Meedya, S., Win, K., Yeatman, H., Fahy, K., Walton, K., Burgess, L., McGregor, D., Shojaei, P., Wheatley, E., Halcomb, E., 2021. Developing and testing a mobile application for breastfeeding support: the Milky Way application. Women Birth 34 (2), e196–e203. https://doi.org/10.1016/j.wombi.2020.02.006.

Moukarzel, S., Rehm, M., Daly, A.J., 2020. Breastfeeding promotion on Twitter: a social network and content analysis approach. Matern. Child Nutr. 16 (4), e13053 https://doi.org/10.1111/mcn.13051.

National Health and Medical Research Council, 2012. Infant feeding guidelines: Information for health workers. National Health and Medical Research Council. Retrieved 23 September 2022 from. ⟨https://www.nhmrc.gov.au/about-us/publications/infant-feeding-guidelines-information-health-workers⟩.

Netting, M.J., Moumin, N.A., Knight, E.J., Golley, R.K., Makrides, M., Green, T.J., 2022. The Australian Feeding Infants and Toddler Study (OzFITS 2021): breastfeeding and early feeding practices. Nutrients 14 (1), 206. https://doi.org/10.3390/nu14010206.

Ord, K., Nuttall, J., 2016. Bodies of knowledge: the concept of embodiment as an alternative to theory/practice debates in the preparation of teachers. Teach. Teach. Educ. 60, 355–362. https://doi.org/10.1016/j.tate.2016.05.019.

Prokop, N., Sim, J., Meedya, S., 2021. A qualitative descriptive study of new graduate nurses' experiences supporting breastfeeding women in neonatal settings. Nurse Educ. Pract. 55, 103172 https://doi.org/10.1016/j.nepr.2021.103172.

Rhodes, B., Burgess, A., 2018. An innovative educational intervention to improve nursing students' knowledge and skills surrounding breastfeeding. Teach. Learn. Nurs. 13 (4), 197–201. https://doi.org/10.1016/j.teln.2018.05.003.

Spear, H.J., 2006. Baccalaureate nursing students' breastfeeding knowledge: a descriptive survey. Nurse Educ. Today 26 (4), 332–337. https://doi.org/10.1016/j.nedt.2005.10.014.

University of Wollongong. (2021). The Milkyway. Retrieved 8/9/2022 from ⟨https://play.google.com/store/apps/details?id=au.edu.uow.MilkyWay&hl=en_AU&gl=US⟩.

Varga, N.L., Cronin-Golomb, L., Bauer, P.J., 2022. Self-derivation of new knowledge through memory integration varies as a function of prior knowledge. Memory 30 (8), 971–987. https://doi.org/10.1080/09658211.2022.2068609.

World Health Organization. (2020). Protecting, promoting and supporting breastfeeding in facilities providing maternity and newborn services: the revised Baby-friendly Hospital initiative. ⟨https://www.who.int/publications/i/item/9789240001459⟩.

World Health Organization. (2021). Infant and young child feeding. ⟨https://www.who.int/news-room/fact-sheets/detail/infant-and-young-child-feeding⟩.

Yang, S.-F., Salamonson, Y., Burns, E., Schmied, V., 2018. Breastfeeding knowledge and attitudes of health professional students: a systematic review. Int. Breastfeed. J. 13, 8 https://doi.org/10.1186/s13006-018-0153-1.

Yaw Obeng, A., 2023. Consequential effects of using competing perspectives to predict learning style in e-learning systems. Cogent Educ. 10 (1), 2218960 https://doi.org/10.1080/2331186X.2023.2218960.

Yin, R.K., 2018. Case Study Research and Applications: Design and Methods, 6th ed.,. SAGE publications Inc.