

Longitudinal integrated clerkships optimize cognitive load to support identity formation

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Abstract

Clerkship years form and re-form medical students' professional identities. Evidence suggests that students in longitudinal integrated clerkships (LICs) develop along a unique path, making the LIC model's impact on professional identity formation a rich area for discovery. This study explores the lived experience of former LIC students becoming a physician during the core clerkship year, across different LIC models and contexts.

This qualitative study used a hermeneutic phenomenological frame. Former students of three different programs were invited to participate. Seventeen volunteers were interviewed using a semi-structured guide. The co-principal investigators read transcripts holistically, then analyzed them through regular discussion with each other and the study team, periodically returning to the transcripts to ensure the emerging narratives remained true to the participant voices.

Cognitive Load Theory provided a novel framework to interpret participants' descriptions of the LIC as the creation of space to learn and space to become. Longitudinal relationships allow teachers to tailor experiences for students and remove excessive pressure on students to perform optimizing intrinsic load and decreasing extraneous load. Relationship continuity with patients and teachers mitigates stress and burnout, further decreasing extraneous load. Optimizing intrinsic load and decreasing extraneous load each provides students with cognitive bandwidth (germane load) to reflect upon and develop their professional identity.

LIC continuity principles, especially longitudinal relationships, are fundamental to professional identity formation across different LIC models/contexts through their impact on cognitive load.

Keywords: professional identity formation, longitudinal integrated clerkship, cognitive load theory, undergraduate medical education

Date submitted: 13-October-2025

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Citation: Poncelet A, Wamsley M, Ziv T, Nichols D, Teherani A, Sewell J, Mazotti L, Saad Riegels N, and Konkin J. Longitudinal integrated clerkships optimize cognitive load to support identity formation. *Educ Health* 2026;39:1-11

Online access: www.educationforhealthjournal.org
DOI: 10.62694/efh.2026.495

Published by The Network: Towards Unity for Health

Background:

Medical students “have committed themselves to a self-altering course of study.”¹ This transformation — professional identity formation (PIF) — should include knowing and upholding the social contract physicians have with society, and integrating the profession’s core values and moral principles into one’s personal identity.^{2,3}

The first year of foundational clinical training (clerkship) is a critical time that forms and re-forms students’ identities.⁴ Jarvis-Selinger et al developed a conceptual framework of medical student PIF that includes the specific context of the learner’s clinical environment; a focus in that context that grabs their attention; a specific catalyst that stimulates them to reflect about their own identity; and the process of building or negotiating their identity beliefs.³ Wald identifies three elements of PIF: relationships, resilience, and reflection.²

Two main structures for the foundational clerkship year are rotational block clerkships (RBCs) and longitudinal integrated clerkships (LICs) (please see definition in Figure 1).⁵⁻⁷ In the generalist LIC model, students are embedded in a generalist practice for the majority of the LIC. In the parallel streaming model, students have longitudinal placements with multiple discipline-specific teachers.⁷ The former model is more likely to be present in rural, primary care settings and the latter in urban settings with a predominance of specialists. Distributed across four continents in an assortment of healthcare systems, LIC contexts vary considerably, ranging from community settings (remote, rural, urban) to urban academic medical centers associated with a medical school.⁷ LICs share a foundational principle of continuity: with teachers, patients, and the learning environment.

LIC students may develop along a different path than RBC students.⁸⁻¹⁴ Prior exploration of PIF in LICs identified common themes including meaningful continuity of relationships with patients, teachers and peers.¹¹⁻¹⁴ These foster the identity of an empathetic patient-centered physician. Hauer et al described LICs as creating “opportunities to grow into a physician role with patients” through authentic participation in patient care.⁸ Gaufberg et al concluded that LICs supported PIF through making values explicit and supporting the integration of personal and professional identities.¹¹

Distinguishing the impact of LIC continuity principles from other factors, such as the specific LIC model, setting and healthcare system, student selection, and supervisor types remains challenging. The purpose of this study is to learn from the narratives of former LIC students across different models and contexts about their lived experience of becoming a physician. This expands our understanding of *how* LICs facilitate PIF with the ultimate aim of improving LICs to optimize identity formation.

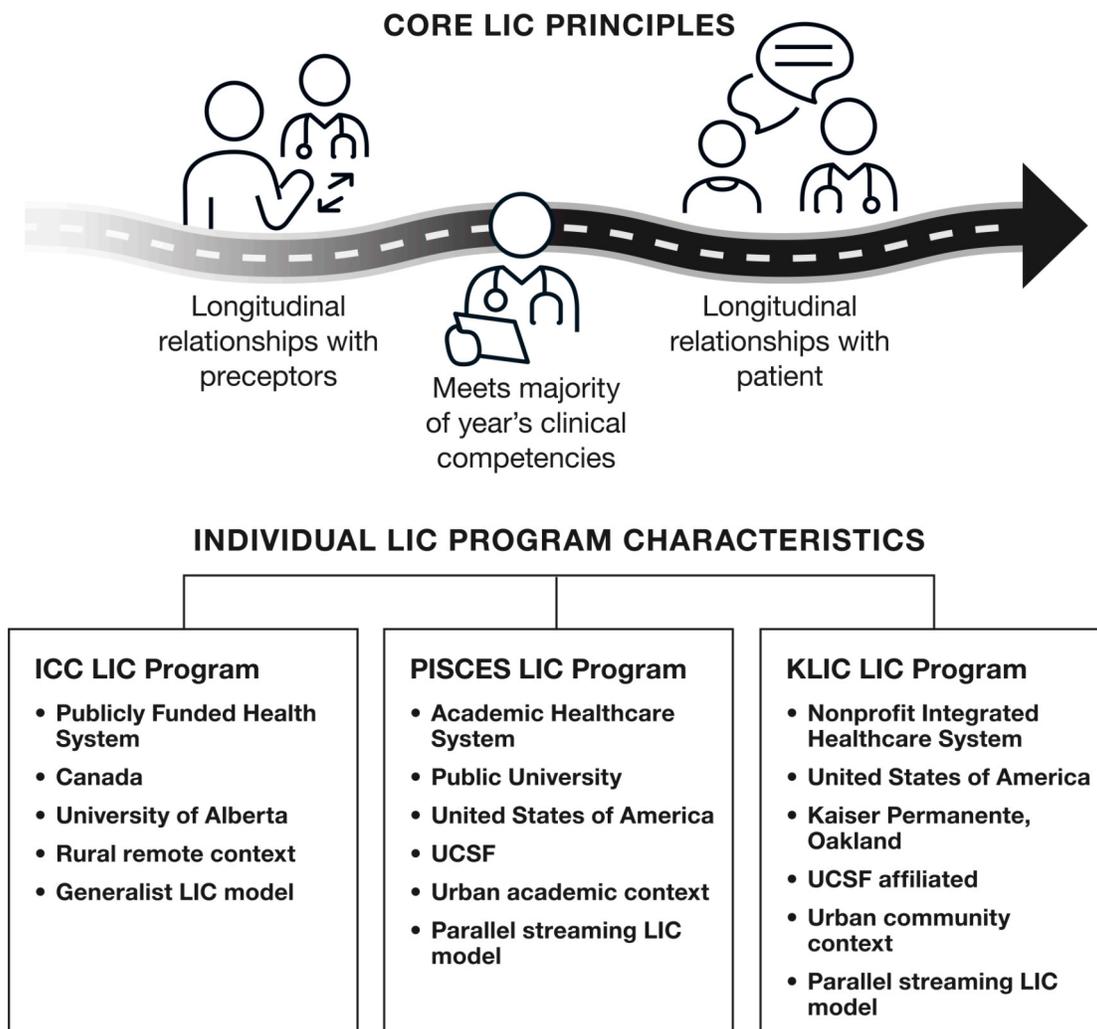
Methods:

The research team used a hermeneutic phenomenology methodology focused on the participants’ experience of becoming a physician (phenomenological) and sought to understand and interpret participants’ narratives (hermeneutic).¹⁵⁻¹⁸ Hermeneutic phenomenology identifies key concepts of the lived experience of the phenomenon being examined, and then seeks to understand or interpret these while remaining true to participant voices. Our methodology follows van Manen¹⁵ and Gadamer¹⁹ in which description is key, but where interpretation is expected in the analysis. Hermeneutic phenomenology allowed us to interpret the participants’ narratives of professional identity formation in relation to their individual contexts. Reporting follows the Standards for Reporting Qualitative Research (SRQR).²⁰

Participants were medical school graduates from two different LIC models across three different health systems. Their current roles ranged from postgraduate training to early practice. Programs included a rural/remote LIC (generalist model), a community-based urban LIC affiliated with an urban medical school, and an urban academic LIC (both parallel streaming models with students from the same university) (Figure 1). All three programs meet the international definition of an LIC cluster C “comprising either the entire year’s study or with very short orientation programs for individual disciplines followed by a full academic year covering all disciplines simultaneously.”⁶

Exempt ethics certification was independently obtained from the UCSF Human Research Protection Program Institutional Review Board (reference number 238257) and full approval from the University of Alberta Health Research Ethics Board (REB1 — reference number Pro00085811) in accordance with the 1964 Helsinki Declaration and subsequent amendments.

Figure 1: Core LIC Principles and Individual LIC Program Characteristics



A semi-structured interview guide was developed by the study team including a standardized study description. Seventeen volunteers were interviewed between February 2018 and May 2019 by an independent interviewer with a confidentiality agreement. The interviewer was an experienced PhD qualitative researcher with prior research on LICs but with no role developing nor leading an LIC, and with no prior contact with the study participants to mitigate bias and provide a safe environment. Interviews were conducted by Zoom or phone and recorded with the participants' consent. All 305 graduates were invited to participate in a separate demographic study of the three LICs with an option to be interviewed. Of the 88 survey respondents, 19 agreed to be interviewed, with completed interviews for analysis in 17. Van Manen emphasizes depth over number with 6-12 interviews adequate for a phenomenological study.¹⁵

The interviewer did not participate in the analysis or manuscript writing. Interviews were transcribed by a transcription company with a confidentiality agreement.

Van Manen was used as a guide for the analysis.¹⁵ Co-PIs (AP and JK) read each transcript twice individually, with the first read for holistic understanding of the participants' description of their experience and the second to identify units of meaning or phrases. They then read through the transcripts together to review their individual analyses and to identify additional units of meaning. After the first three transcripts were analyzed, the findings were discussed with a subgroup of the study team (DN, MW, TZ) for their perspective. Minor modifications to the interview guide were made for subsequent interviews. The Co-PIs analyzed the remaining transcripts with a

regular return to the transcripts to ensure the analysis remained true to the participants' voices. They performed iterative cycles of capturing and discussing reflections towards an evolving understanding of the participants' lived experience of PIF in the LIC. They met periodically with the study team to review their findings, gain study team insights, and revise the analysis. Field notes were written during transcript analysis and study team meetings.

The researchers started with the intent to hear the participants' experience of the phenomenon being studied and then explored established theories to help frame and interpret the participants' narratives (see Results).

Our study team included generalist and specialist, rural and urban physician educators from the three LICs, and a PhD educator. Each physician educator brought potential biases from their own lived experience of becoming physicians and as creators and directors of LIC programs. These were discussed during transcript analysis. The varied backgrounds afforded the research team a broad range of perspectives regarding medical education and LICs, which helped to mitigate bias and enhance interpretive depth. All but one of the study team had experience with qualitative research, and one of the Co-PIs (JK) had experience with hermeneutic phenomenology.

Results:

Participants across all three clerkships experienced the LIC as a "space" that supported personalized learning, growth, and the awareness of the physician they were becoming.

"I do think that all throughout medical school I felt, and certainly through my clinical time in medical school, I felt very supported in my development. I had a really good experience with my LIC and had great mentors through that and felt very welcomed in the clinical environment and well-taught and I felt that I had space to grow and learn. 07-urban academic LIC (163-167)"

Understanding what participants meant by "space" became an emic question for more focused reading of the transcripts. The researchers considered several theoretical underpinnings of clinical learning, including social constructivism, situated

learning, experiential learning and cognitive load theory (CLT) with which to frame the findings. To our knowledge, there are no published studies applying CLT to LICs or to PIF. The team reviewed CLT in depth through the literature and consultations with CLT experts, Drs. John Q. Young and Justin Sewell. Based on the participant narratives and our exploration of CLT, we chose the CLT frame to bring a unique perspective on LICs and PIF. Dr. Sewell was invited to join the study team.

Cognitive Load Theory:

CLT is an established model of human memory encompassing sensory, working, and long-term memory subsystems. The history of CLT is summarized well by Sweller et al.²¹ The theory examines the structure and capacity of working and long-term memory, the relationship between the two, and the impact on learning. Working memory is the bottleneck for learning: it can only process up to seven elements of information at once²² and when these require active processing, two to four elements may be its maximum.^{23, 24} When the cognitive load exceeds working memory capacity, the learner's performance and learning are impaired.²⁵

Three types of cognitive load are identified: intrinsic, extraneous, and germane.²⁵ Intrinsic load is essential to the learning task at hand.²⁵⁻²⁷ and is relative to the "proficiency of the individual, the number of information elements and the extent to which the elements associated with the task interact with each other."²⁵ Changing intrinsic load involves either altering what the learner is expected to learn or changing the learner's expertise.²¹ Extraneous load comprises elements which add to the learner's working memory but are not necessary for learning,²⁵⁻²⁷ from background noise, to busy diagrams, to the amount of stress a learner experiences. Germane load is "the load imposed by the mental processes necessary for learning... to occur"²⁵ – the learner's deliberate use of cognitive strategies to facilitate learning (schema construction).²⁵ In other words, "intrinsic load is associated with task performance, while germane load is concerned with task learning."²⁶

The impact of some aspects of the medical learning environment on cognitive load and learning is well established. Until recently, elements of the learning environment considered are physical characteristics.^{28, 29} The impact of broader

contextual determinants, such as clerkship structure, have not been explored.

Intrinsic Load:

LIC graduates described that being known by their teachers through longitudinal relationships was transformative. The strength of that relationship allowed clerkship teaching, feedback, and experiences to be individually tailored. Longitudinal relationships with teachers, patients and the learning environment were all key to optimizing intrinsic load.

“I think that’s the biggest thing is constant feedback, you work with the same person all the time so they really get to know your strengths as a learner, how to help you, what works well for you, what sort of new experiences you need to see so you can continue developing. 16-rural LIC (697-701)”

Extraneous Load:

Longitudinal relationships with teachers reduced the pressure to perform, the stress of being evaluated and concern about competition with their peers. As a result, students could focus on meaningful learning, patient care and PIF.

“I think just by virtue of being in that community for quite a number of months... I was able to get to know a lot of the people that were mentoring and teaching me, I was able to feel quite supported in a lot of respects just because I knew that they knew me. I didn’t have to worry in a lot of ways about having to prove myself because they knew me from before.” 05-rural LIC (202-207)

“I think that I am somebody who appreciates relationships, especially in my workplace and I am certainly am the kind of person who like many of us, ah, like to do a good job and, and can get caught, I think as a trainee, I could get caught up in just sort of the stress of trying to please my preceptors and evaluators and kind of I think that in my rotations in a city, like I almost would, as somebody who, who cares deeply about patients and, and that’s an integral part of my practice and who I am, I still would, I

still found that I, you know would be so focused on what I was supposed to be doing and how I was supposed to be doing it that, that that would almost overshadow the ex, what it, what the purpose was of what I was doing.” 01-rural LIC (292-302)

The LIC enhanced wellness which in turn lessened extraneous load. Longitudinal patient relationships mitigated burnout, further minimizing extraneous load.

“I think it had a big contribution to my wellness. I wasn’t anywhere close to being burned out or anything like that and it feels like a little bit of, like a charmed experience I had in medical school. I was just very emotionally well while having still learned a lot going into residency and I was able to focus on things that I wanted to focus on...and try to be the person that I wanted to be.” 07-urban academic LIC (480-486)

“It can be very easy in medicine to become quite jaded and burnt out. If the focus is just on disease processes or different social issues it can get quite tiresome, especially if you’re seeing the same issues again and again. I think having a deeper or a more compassionate or empathetic relationship with my patient can really help to bring things into a better focus, help to remind me that this isn’t just a disease I’m treating. This is a person with a disease that is really affecting their life.” 05-rural LIC (151-158)”

Sometimes LICs added to extraneous load. The specific structure of an LIC could negatively impact learning and wellbeing, especially if relationships did not develop. Frequent geographic transitions, notably in the parallel streaming LIC structure, were further examples.

“I remember distinctly that I did not connect with my mentor, my preceptors in a way that I felt like they were mentors for my own personal experience.” 02 urban community LIC (238-240)

“It was way too specialized and it was scattered all over the city and the schedule was too insane and to be very frank it was the most destabilizing year of my entire life,

and I became extremely depressed.” 03-urban academic LIC (333-335)

Germane Load:

When learners could engage germane load to reflect on who they were becoming, they had the time and bandwidth to make sense of their own personal and professional development. This occurred through self- and guided reflection with their LIC mentors and teachers. Relationships played a critical role in providing the cognitive capacity to focus on their professional identity formation.

“My mentors have allowed, have given me time and space to think about my career and where I can develop and what positions I can develop in and making sure that those match the things that I enjoy.” 11-urban academic LIC (376-378)

“Having preceptors who were interested in my development as a physician and as a person were important. I think those are really meaningful relationships for me and I think maybe that I wouldn’t have had that if I hadn’t done that experience. So maybe more of a sense of community I got out of it in the sense that people were committed to my development, not just my knowledge and being an efficient worker but also just as, as a practitioner and as a human being.” 12-urban academic LIC (412-418)

“[my teachers] all really seemed to care about me as a person and care about me as a physician and I think people who are in a normal, non-longitudinal program, 3rd-year medical students. . . I would say very rarely have relationships like that with attendings.” 08-urban community LIC (242-245)

In contrast to the “space” afforded by the LIC to develop in, the graduates described efficiency outweighing reflective professional development as a primary driver in residency.

“There have been times in my career where the work was the priority and not necessarily my personal or professional development and I would say probably the most notable time where that was true was in residency where the work was just long and hard and exhausting and so I think even though obviously I

was developing as a professional, I just didn’t have the time to sort of think about or seek out mentor, seek out professional development or support.” 11-urban academic LIC (165-171)

Discussion: Space to Learn; Space to Become

Former LIC students identified that the LIC afforded them space to grow and learn. When describing their experience of becoming a doctor, participants first talked about how the LIC supported their learning and gave them that space to learn. To them, learning was inextricably connected to their professional identity formation (PIF). This is confirmed in the PIF literature: “Achieving competence is a necessary component of professional identity formation.”²⁹

How do LICs facilitate this space to learn and grow? Study participants described how longitudinal relationships with their teachers allowed for experiences and feedback to be tailored to their learning level. The propensity for LIC teachers to align learning experiences and tasks with the students’ evolving skills and abilities can confer a significant advantage over RBCs, where, with less continuity, teachers often do not know learners’ skillsets. This optimizes intrinsic load.

LICs can decrease extraneous load through longitudinal relationships with teachers, patients, and the learning environment. O’Brien et al in a study of RBC and LIC students found RBC students perceive the most valued student is a “performer” who appears competent.³⁰ LIC students, on the other hand, were more likely to feel valued as “caregiver(s),” with an emphasis on their personal growth. Longitudinal relationships free LIC students from the daily need to prove themselves, allowing them to focus on their actual skills and growth edges.

By minimizing extraneous load, optimizing intrinsic load and expanding germane load, LICs can allow students to focus on their learning and their professional identity formation. Participants stated relationships gave them room to be self-reflective about who they were becoming, “*what it’s like to be a real physician*” (08-urban community LIC 340-350). Guided and self-reflection on identity, a key mechanism for PIF,^{2,3} represents a product of germane load that occurred naturally within the clinical environment of LICs.

Participants reported LIC teachers were interested in them as people, not just as students. This supported wellness and personal growth mitigating against burnout. Longitudinal therapeutic relationships with patients lowered extraneous load by decreasing unnecessary stress and by supporting compassion. Participants experienced lessening extraneous load and found opened space for learning and becoming. CLT theorists confirm that stress is “one of the essential manifestations of cognitive overload.”²⁶ Wald states, “Growth within relationship-centred education and resilience can feed back and deepen reflection on being, relating, and doing to foster awareness and meaning-making within learning.”²² The increased wellness and decreased stress through the relationship-centred LIC model not only optimized learning by mitigating extraneous load and optimizing intrinsic load, but also allowed for the cognitive capacity for deeper reflection needed for PIF.

Transformative learning theory posits that learners need discomfort about their current frame of reference in order to change their mindset and learn.^{31,32} Mezirow terms this a “disorienting dilemma.”³² This discomfort needs to be sufficient to motivate the learner to change – that is, this should optimize the intrinsic load to find the learner’s growth edge. It should not be so overwhelming that this discomfort becomes extraneous load and compromises learning.

Sarrafi-Yazdi et al, through the lens of the Ring Theory of Personhood, identify Innate, Individual, Relational and Societal level factors influencing PIF.³³ The authors identify the following as possible barriers to PIF: “No mentors or role models” and structures in the clinical environment that “deter students from seeking help or speaking up” as described by participant 02.³³ It appears crucial that students develop longitudinal relationships with their LIC teachers. Programs need to be able to identify when this is not happening and intervene early.

Clerkship structure establishes how often a learner must shift to new unknown settings. Navigating a new context will add to extraneous load. CLT theorists have expanded consideration of the physical environment on cognitive load^{27,28} but have not thus far considered the clerkship structure. Clerkship directors and students identified factors that students struggle with in the clinical setting: understanding roles and responsibilities, adjusting to clinical culture, learning the logistics of clinical

settings, and encountering frequent changes in staff, settings and content.³⁴ A consistent learning environment, once familiar, has the potential to decrease extraneous load, optimize intrinsic load, and allow for increased capacity in germane load. LIC directors should review their programs with an eye to identifying discontinuities in the learning environment, minimizing these as much as possible and mitigating disjunctions where they are unavoidable in order to optimize learning and PIF.

Based on the foregoing discussion, we developed a model that depicts the interface between CLT and LICs (Figure 2).

Our participants highlighted that it is important to have space to learn in order to have space *to become*. Several participants expressed frustration during residency when the dominant focus was work efficiency and task completion, describing neither the time nor space to think about who they were becoming. It would be interesting to explore whether an LIC-like model for residency could mitigate this.

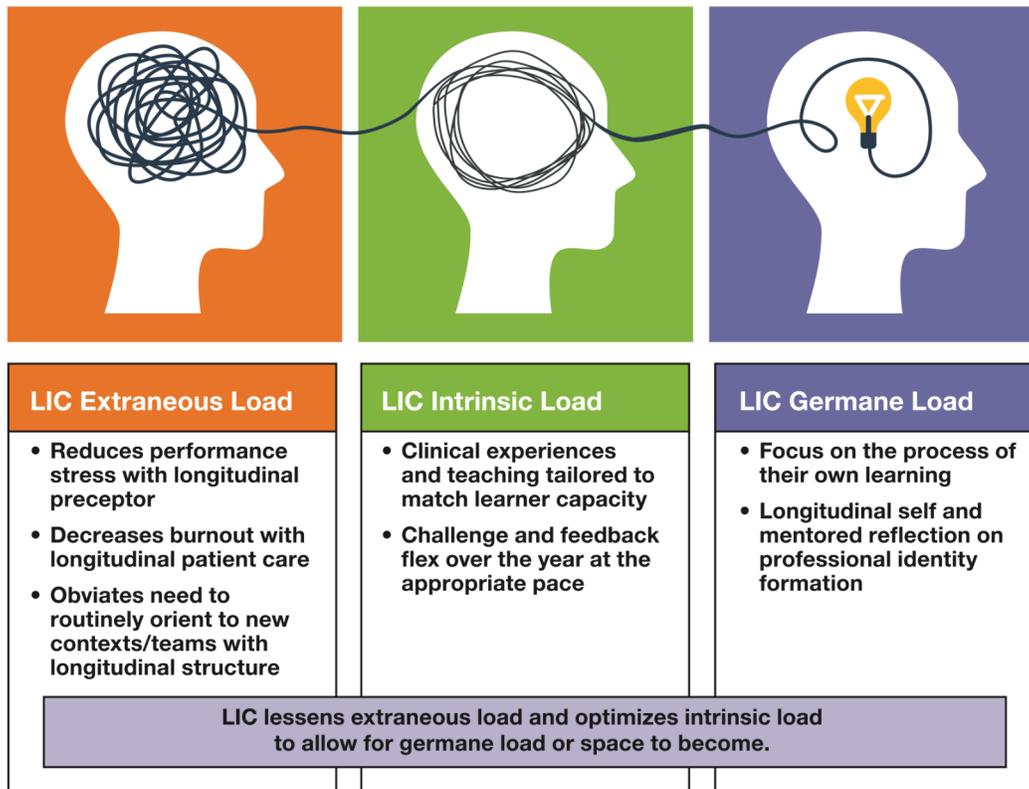
The study findings suggest that PIF requires germane load – moving beyond the tasks of acting as a physician to do the work that builds the identity of a physician. Young et al posit that space for germane load is not possible if cognitive load is completely expended with intrinsic and extraneous load; this is true for all aspects of learning, from foundational science to clinical science to professional identity formation.²⁴ We conclude that optimizing intrinsic and minimizing extraneous load in the LIC allows much needed space to engage germane load, not only for learning, but also for PIF (Figure 2), and that this finding may be independent of the specific LIC model or setting.

Limitations

The three participating LIC programs in this study are situated in high resource countries. The study did not explore the influence of race, ethnicity or gender on PIF in LICs.

The research team members are medical educators with strong representation from each of the LIC models which afforded accountability within the research group and mitigated possible bias for one's own clerkship. As in any phenomenological study, the researchers’ individual experience of the phenomenon, professional identify formation (PIF), is a potential bias. Our interpretation is one of

Figure 2: How LICs support PIF by Influencing Cognitive Load



possible complementary interpretations and does not encompass all perspectives on PIF.

The time between the LIC and the interview could impact recall of lived experiences, though description of lived experience is always retrospective.¹⁵ The stages of practice from residency to clinical practice added a rich lens to the participants’ reflections on PIF and the LIC. The interviews were performed before the COVID-19 pandemic which might also influence their lived experiences as learners.

Generalizability can be limited. As a hermeneutic phenomenological study, the inquiry is into the experience of the participants. Our purpose was to attend to the experiences of participants in three LICs in three unique contexts to identify commonalities. Those involved in other LICs can determine whether the results are relevant to the experiences in their clerkships.

Conclusion:

This study reinforces that Longitudinal Integrated Clerkship (LIC) continuity principles are likely key

for learning in LICs and for facilitating Professional Identity Formation. Cognitive Load Theory provides an apt lens for understanding how these principles support PIF.

Germane cognitive processing is expanded when intrinsic and extrinsic load are optimized, providing the cognitive space for PIF. Assessing learning environments with this understanding may lead to actionable steps that support this critical part of becoming a physician.

“Overall, I would not have traded my longitudinal clerkship experience for anything. Looking back, I think that it was incredibly formative for me as a physician and as a learner...it really helped develop me and it helped establish some of the values that I still have today, and I think it was done in a really careful and supportive manner that I really appreciate. I really, really am grateful for the time that I was able to spend in that program.” 09-urban academic LIC (520-526)

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