

Capturing the Integration of Practice-Based Learning with Beliefs, Values, and Attitudes using Modified Concept Mapping

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ABSTRACT: Practice-based learning integrates the cognitive, psychomotor, and affective domains and is influenced by students' beliefs, values, and attitudes. Concept mapping has been shown to effectively demonstrate students' changing concepts and knowledge structures. This article discusses how concept mapping was modified to capture students' perceptions of the connections between the domains of thinking and knowing, emotions, behavior, attitudes, values, and beliefs and the specific experiences related to these, over a period of eight months of practice-based clinical learning. The findings demonstrate that while some limitations exist, modified concept mapping is a manageable way to gather rich data about students' perceptions of their clinical practice experiences. These findings also highlight the strong integrating influence of beliefs and values on other areas of practice, suggesting that these need to be attended to as part of a student's educational program.

KEYWORDS: attitudes, beliefs, concept mapping, practice-based learning, values

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Introduction

This article discusses the use of modified concept mapping in a study investigating occupational therapy and medical students' perceptions of connections between three domains of practice-based clinical learning. The article frames practice-based learning as an integrated, situated, whole-person activity, but suggests that, by contrast, clinical education and research focus on knowledge and skill development. We used a modified concept mapping tool to more holistically investigate students' perceptions of how their beliefs, values, and attitudes are connected to the cognitive, psychomotor, and affective domains of learning. This article describes the four methodologies informing this modification and our data analysis. It presents findings and examples that demonstrate participants' perceptions of these connections and the importance of beliefs and values. A discussion of the efficacy and limitations of modified mapping and implications of the findings for practice-based clinical education concludes the article.

Practice-based higher education immerses students in the world of professional practice, promotes personification of specific professional skills and characteristics, and generates particular forms of knowing, being, and doing.¹ While research suggests that practice is a mostly tacit collective creation and reshaping of situated knowledge, most health

professional practice-based education continues to prioritize individual accumulation of knowledge and skills.^{2–4} Despite this, the process of becoming a person and a professional is a slow, integrated holistic one where affective, bodily, and cognitive learning are affected by the beliefs, attitudes, and values that underpin character and disposition.^{3,5} Thus, practice-based learning may be a "...highly personalized and transformative reframing," changing students' worldviews.^{6(p. 180)}

Increasingly authentic participation in practice-based learning feeds the integrated holistic process of becoming a person and a professional and develops skill, responsiveness, growing expertise, and desirable capacities such as discernment and moral judgment.^{5,7–10} From an integrated learning perspective, practice is an interpersonal form of knowing, being, and doing. This is reflected in apprenticeship models of clinical education adopted in disciplines such as medicine. The study reported here sought to discover the extent to which students perceive practice-based learning as integrated, using an holistic, longitudinal participant-driven approach.

Integrated learning and desirable capacities are not easy to define, assess, or research. The Western academic elevation of rationalism² has led to highly cognitive conceptualizations of holistic skills such as critical thinking and reflection. These conceptualizations exclude bodily, affective, and belief-based

capacities such as intuition and morality.¹¹ Yet, affect is crucial to criticality,¹² and students' personal values and beliefs affect their learning and sense of self.¹³ One study suggests that these values may even be repressed during clinical education.¹⁴ Despite this, there has been little research into practice-based belief and value development.^{14,15}

Similarly, little is known about learners' emotional and bodily responses to challenging practice contexts that may influence cognition and metacognition and prompt the questioning of tacit practice assumptions.^{6,16} These responses depend on epistemological beliefs (beliefs about knowing and knowledge) and ontological beliefs (beliefs about existence and being) based on values, attitudes, and life experience.^{5,16} The study sought to capture specific learning experiences in which participants were aware of these responses, their attitudes, values, and beliefs.

Previous studies have focused on attitudes or epistemological beliefs affecting performance and knowledge by employing psychological or self-reporting scales, semistructured interviews, and questionnaires.^{13,17} Meanwhile, studies of knowledge and expertise development have used concept mapping to show knowledge structures and how these change during learning. The study reported here drew on aspects of these approaches. Concept mapping was used in a modified way in order to gather longitudinal data about students' perceived connections between the domains of practice-based clinical learning, including beliefs and values, and the experiences related to these.

Methodology: Modifying Concept Mapping

The computerized concept mapping tool Cmap® was used to gather data for the study because it was free and convenient for participants in various locations; however, as this section

explains, it does not reflect an integrated learning perspective. The theory behind concept mapping is outlined, followed by a description of the ways in which ethnography, phenomenography, and visual methodology informed the modification of Cmap® to make it a more integrated holistic tool. The benefits and drawbacks of using a self-reporting, self-assessing approach to gather research data are also discussed.

Concept maps show hierarchically arranged concepts and connections created around a question or a topic. Concept mapping has its roots in Ausubel's theory of meaningful learning, which theorizes that new knowledge is assimilated into hierarchically organized knowledge structures.¹⁸ This highly structured approach is directly reflected in the hierarchical schemata of information technology (trees, folders, and directories) and in the use of organizing structures to teach higher order thinking skills.¹⁹ Novak developed the computer-based concept mapping tool Cmap® from Ausubel's theory and perceived affinities between human and machine cognition.¹⁸ Cmap® is purported to be a cognitive scaffold, facilitating meaningful conceptual learning and new knowledge creation.²⁰ As shown in Figure 1, completed Cmaps® include strictly hierarchically ordered concepts in a topic area. Pairs of concepts are connected by a word or phrase to form propositions that can be briefly explained with annotations (indicated by yellow icons).

Studies in medical and dental education claim to demonstrate the specificity and reliability of concept mapping for showing hierarchical arrangements of concepts and progressive expertise development.^{10,21,22} Concept mapping has also been used to show how threshold concepts link *chains of practice* with *networks of understanding*.^{23(p. 212)} In these studies, Hay et al apply a postpositivist interpretive deductive analysis to the maps, while also citing methodological allegiance to Jarvis's notion

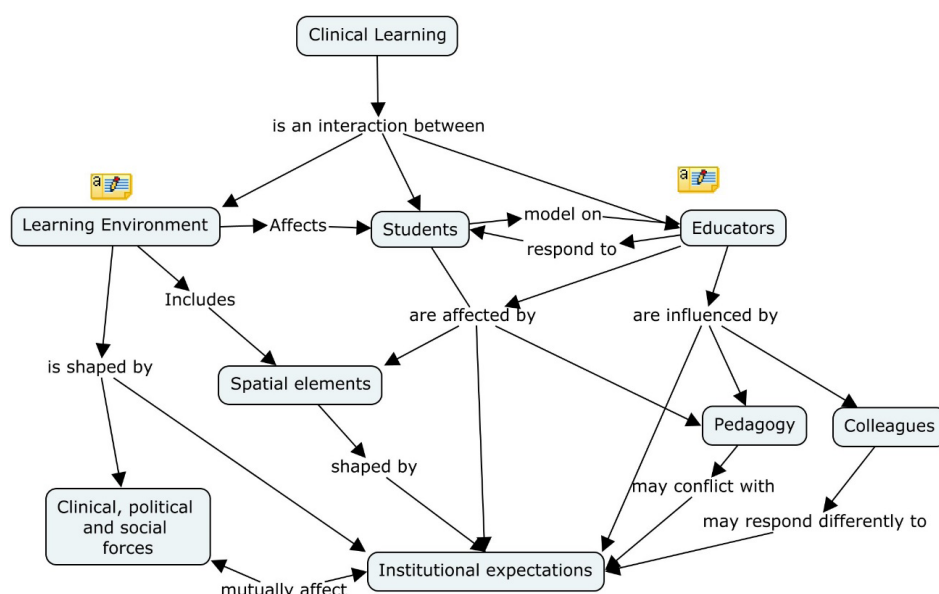


Figure 1. Traditional CMap example: concepts of clinical learning.



of adult learning as a person-centered change.²⁴ This signals conflict between more objective and more subjective ways of understanding concept mapping. Studies of repeated concept mapping have demonstrated increased scores and complexity over time, but no correlation with summative knowledge assessments.^{22,24} This could be because changes to knowledge structures represent general or emerging connections, or because concepts used are not connected to epistemological beliefs or mean different things to teachers and students.¹⁶

Significantly for whole-person learning, Cmap® analysis draws on memory and emotions to explain map organization,²⁰ but does not consider beliefs, values, or doing. The initial development of Cmap® incorporated Gowin's Knowledge V (or Vee) heuristic, a knowledge construction tool that requires learners to consider interactions between their epistemological and ontological beliefs and values when formulating concepts.²⁵ These important elements were not retained in Cmap®. The study reported here sought to recover this more inclusive whole-person view of concept mapping, while gathering comprehensive data about ontological and epistemological connections in a rigorous way.²⁶ Hierarchical requirements were removed, and the recording of emotions, actions, attitudes, values, beliefs, and specific experiences related to connections was added. The aim of these changes was to increase the visibility of concept meanings, reasons for structural change, and connections between internal knowledge and beliefs. This was based on the following methodological understandings of the rich subjective detail and the objective patterns and sequences of practice-based experiences and how these could be captured.^{27,28}

Ethnography. Since ethnography seeks to describe and depict the patterns and symbolic meaning of everyday communication and practice, it may reveal educational, social, and collective influences on practice-based learning.^{27,29} The study asked participants to record their specific lived experiences of practice-based learning over time to gain insight into these influences.

Phenomenography. Discerning critical elements of experiences and integrating them into an inclusive hierarchical whole requires affective, social, moral, and epistemological judgment.^{9,16,31} Phenomenography seeks to identify and systematically sort discerned elements into a limited number of categories reflecting different levels of awareness.^{31,32} Phenomenographic analysis emphasizes structural relationships within and among these categories,³³ thus giving insight into how participants view complex relationships between elements. While the study did not use pure phenomenographic analysis, it drew on the principles of structural relationships, interrelated categories, and the part-whole nature of experience.

Visual methodology. As meaningful everyday objects, maps show visually organized ethnographic data.²⁷ Maps express physical, cognitive, and affective capacities, emotional significance, and the beliefs and spiritual values behind these.^{34,35} Not only does the positioning of elements in visual images reflect what we believe about the world,³⁶ but visualizing and creating images of social activities and practices also integrates memory

with perception.³⁷ Despite the dominance and sophistication of the visual in today's world, visual tools remain poorly represented in research.³⁸ Modified concept mapping allowed some visual and spatial expression of perceived relationships.⁷

Self-reporting and self-assessment. Educational self-assessment is intrinsically motivating through alignment with professional expectations, but it is also inaccurate and poorly aligned with formal knowledge and performance.^{15,39} Despite this, reflective self-assessment can capture what students value, their internal belief systems, attitudes, self-concepts, and emotions, even if sanitized or socially acceptable responses are given.^{16,28,40} Repeated self-evaluations of experiences connected with internally held beliefs and attitudes may help students see how emotions create reconstructed versions of events.¹²

As a personalized interpretation of experience, self-reporting does fulfill qualitative research criteria for rigor and epistemic worth,^{29,41} and it gives participants some control of the research process.²⁷ Online concept mapping has been noted to make it easier for participants to see conceptual gaps,⁴² and it balances the predominantly dialogic data of practice-based research.⁴³ In this study, longitudinal computerized mapping allowed participants to own, change, add to, and personalize their representations of clinical practice-based learning.

Method

Participants. Following ethical approval from two New Zealand universities, fifth year medical students and third year occupational therapy students who were on clinical placements in hospital or community-based settings were invited to join the study. Eight medical students and three occupational therapy students (10 females and one male) volunteered to participate during the completion of two to four clinical placements of 4–10 weeks each. Ethical approval was obtained from the University of Auckland Human Participants Ethics Committee and the Auckland University of Technology Ethics Committee. This research complied with the principles of the Declaration of Helsinki.

Data collection. Instructions for using the modified version of CMap® were emailed to participants in their various locations. They practiced using it during their first month of placement, at the end of which they completed a map based on this focus question: "From my experiences, what are the relationships between thinking, feelings, behavior, attitudes, values, and beliefs in clinical learning?" Participants were asked to map perceived connections between the five domains of learning: thinking/knowing, feelings/emotions, actions/artifacts, attitudes/values, and beliefs.

These five domains plus other self-selected concepts were placed as desired on the map. Participants formed propositions by linking concepts with words describing the connection, eg, thinking/knowing (concept) affects (linking word) confidence (concept). They then added specific descriptions of clinical experiences (annotations) they felt explained the connections. The completed

map was saved and emailed to the researcher. A second map was completed and emailed to the researcher after three to four months of placements, and a third after six to eight months. Participants could create new maps or rework previous versions.

Data analysis. In order to identify patterns of connection and critical elements of experience, map structure and content were subjected to visual, numerical, and textual analyses. The aim and small participant numbers precluded statistical analysis. For this article, only analysis of propositions and annotations is described.

Proposition data were coded and stored using NVivo 10®. Analysis involved identifying the intended direction of each proposition, then coding it to nodes and subnodes for the five domains and concepts used. For example, the proposition “Thinking/knowning affects confidence” was coded to the “Thinking/Knowing” node at the subnode “to Attitudes/Values” to reflect the direction of the proposition. Other NVivo 10® analyses such as word frequencies, matrix coding queries, and cluster analyses were performed between and within domains, between individual participants, and between pairs from the two disciplines with similar coding frequencies to show patterns among propositions.

Analysis of the annotations began with grouping the documented experiences by domains connected, then repeatedly reading them over a two-month period with no attempt to categorize them.³¹ Two provisional interrelated sets of categories of critical elements emerged. These were refined with further reading. The final sets with the smallest possible number of categories in each were repeatedly refined until all annotations fitted into them.³²

Triangulation. Both quantitative and qualitative approaches to data collection and analysis were used, providing a form of triangulation, which is desirable in qualitative research.^{26,29} There was qualitative–quantitative overlap in the visual and textual elements of the maps and their interpretation, which potentially addressed criticisms of concept mapping as a reductionist technique producing incomplete or contradictory findings.⁴²

Findings

Twenty-nine maps were completed in total, representing one (one participant), two (two participants), or three (eight participants) maps per person over the eight-month period. Maps took one to two hours each to construct and altogether included some 500 propositions and >300 annotations. Examples of first and third maps can be seen in Figures 2 and 3, labeled with a pseudonym and number.

An example of a proposition and an attached clinical experience annotation from each of the first, second, and third maps is given as follows.

Beliefs influence attitudes. My belief influences my attitudes, eg, I believe and value autonomy and so my attitude in a recent case was that a patient had the right to choose to have surgery or not (as long as they were well informed) even if the clinician thought they should (Leah 1).

Thinking/knowning—I don’t always think before I act—Actions/Artefacts. I am learning it is better to think before I speak and weigh up the consequences of my actions, eg, I was given the opportunity to do a Montreal Cognitive Assessment (MOCA) assessment on a patient and I turned

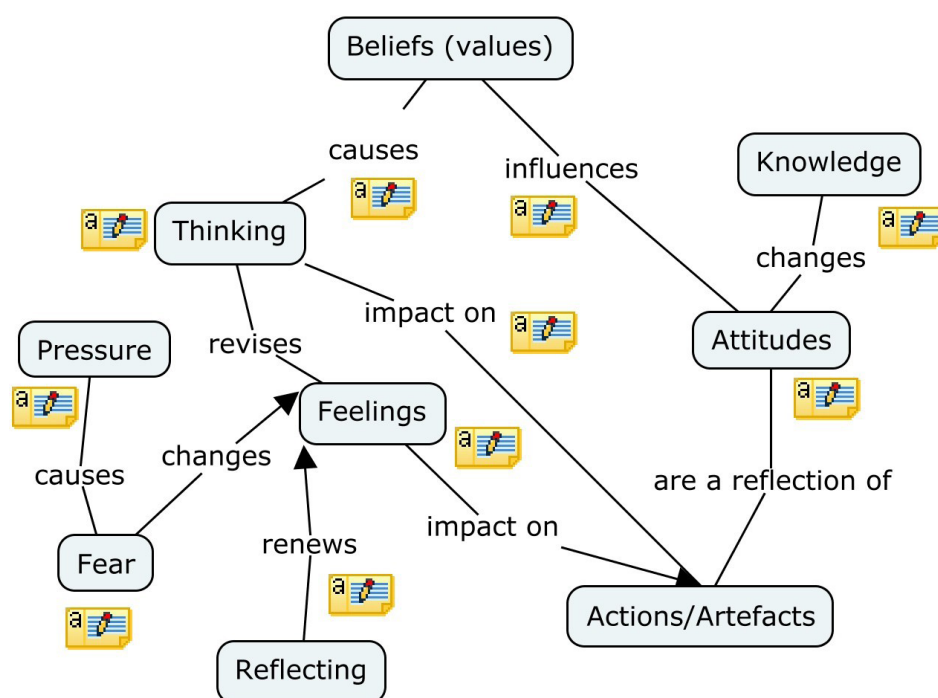


Figure 2. Example of first map: Leah 1.

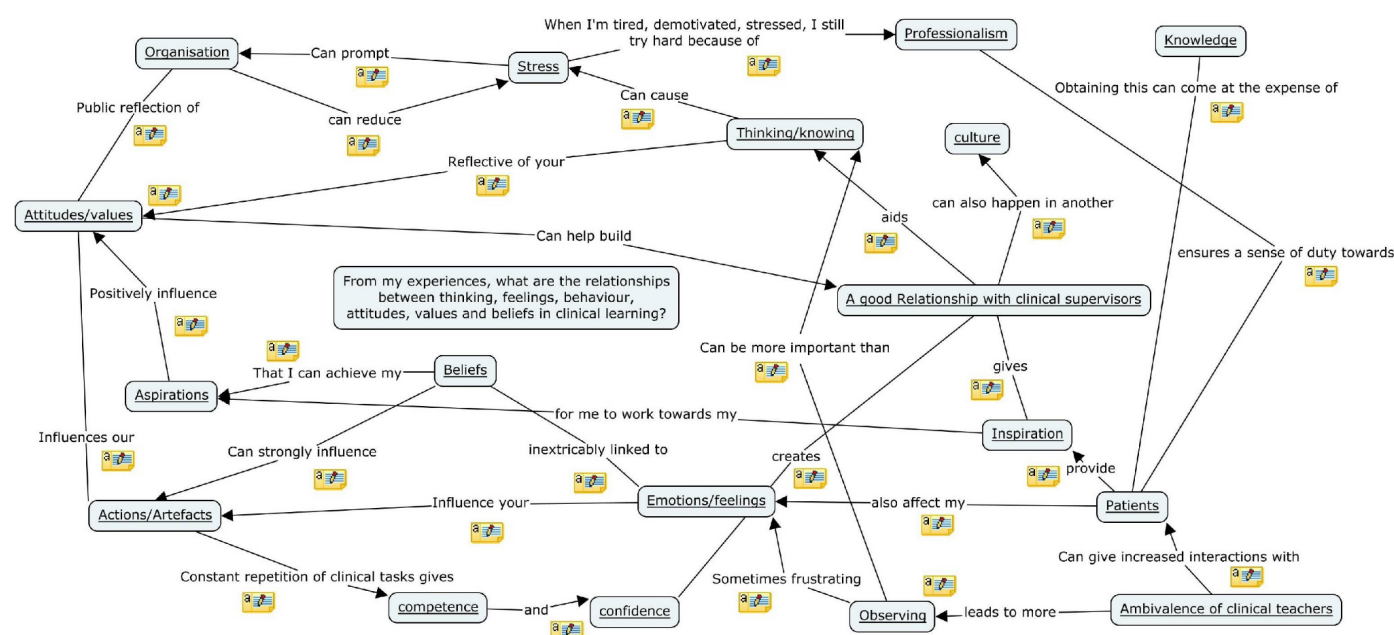


Figure 3. Liz: Example of third map: Liz 3.

it down because I was anxious about getting it wrong but I ended up wishing I had done it as it looks like I may have missed the only chance for doing one that will come along during my placement (Claire 2).

Attitudes/values—can help build—a good relationship with clinical supervisors. I had a paediatrics run back to back with an obstetrics and gynaecology (O&G) run. I tried to take a really proactive, positive attitude into both. On the O&G run, this resulted in a great experience with great clinical teachers, but on the paed run, it never really worked out that way. I'm still not sure why. As a student, all you can do is try your best to build good rapport with your supervisors in the very short space of time we have for each attachment, or run. It's hit or miss, but can make or break a learning experience. As I move towards my final exams, in my fifth year of study, I'm still not sure I've got this all worked out! (Liz 3).

There was no common pattern over time in map structure, complexity, or content, although changes were noted in some individuals. These aspects will be discussed in a future article, but here the focus is on connections and domains.

Tables 1 and 2 summarize the proposition and annotation frequencies between the five domains.

Analysis of the experiences in the annotations revealed a set of six categories of context. Almost all involved interpersonal interactions, particularly with patients or clients, supervisors, and members of the clinical education team. The second set included six critical elements of experience. The most frequently found critical element, "Changing or revealing beliefs, values, and attitudes" appeared in over half the annotations while the second most frequent element, "Building or negotiating relationships", appeared in over one third. Many annotations, for example Liz 3 above, included both.

Discussion

Capturing integration of domains. Table 1 and Figures 2 and 3 show the number and diversity of propositions and connections, demonstrating a broader scope than traditional concept mapping (Fig. 1). Individualized expression made changes over time more visible than is possible with traditional concept mapping, while the greater emphasis on the

Table 1. Frequency of connections between domains.

TO:	THINKING/ KNOWING	EMOTIONS/ FEELINGS	ACTIONS/ ARTIFACTS	ATTITUDES/ VALUES	BELIEFS	TOTAL FROM
From:						
Thinking/knowning	19	26	11	23	8	87
Emotions/feelings	17	22	15	16	12	82
Actions/artifacts	25	28	19	16	7	95
Attitudes/values	11	13	25	11	13	73
Beliefs	19	28	12	14	26	99
Total to	91	117	82	80	66	436

**Table 2.** Frequency of annotations to links between domains.

LINKS TO:	THINKING/ KNOWING	EMOTIONS/ FEELINGS	ACTIONS/ ARTIFACTS	ATTITUDES/ VALUES	BELIEFS	TOTAL ANNOTATIONS TO LINKS FROM
Links from:						
Thinking/knowing	13	11	5	15	5	49
Emotions/feelings	12	22	19	12	2	67
Actions/artifacts	15	9	3	17	1	45
Attitudes/values	8	8	16	5	6	43
Beliefs	11	13	3	11	8	46
Total annotations to links to	59	63	46	60	22	250

annotations as a vehicle to explain relevant clinical practice situations gave insight into the often very different meanings of similar propositions among participants.

The greater number of propositions directed toward the emotions/feelings domain suggests that this area of learning is perceived to be the most integrated in learning for clinical students; many annotations identified emotions/feelings as a source of both motivation and tension, and many included emotions of uncertainty even when these were not the main focus (eg, Claire 2). The consistency of propositions linked *to* this domain and *from* the beliefs domain over the three mapping periods suggests that modified concept mapping provides an effective vehicle for capturing the effects of affect and beliefs on the higher education process of becoming.⁵ This process is, in turn, linked to development of the meta-cognitive capacities and graduate attributes that higher education seeks to produce.⁸ As a holistic self-reporting ethnographic approach, modified concept mapping has allowed the documentation of the complexity of these learning processes.

Changes to the number and variety of connections between maps one, two, and three varied between individuals and related directly to the depth of engagement reflected in the annotations, rather than to the concepts chosen. This highlights the importance of collecting the annotations as in-depth explorations of the interrelationship between everyday clinical practice and knowing,² which include actions, emotions, attitudes, and beliefs. There is no single linear way in which developing professionals process and interpret the relationships between cognitive, affective, and bodily practice-based learning and their epistemological and ontological beliefs, values, and attitudes.^{16,30} Modified mapping allowed insight into particular experiences and the resultant visible structures that signify these processes and interpretations.

Establishing propositional links between domains and between concepts from different domains involves participants' thinking about inferential connections, while describing specific experiences draws on emotionally invested reflective skills.^{11,12} Modified concept mapping thus allows the mapper to integrate and separate critical thinking and reflection and identify specific beliefs, values, and attitudes

behind this. This may enhance self-assessment even if the outcome is unlikely to correlate with knowledge or skills assessment.^{15,39}

In summary, as a holistic, practice-based, self-evaluation tool, the best uses of modified concept mapping may be in revealing learners' engagement with epistemological or ontological beliefs and how these beliefs are changed by practice.¹ Since practice relationship dynamics such as emotional congruence affect student learning and professional development,^{3,44} modified concept mapping could also be used to explore challenges to emotions, values, and beliefs, or the interrelationship between environment, knowing, and practice.^{2,23} Finally, because the annotations primarily record relationship-related events in practice, modified mapping could be useful for longitudinal research into interprofessional practice.

Significance of values and beliefs. The participants' word choices and the finding that propositions were more consistently and frequently *from* rather than *to* beliefs (Table 1) suggest that this domain is an important influence on the others. Additionally, many annotations (eg, Leah 1) suggested that values were actually more closely aligned with beliefs than with attitudes, so the number of propositions related to beliefs in Table 2 may be an underestimate. The tendency to place beliefs and values in the left and middle/upper parts of the maps (Figs. 2 & 3) correlates with the representation of known and ideal aspects of a person's worldview.³⁶ This is supported by the unidirectional nature of this influence noted repeatedly across all maps.

The Figures 2 and 3 and Tables 1 and 2 illustrate the perceived importance of beliefs and values as influences on thinking, feelings, and attitudes in particular. The annotations explain how beliefs and values influenced what participants thought and did and their attitudes, illustrating why "Changing or revealing beliefs, values, and attitudes" was so strongly represented as a critical element of experience. Claire and Leah's annotations also highlight how this is linked to behaviors, which may be interpreted by others to mean something very different. All three annotations are typical in that beliefs and values permeated the participants' records of practice experience, even when the connection being illustrated was not linked to these domains. Liz clearly identifies not only

how important attitudes and values are to clinical students but also how her “hit or miss” experiences of belief, value, and attitude mismatches were accepted as normal. Leah’s experience of thinking differently from the clinician suggests that, in such situations, students do not voice and perhaps repress values they esteem.¹⁴

Modified concept mapping attempted to recapture the ontological basis for concepts, connections, and integration.²⁵ The depictions of beliefs, values, and attitudes and their significant influence on other domains suggest that ontology is at least as important as epistemology in forming clinical students’ perceptions of practice-based learning. While the findings indicate that visible changes to practice such as knowledge application, emotions, skills, and behavior are constantly affected by less visible subjective attitudes, values, and beliefs, these attitudes, values, and beliefs may not be changing in the same way, or at all. In many annotations, the critical element was that beliefs and values were revealed rather than changed; thus, it is significant that little is known about their formation in the years leading up to practice-based learning.^{13,15}

If the conception of adult learning as a process of becoming a person and professional through person-centered change is valid,^{5,24} then whether and how beliefs, values, and attitudes change during clinical learning is very important, especially since these are modeled in mostly tacit ways.^{3,4} The interaction of subconsciously developed tacit capacities such as discernment and moral judgment with knowledge and skill is at the heart of the apprenticeship model of clinical learning. Thus, increasingly authentic practice and participation depends on understanding what underpins these changes and interactions.^{3,7–10} Further attention to the formation and change of beliefs and values throughout the curriculum may assist this.

Limitations. While documenting connections and changes over a longer period of clinical learning produced sufficient rich data to illustrate patterns in conceptual connections and categorize experiences, there were insufficient participants for statistical analyses. Additionally, despite the honesty, depth, detail, and relatively freely chosen content of the maps, subjectivity and bias have influenced the interpretations. Mapping was too time consuming for students, some of whom perceived it to be similar to mind mapping, which they did not like. While CMap[®] was convenient, participants felt it limited visual expressiveness and was cumbersome to use. Further development of visual methodologies and tools to investigate integrated learning may address some of these issues.

Conclusion

As a data gathering tool for holistic practice-based learning research, modified concept mapping can demonstrate differences in the integration of cognitive, affective, and bodily learning with attitudes, values, and beliefs. Through rich, detailed visual and textual depictions of participants’ experiences of and engagement with clinical practice, it also makes visible epistemological and ontological beliefs and

values. Further development of concept mapping may increase its potential for research exploring the complexities of integrated practice and student perceptions of transitioning to this. These findings also highlight the significance of clinical students’ beliefs and values in how they perceive and respond to practice-based learning, suggesting that more teaching and learning attention to belief and value development throughout the curriculum, and research into this, are warranted.

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Author Contributions

Conceived and designed the study: SM. Analyzed the data: SM. Wrote the first draft of the manuscript: SM. Contributed to the writing of the manuscript: SM, MB, WB, and SF. Agreed with manuscript results and conclusions: SM, MB, WB, and SF. Jointly developed the structure and the arguments for the paper: SM, MB, and WB. Made critical revisions and approved the final version: MB and WB. All the authors reviewed and approved the final manuscript.

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