

Understanding Medical Students' Self-Directed Learning in the Clinical Setting:
A Cross-Cultural Qualitative Interview Study in the U.S. and Taiwan

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Abstract

Self-directed learning (SDL) in the clinical environment is an important Western construct that may be difficult to translate into other cultural settings. In recent decades, most Asian countries have adopted a Western model of medical education reform that emphasizes an individualistic, student-centered model of education. However, the applicability of this model in Asian medical education setting has not yet been examined. In addition, while SDL has been well-studied in classroom settings, barriers to and facilitators of SDL in the clinical setting are not well studied. To compare and contrast Western and Asian students' conceptualization and experiences of SDL in the clinical setting, we carried out a cross-cultural qualitative study with medical students at Harvard Medical School (HMS) and National Taiwan University College of Medicine (NTUCM). Students who recently finished core clerkships were recruited for this study. A total of 30 semi-structured interviews were conducted with 15 HMS students and 15 NTUCM students, and all the affiliated hospitals where students had core clerkships were represented. Data was analyzed using the Framework Method of content analysis. Building on existing theoretical frameworks of SDL, our findings identified the essential themes across three dimensions of SDL and six major steps in the SDL process in the contexts of both the U.S. and Taiwan. Medical students described using cognitive, social-emotional, and peer learning strategies to enhance their SDL. They characterized the learning environments that fostered SDL as those in which faculty and residents demonstrated an educational orientation, promoted psychological safety, invited student engagement and reduced the sense of urgency. While there

were many similarities across the two groups, several consistent differences emerged: HMS students tended to focus more on individual performance and put considerable effort into impression management, whereas NTUCM students were strongly oriented to collaboratively learning with their peers but avoided standing out when learning in a group. For specific contextual considerations, lowering the anxiety caused by evaluation and encouraging peer learning may promote SDL in the U.S. As for medical schools in Taiwan, moderating students in group learning will help facilitate SDL.

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1. Chapter 1: Background

1.1. Background

Self-directed learning (SDL) is a widely-recognized construct in medical education. Medical students are expected to cultivate the habits of SDL and develop lifelong learning skills at medical school. [1] As Knowles defined it, “A self-directed learner takes responsibility for their own learning and has internal motivation to develop, implement, and evaluate their approach to learning.” [2,3] SDL involves general learning approaches that learners can adopt. Knowles described SDL as a linear process comprised of six major steps (See Figure 1). [2] As Figure 1 implies, the emphasis is placed on individual learners. However, some investigators have cautioned that the focus directed towards the individual dimension of SDL may be synonymous with a lack of support in certain contexts. [4] Hiemstra and Brockett address this potential pitfall in their “Person, Process, Context” (PPC) model (See Figure 2). In that model’s three dimensions, “Person” refers to characteristics of the individual, “Process” refers to the teaching-learning transactions, and “Context” refers to the environmental and sociopolitical climates. SDL is most effective when Person, Process, and Context are in balance. [5]

SDL in the classroom setting, such as problem-based learning in medical schools, has been well-studied in the last two decades. [6] However, the effects of SDL in clinical environments remains understudied. Some exploratory studies related to SDL showed that clinical learning’s key components include participation in patient care and engagement of the team. [4,7-9] For novice students, a supportive environment that helps them to navigate clinical learning experiences would improve their SDL. [10,11] However, students were also aware of hierarchies and orders of priority in the clinical setting. Hence, students' perception of boundaries may have influenced their interactions with others and impacted their learning ability. [12] A recent study underscored the importance of external guidance for SDL in medical residents and motivated further studies on medical students. [13] These findings align with the Person, Process, and Context model, yet their ability to define specific characteristics and processes that support SDL in the clinical setting remains limited. They also investigated clinical learning environments in the Western world but do not provide insight into the application of SDL in clinical learning environments in East Asian countries.

In most Asian countries, medical education reforms in recent decades have adopted a Western model that emphasizes an individualistic, student-centered model of education. The applicability of this model in the Asian medical education setting has not yet been examined. [14-16] SDL in the clinical environment is an important Western construct that may be difficult to translate into other cultural settings. The traditional education systems in East Asian countries, such as Taiwan, China, Japan, and Korea, are deeply rooted in Confucianism. Confucian-heritage education emphasizes the superiority of seniors and obedience to authority, and it may present as a barrier to the implementation of SDL. [14] For instance, one study found that in

Japan, medical students tended to identify themselves as one of the crowd and employed homogeneous, non-self-regulated learning strategies. [17] For medical educators who want to build a pro-SDL clinical environment, it is important to identify SDL themes which transcend cultural boundaries and those that may differ from culture to culture. The latter may help to inform how we can better support students' SDL in certain cultural contexts.

To further understand how medical students in different educational cultures experience and employ SDL strategies, we carried out a cross-cultural qualitative study on medical students in the U.S. and Taiwan. The medical education system in Taiwan has undergone various reforms to meet the American and British standards, and the Taiwan Medical Accreditation Council (TMAC) also refined its accreditation standards to keep up with the Liaison Committee on Medical Education (LCME). [1,18] These curricular changes have had effects on Taiwanese medical students, with many reporting that they feel stressed when faced with the clinical learning environment. [19,20] The general goals of this study are to understand student experiences of SDL in their clinical training and to identify the role that local social and cultural contexts play in shaping their experiences of SDL. Specific research questions (RQs) addressed in this study are as follows: How do students describe the nature and practice of SDL in the clinical clerkship setting? Do descriptions of SDL vary across the Western and East Asian educational settings, and if so, in what ways do they differ? How do these findings inform the current models of SDL?

1.2 Schematic figures



Figure 1. Knowles' six major steps of self-directed learning

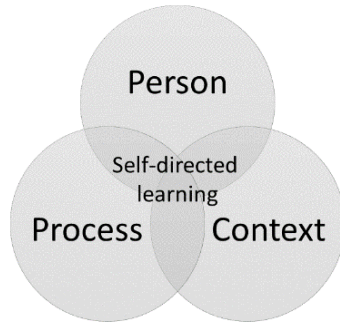


Figure 2. Brockett & Hiemstra's "Person, Process, Context" (PPC) model

2. Chapter 2: Data and Methods

2.1. Short Introduction

To describe students' experiences of SDL in the clinical setting and to explore whether cultural differences related to SDL exist in these settings, we chose to conduct our study at Harvard Medical School (HMS) and National Taiwan University College of Medicine (NTUCM), both of which are the leading medical schools in their respective countries and have a high conformity to the accreditation standards of medical education. Because we aimed to understand how students adopted SDL strategies in their clinical training, our targets were medical students who just finished their core clerkship and who were likely to have vivid memories of their learning experiences.

For medical students at NTUCM, the core clerkship starts in their fifth year. There are 6 rotation blocks in the core clerkship, including medicine, surgery, OB/GYN, family and social medicine, ambulatory and emergency medicine, physical medicine and rehabilitation, and neurology, and each block lasts 6 weeks. Medical students participate in acute and outpatient care for the patients and have self-study time on their rotations.

At HMS, medical students have the one-year Principal Clinical Experience (core clerkships) shortly after their second year begins. Most of the students enter the traditional rotation blocks (including medicine, neurology, OB/GYN, pediatrics, primary care, psychiatry, radiology, and surgery) lasting from 4 to 12 weeks in the affiliated teaching hospitals. Both the traditional rotation manner and the longitudinal integrated clerkship at HMS shares the self-study time on schedules. [21] This study was deemed exempt by the Harvard Faculty of Medicine Institutional Review Board (IRB18-0891) and approved by the National Taiwan University Hospital Institutional Review Board (201705095RINB).

2.2. Materials and Methods

We invited medical students who recently finished their first year of the clerkship at HMS (graduate courses) and NTUCM (high-school entry courses) for our study. Our target students at NTUCM were generally one year younger than students at HMS. We used volunteer sampling to recruit students for the interview. Sampling continued concurrently with data analysis until no new themes were identified and the samples represented the range of student genders, racial/ethnic characteristics, curriculum systems, affiliated hospitals, and types of clerkship training. The participants were 30 students, 15 for each medical school.

Semi-structured interview questions were developed in two language versions (English and Mandarin) from the literature review and pre-testing with 2 medical students for each medical school. The questions in the interview guide (See Appendix A, annotated with purposes of each question) asked participants to describe their current SDL experiences and their own definition of SDL. Interviews were conducted by one researcher (THL) between May to June 2018 at HMS, and June to July 2018 at NTUCM. All the interviews were audio-recorded and transcribed verbatim, and the transcripts were checked for accuracy against the recordings. All the transcripts were de-identified, and the audio recordings were deleted after the transcription was complete.

We analyzed all the transcripts through the Framework method (See Appendix B for further details). [22] The Framework method allows for both deductive and inductive approaches. The deductive approach is using the predefined themes (Knowles' six major steps of SDL and Brockett & Hiemstra's PPC model), while the inductive approach is exploring emergent themes from the data. Two authors (THL and AMS) did the open coding for the transcripts in English, and two authors (THL and KKL, a NTUCM-based author) took charge of transcripts in Mandarin. Initial codes were identified with thorough reading and familiarization of transcripts by the researchers. To address the validity of interpretation across the two languages, four randomly selected interview scripts of NTUCM students with initial codes and excerpts in Mandarin were translated into English for independent review by the HMS-based author (AMS). Likewise, four randomly selected interview scripts of HMS students were reviewed by the NTUCM-based author who was proficient in English.

Codes were systematically generated through line-by-line analysis using Dedoose Software (SocioCultural Research Consultants, CA, USA), and a codebook that identified inclusion and exclusion criteria was developed. We estimated interrater reliability using pooled Cohen's Kappa tests. We used both code application (frequency of one specific code applied to one excerpt across all excerpts) and code co-occurrence (frequency of two specific codes both applied to one excerpt across all excerpts) to identify the importance of codes and the relationships between codes. We searched for emergent themes iteratively among excerpts. All other authors independently reviewed the transcripts to ensure the capture of all key themes. Any differences in defining or naming the themes were reviewed and resolved by consensus. For member

checking, we sent interviewees the analytic results, received their comments, and added a bit of explanation in their quotes. The researchers use multiple strategies to promote trustworthiness of the results (See Appendix C).

2.3. Results

We conducted 30 interviews with medical students who recently finished their core clerkships. Fifteen (50%) of them were students at HMS in the U.S. and fifteen (50%) of them were students at NTUCM in Taiwan (Table 1). Eleven (73%) of the HMS students and eight (53%) of the NTUCM students were female. All NTUCM students were Taiwanese, while four (27%) of the HMS students were second generation Taiwanese or Chinese. We recruited students from all the affiliated hospitals where clinical clerkships were provided. Almost all students at both schools attended clerkship with traditional blocks, with only one HMS student trained in the longitudinal integrated clerkship (LIC).

Table 1. Characteristics of student interviewees in the U.S. and Taiwan (n=30)

	The U.S. (n=15)	Taiwan (n=15)
Gender		
Male	4	7
Female	11	8
Race/Ethnicity		
Taiwanese/Chinese	4	15
Non-Taiwanese/Chinese	11	0
Clerkship		
Traditional blocks	14	15
Longitudinal integrated clerkship	1	0

RQ1: How do students describe the nature and practice of SDL in the clinical clerkship setting?

In our analysis, we found our results aligned with the “Person, Process, Context” model of SDL proposed by Hiemstra and Brockett. Through emergent themes, we enriched the model and added specific themes in these three dimensions (Person, Process, and Context) for medical students in clinical learning. We thus present the themes in all SDL dimensions and delineated how each dimension might interact with the others. Themes presented are similar in both groups of students, unless otherwise specified. Quotations are annotated with the interview case number and the school in parentheses.

The Person Dimension

We found that motivation, interests, autonomy, and a growth mindset were four essential themes in the personal dimension of SDL.

Motivation

Students are most commonly motivated by patient care, followed by anticipating how they will work as attendings or residents in the future. Students with a stronger motivation induced by future doctoring seemed to be more engaged in SDL:

When I become an attending, I won't expect anyone to teach me or help guide me anymore. I should be responsible for what I need to learn now. (Case No.29, NTUCM)

Interests & Autonomy

Students often discussed autonomy when they talked about their personal interests in learning. In the clerkship, students may have had more interests in some specialty or subspecialty training; however, they were not allowed to do so because of a strict timeframe or accreditation requirements. Seven (23%) of the students argued that if they had autonomy in modifying the course structure for their own learning purpose, they could pursue more SDL:

I think I would give medical students a little bit more power. Some of it [the course] is very scripted. ... So, there was a little bit more direction that the students had to be like, 'I really don't want to do this, but can I pursue this option for a week?' (Case No.6, HMS)

Growth Mindset

Seven students (23%) reported that a growth mindset was important in facilitating their SDL. Students can cultivate a growth mindset and be open to all sorts of learning opportunities. Students who demonstrated a growth mindset focused more on learning itself and seemed less intimidated by evaluation:

I've cultivated it [a growth mindset] through the years. I was not always like this. I think in the first few years of college, I was much more stressed out about grades. And then I hit a point where I realized that no matter how much you're stressed about it, there are always things outside of your control. It's just not helpful to try to control for things that are uncontrollable. So, I made an adjustment. ... I just went for a different mindset of "I'll try my best."
(Case No.14, HMS)

Growth mindset also appeared to help students push beyond what they are expected to learn:

Although I was identified as a medical student, I did not restrain myself from learning more advanced material like those in resident levels. (Case No.21, NTUCM)

The Process Dimension

The process dimension includes the six steps of SDL, formal and informal learning activities, as well as interpersonal interactions.

The Six Steps of SDL

Based on Knowles' six steps and our analysis of the results, especially from the students' own definition of SDL, we identified the new six steps of SDL in the context of clinical clerkships. When being asked the definition of SDL, most students answered three to four steps out of the six steps. They described following the steps in this sequence: identifying gaps in knowledge; generating learning topics; finding learning resources; implementing learning strategies; self-assessing learning outcomes; building the framework in learning. The six steps make a continuous cycle of learning and have key components in each step.

Step 1: Identifying gaps in knowledge

All student interviewees addressed the importance of detecting their gaps in knowledge, essentially gaps in content knowledge. Content knowledge mainly refers to the knowledge students may learn from textbooks or online resources. Seventeen (57%) of them further discussed the challenge in the application of knowledge to patient cases:

“I feel the gap is that you have to have that knowledge base of what is the classic way that these diseases present, but then you also have to be okay with ambiguity and weighing different competing factors, that would never happen in a UWorld [an online question bank] question.” (Case No.11, HMS)

Step 2: Generating learning topics

After students identified their gaps in knowledge, they described generating the learning topics that they could focus on and re-allocate their limited time and resources. The learning

topics were found either by students themselves or with the guidance of the team members. There were two common pathways that students went through to generate the learning topics. One was in patient case preparation, in which students actively collected a patient's data and systematically presented the case on rounds or teaching sessions. The other path was through direct patient care, when students were directly involved in primary care and encountered a series of clinical problems. One interviewee remarked on what she would do in the patient case preparation:

“When it comes to a case presentation, I want to be fully prepared. I would re-read the chart and think through it to see if there is any topic to learn in detail. I would also go back to the patient for any question that others might ask for the differential diagnosis.” (Case No.20, NTUCM)

One interviewee reflected on how she identified the learning topics via direct patient care:

"It wasn't like 'Okay, the patient comes in with this, these are the things that you need to research to figure out how to do and what to do for the patient.' It was more 'What do you think you need to do for the patient? What do you think are the important diseases or important problems?'" (Case No.13, HMS)

Step 3: Finding learning resources

All student interviewees mentioned that finding learning resources was a critical step in self-directed learning. They used a wide variety of online and printed resources for reading and test preparation. Overall, there were five major types of online resources (ranked from high to low coding frequency): summaries on topics (e.g. UpToDate), question banks (e.g. UWorld), journal articles (e.g. PubMed), visual learning (e.g. YouTube), and direct web search (e.g. Google Search). The printed resources named were textbooks, pocket manuals, and question-based books.

One thing worth noting is that students in Taiwan used question-based books but rarely used the online question banks, which are more USMLE-based, and currently there is no equivalent for the board exam in Taiwan. In addition, students in Taiwan reported taking advantage of visual learning less frequently. Except for these two online resources, the two groups of students showed great similarities in terms of usage of other online and printed resources.

Students also described interacting with people around them to find learning resources. Since medical students were assigned to a team with the intern, resident and attending physician in each rotation, they naturally and frequently sought help from these people who were more

experienced than they. A couple of medical students mentioned that they might learn from nurses and paramedics as well. Students described learning self-directedly by two dominant mechanisms: asking these team members questions and seeking their feedback. These two mechanisms were prominent in students' descriptions of interactions with team members, which were consistent with the findings in the dimension of the process in SDL.

Peer learning played a vital role in promoting SDL. There were four common categories described in peer learning and support: peer teaching, word of mouth, shared resources, and emotional support (Table 2). These peer learning strategies were observed in both groups of students. However, a major difference is that thirteen (87%) of students in Taiwan reported peer learning in their SDL process, compared with only six (40%) students in the U.S. For instance, students in Taiwan would create collaborative notes, form study groups, and spend extra-curricular time with peers discussing the cases they had.

Table 2. Peer learning and support described as promoting self-directed learning

Strategies	Explication	Quote
Peer teaching	Students can teach and learn from peers because one student may have more experiences or knowledge on a topic than others.	"I think that it definitely helped me to study with someone or at least do questions with someone and see how they were thinking through the questions versus how I was thinking through the questions." (Case No. 13, HMS)
Word of mouth	Students inform their peers about specifics like whom to ask or what to read in each rotation.	"There are a lot of tricks we share with each other. To the finest point, we remind our classmates of specific ways to communicate with Professor A or never being late in Dr. B's clinic." (Case No. 20, NTUCM)
Shared resources	Students may share learning resources through an online platform (e.g. Google drive).	"We have a cloud drive that everyone shares whatever learning resources they have, such as collaborative notes and slides for each class. Whenever our classmates think of something as useful, they upload it." (Case No. 16, NTUCM)
Emotional support	Students can share the difficulties in clinical training and support each other.	"Whenever I got to see friends, the medical students, I think there's a lot of commiserating or shared feeling of not being alone." (Case No. 3, HMS)

Step 4: Implementing learning strategies

Beyond reading, students reported a variety of strategies, including both cognitive and social-emotional strategies (Table 3). Students in the U.S. described all these cognitive strategies,

while students in Taiwan described visual learning and flashcards/mnemonics less frequently. In both groups, very few students reported that they learned by teaching others or writing study guides.

Table 3. Cognitive and social-emotional strategies used in self-directed learning

Cognitive strategies	Social-emotional strategies
1. Note-taking	1. Build relationships with team members
2. Use question banks	2. Observe team members' personality
3. Self-quizzing	3. Be aware of situations (e.g. workflow)
4. Visual learning (e.g. videos)	4. Be sensitive to how they are perceived
5. Use flashcards/Mnemonics	5. Use specific languages when asking questions/seeking feedback
6. Teach to learn/Write study guides	

Social-emotional strategies were discussed in depth by almost half of all the student interviewees. Students noticed that they had to develop these strategies in their early phase of clinical training so that they could find more learning resources or seek more help from others. The most commonly used social-emotional strategy was to build relationships with team members:

"If I can be acquainted with the attending in activities like seminars before the rotation starts, it will be much easier for me to ask the attending questions on rounds. The attending will know that I have thought through the topic and take my question seriously rather than view it as a random question." (Case No.26, NTUCM)

Because the students rotated on a regular basis and were assigned to a new team each month (sometimes weekly or biweekly), they observed team members' personalities to identify potential resources in terms of asking questions or seeking feedback. They often described being aware of situations, especially when there was a busy workflow, so that they would not ask questions in an inappropriate time. Some of the students were sensitive to how they were perceived. They cared about their evaluation and do not want to seem low-performing or disengaged.

Students used specific phrasing, derived from the above-mentioned strategies, when asking questions or seeking feedback. One student gave an example in which she intended to learn more about the case and would get completely different responses if she asked the question in different ways:

If you say, 'I just admitted someone with diarrhea, what's the differential?'
They [The residents] will probably encourage you by asking you back, 'Well, what do you think?' versus if you say, 'I'm thinking the differential is

probably exacerbation [of ulcerative colitis (UC)] versus infection, but I've never seen joint pain associated with it. Is that part of the picture? Or should I be thinking about the joint pain totally separately, like a septic joint?' and they can say, 'No, that's probably an extra-intestinal manifestation [of UC].' and they can teach you. (Case No.7, HMS)

The last part of learning strategies in SDL was related to time management. Students are concerned about whether they have efficiency in learning and patient care, just-in-time preparation for rounds or case presentations, and a balance between work and life. Based on the analysis of code co-occurrence, we found students asked questions and used question banks or question-based books to have better efficiency in learning. For the purpose of just-in-time preparation, students preferred using the online summaries on topics (e.g. UpToDate).

Step 5: Self-assessing learning outcomes

Students in the U.S. and Taiwan both have shelf and board exams. Students in the U.S. spent a great amount of time doing the questions banks not only for preparing for the exams but also for gauging their level of knowledge on certain topics. While students in Taiwan did not pay as much attention to the exams, they used the question-based books to gauge their knowledge as well. Both groups of students regarded feedback seeking as a way of self-assessing their clinical performance.

I would ask the attendings if I did something wrong or had an incorrect clinical judgment. If I had a misconception in my clinical knowledge, the attendings may discover it and give me feedback with explanations. (Case No.25, NTUCM)

Only a few students did this purposefully. They reflected on their progress after a short period of time. By doing so, students appeared to focus more on personal growth and be less bothered by evaluation. One student interviewee shared how she practiced self-reflection:

For most rotations, I would track what I've done, how many patients I saw or what they had. Like anything important that happened during the day, I would write down. So, I do like to track all the patients that I've seen, what conditions they have, what their diagnosis was. That's a good way to go back and reflect and see what you've done. (Case No.14, HMS)

Step 6: Building the framework in learning

The sixth step in the SDL cycle was to build the framework in learning. The framework that was developed throughout the first five steps helped students identify their knowledge gaps when encountering the next patient case. When students mentioned the framework in learning, there were two layers of meanings: the adapted operating procedures and the big picture for learning. As students received clinical training, they learned from either textbooks or their team members about all sorts of operating procedures in approaching patients, performing exams, writing notes, and presenting cases. For SDL, they needed to develop their own operating procedures, which were adapted from others and best fit their learning purposes:

What's most important for me in self-directed learning is that I would develop my own standard operating procedure [SOP] in clinical learning. For example, when I admit a patient, I can follow my SOP step by step to achieve efficiency and accuracy. Everyone's SOP would be a bit different, and it is a summary of your prior experiences. (Case No.28, NTUCM)

The other layer of meanings of the framework was the big picture of learning. A student thought of the way how the team members could be most helpful in her SDL:

They [The residents] definitely do not help guide you by telling you, "Go read this thing." ... They do not do that. I think the way they help guide you is they might ask you the leading questions about this particular case, to help you recognize this patient's big picture. (Case No.12, HMS)

Formal and informal learning activities

Based on our interviews, both groups of students regarded rounds, morning meetings, teaching sessions (lecture or case presentation), and feedback sessions as formal learning activities. Informal learning activities included seminars, workshops, study groups or any learning activities that were not arranged by the course director. Whatever learning activities the students participated in, they demonstrated SDL by asking questions and seeking feedback. Beyond utilizing formal learning activities, students sought informal ones as a way of SDL. One student shared how she took advantage of informal learning activities:

You have nearly no responsibility now and can learn as much as you want. ... For example, this noon there was an attending giving a talk on treatment for a specific disease. The other day, an attending from an outside hospital came here to introduce how they performed some procedures. Whenever I have time, I will join those learning activities. (Case No.21, NTUCM)

Interpersonal interactions

Interpersonal interactions were prominent in students' descriptions of SDL, particularly when help from others was needed (See Appendix D, Note on Interactions). Some of the interactions, such as building relationships and rapport, reading people and situations, avoiding being annoying, and fostering good communication, aligned well with the social-emotional strategies addressed by students. Some of the interactions, like engaging students in the learning environment and avoiding the flaws of peer/group dynamics, have more to do with the context dimension which we will soon present.

The Context Dimension

The contextual dimension refers to the learning climate, culture, and environment that may facilitate or inhibit SDL. Three major themes emerged through our analysis: the learning environment, impression management, and group learning culture (Table 4).

Learning Environment

When students discussed the learning environment, they referred to less the physical location but more the educational approach within its cultural context. The learning environment had four subthemes: education orientation, psychological safety, student engagement, and a sense of urgency. The first three are facilitating factors of SDL, while the last one acts as an inhibiting factor.

Impression Management

Impression management is a critical issue in clinical training. Students addressed three topics: looking good, being constantly evaluated, not seeming disinterested. In a performance-oriented environment, the “fear of not looking smart enough” caused great pressure and anxiety among many medical students. In their descriptions of impression management, students' SDL appeared inhibited because it took so much attention and energy to perform well rather than learn well. This phenomenon was more apparent in the U.S group, where every student talked about the potentially negative effects. Among 68 excerpts coded with impression management, 53 (78%) of them were in the U.S. group.

Group Learning Culture

Group learning culture may be unique in different educational culture settings. For both groups of students, collaborative learning, such as learning from team members on the ward, was helpful for students to conduct SDL. However, a subtheme, avoiding standing out in a group, emerged from only the group of students in Taiwan. Students in Taiwan would try to be an

Table 4. Emergent themes related to the contextual dimension of self-directed learning

Theme/Subtheme	Definition	Frequency	Quote
Learning environment			
<i>Education orientation</i>	Students gain adequate support from the team members to try, explore, and learn in a clinical setting.	55 excerpts, 26 interviews	"On medicine, the residents regard teaching medical students as an important job and the attendings spend more time discussing with you about your patients." (Case No.23, NTUCM)
<i>Psychological safety</i>	Students feel safe to speak up and learn something they are not familiar with.	41 excerpts, 15 interviews	"If the attendings think it is totally fine that I don't understand something, I feel safe to ask questions without any hesitancy." (Case No.30, NTUCM)
<i>Student engagement</i>	Students can feel engaged when the team members invite them to talk, discuss, or practice.	27 excerpts, 15 interviews	"If they extend the invitation like, 'Do you want to come?' Then, that's also an opportunity to see more." (Case No.14, HMS)
<i>Sense of urgency</i>	Students notice the team members just want their jobs quickly done without spare time for teaching.	44 excerpts, 22 interviews	"It was drilled into me that people are busy, so don't ask them questions... It's just a consequence of the busy system that is there, it should change... That was my biggest struggle." (Case No.1, HMS)
Impression management			
<i>Looking good</i>	Students want to perform well, look good, and get a great evaluation which benefits their application for residency.	37 excerpts, 19 interviews	"I think there's always a fear of not looking smart enough... I don't think any curriculum is really going to be able to help you get over that." (Case No.4, HMS)
<i>Being constantly evaluated</i>	Students are evaluated almost all the time when they are in the workplace interacting with others.	33 excerpts, 17 interviews	"The evaluations of the clerkship are so subjective. It adds a lot of stress. And in some ways, I described to people that it feels like you're being interviewed every day for a year." (Case No.2, HMS)
<i>Not seem disinterested</i>	Students fear that they will get a bad evaluation if they seem disinterested in clinical learning activities.	10 excerpts, 6 interviews	"If you didn't say anything on rounds, you would be viewed as a disinterested student not concentrating on your learning. So, you had better participate in the discussion." (Case No.22, NTUCM)
Group learning culture			
<i>Collaborative learning</i>	Students are encouraged to collaborate with the team members, learn from them, and contribute to the team's learning.	22 excerpts, 11 interviews	"I think it's just really important in the medical profession to work closely with colleagues and collaborate and feel comfortable speaking up when there are questions and you're not sure how to proceed." (Case No.5, HMS)
<i>Avoiding standing out in a group*</i>	Students feel more comfortable being an average person in a group and not showing off their abilities.	4 excerpts, 3 interviews	"Sometimes, I hope to perform similarly to others' levels so that everyone seems to be equally competent and I won't be an outcast." (Case No.28, NTUCM)

* This subtheme only emerges from the transcripts of NTUCM students.

average person in a group no matter how competent they are to avoid being “an outcast.” This sometimes seemed to inhibit the students’ SDL since they could have higher standards of learning.

RQ2: Do descriptions of SDL vary across Western and Asian educational settings, and if so, in what ways do they differ?

According to our analysis, there was not much variation in SDL experiences across both educational settings. Both groups of students reported the same themes and subthemes in all three dimensions, except for the subtheme “Avoiding standing out in a group” of the theme “Group learning culture” in the contextual dimension. This subtheme only emerged from the group of students in Taiwan. A student described that it was one of the cultural norms in education and may impact on her learning in a group:

In East Asian societies, I feel everyone should be the same. We don't want anyone to fall behind but also don't like that someone stands out in a group. This kind of thoughts may become burdensome when you are engaged in a group learning activity. (Case No.21, NTUCM)

While there were many similarities across the two groups, several consistent differences emerged within the same themes in the process and contextual dimensions. In terms of learning resources, students in Taiwan used question-based books but rarely took advantage of the online question banks which students in the U.S. used a lot. As for learning strategies, students in Taiwan described visual learning and flashcards/mnemonics less frequently but reported peer leaching strategies more often. Impression management was more apparent in the U.S group, where every student was aware of the potentially negative effects of subjective evaluation. Overall, HMS students tended to focus more on individual performance and put considerable effort into impression management, whereas NTUCM students were strongly oriented to collaboratively learning with their peers but avoided standing out when learning in a group.

RQ3: How do these findings inform the current models of SDL?

As we analyzed our data, the first 5 steps in SDL reported by students were very much like the steps 2 to 6 in Knowles' linear model. We renamed each step using the students’ terms such as identifying gaps in knowledge. Since most students started a SDL cycle with identifying gaps in knowledge, we made it the first step and followed by others. In Knowles' linear model, climate setting is the first step which refers to creating an atmosphere of mutual respect and support. However, climate setting was not one of the emergent themes in the data. Instead, students described that building the framework in learning was the last step in SDL and helped students start a new SDL cycle. We thus replaced climate setting with building the framework and reshaped the linear model into a circular one. The new six steps of SDL were then added into the process dimension.

In Figure 3, we developed a conceptual model representing students' descriptions of SDL based on the prior models and our analytic results. The inner circle contains the three dimensions of SDL, derived from the "Person, Process, and Context" (PPC) model of SDL. The outer part is the six-step process in SDL adapted from Knowles' definition. The three dimensions of SDL are interrelated with each other, and the six steps constitute a learning cycle in SDL. We outlined the specific components in each dimension and each step.

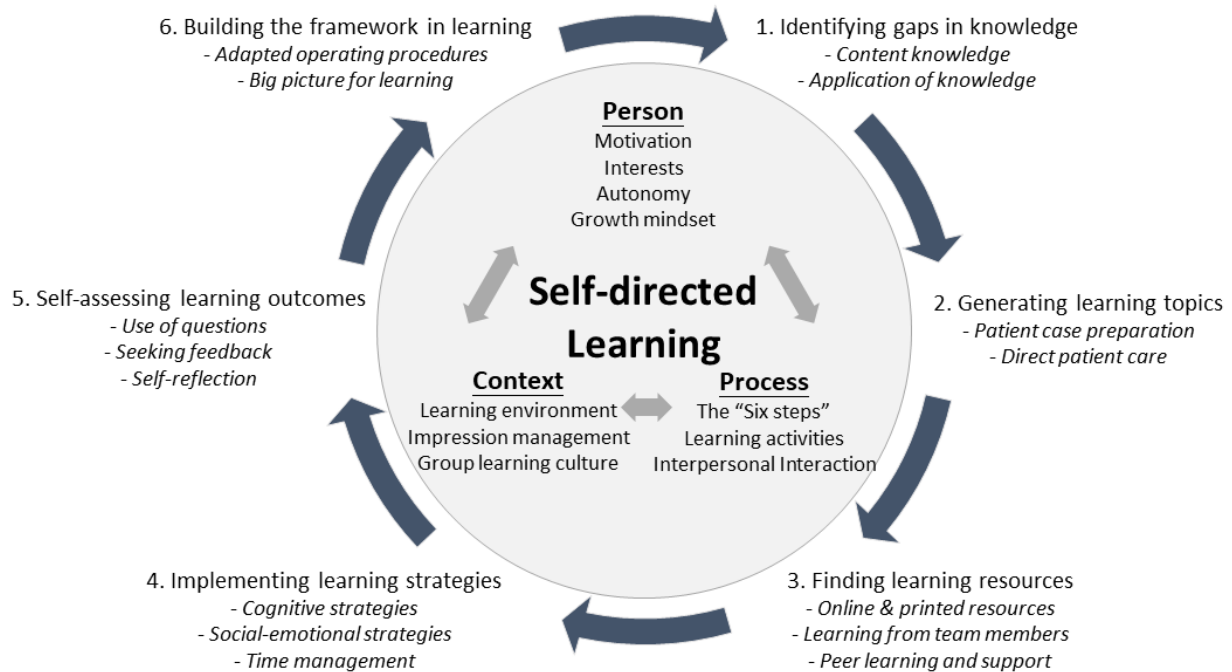


Figure 3. A conceptual model of self-directed learning (SDL)

3. Chapter 3: Discussion and Perspectives

3.1. Discussion

Our study explored medical students' perception of SDL using two well-established theoretical and conceptual models as a foundation to explicate the manifestations of SDL in the clinical setting and to explore its application and relevance in the setting of an Asian medical school. Student descriptions of SDL in both medical schools aligned well with the "Person, Process, Context" model of SDL proposed by Hiemstra and Brockett. Our data added to this work by describing specific themes that had major influences on medical students' SDL in each of the three dimensions. Specifically, we found that motivation, autonomy and the growth mindset were salient in the personal dimension; interpersonal interactions featured prominently in the process dimension; impression management was highlighted in the contextual dimension.

These are themes that we need to work on and improve. This will inform us how to build a better training environment for medical students and foster their SDL.

Our findings in each dimension of SDL have their own implications in clinical education. In the personal dimension, autonomy in learning will facilitate SDL if students have interests in specific fields of training. However, some students reported a lack of autonomy in their core clerkship. A relevant measure is the individualized learning plans (ILP), which had not been used widely in undergraduate medical education. A prior study has shown ILP improved the SDL strategies for senior medical students. [23] The standard learning outcomes can be achieved while the learning process is individualized.

The growth mindset is another theme worth noting in the person dimension., A growth mindset, which Dweck first mentioned in the implicit theories of learning, has strong correlations with students' learning behaviors. [24] Medical students often encounter setbacks in clinical training, while keeping a growth mindset help them rebound and work toward the mastery of knowledge. As stated by our interviewees, the growth mindset can be cultivated, and students more easily become self-directed in learning once they have this mindset. Further growth mindset approaches to promoting SDL should be examined.

In the process dimension, the six steps of SDL identified in our results have great similarity with how Knowles defined SDL. Five out of our six steps are synonyms for diagnosing learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes in Knowles' model. Beyond these five steps, we discovered building a framework in learning is also important in the SDL process and will facilitate knowledge gap identification of a new learning cycle. However, the framework in learning may not be easy for medical students to envision in clerkship, so most of the time, students need guidance from their team members. Besides, the step of climate setting in Knowles' model was not reported by students. Absence of this step may imply that students can not encourage an atmosphere of respect on their own and support from clinical teachers is lacking.

Both groups of students described the same Step 4 of SDL (Implementing learning strategies). We discovered that in cognitive strategies, very few students reported that they learned by intentionally teaching others or writing study guides. This teach-to-learn strategy may be a higher-level strategy in SDL. To self-assess the learning outcome, only a couple of students practiced self-reflection and benefited much from that. Self-reflection may be a higher-level skill in facilitating SDL. For medical students, both teach-to-learn strategy and self-reflection worth developing with faculty assistance.

The examples of the interpersonal interactions (See Appendix D, Note on Interactions) align well with the social-emotional strategies addressed in our Step 4 of SDL. These findings remind us that SDL is about far more than learning on one's own, and it also includes learning from team members and peers. We listed five social-emotional strategies students used in SDL (Table 4). Likewise, the clinical teachers can use these strategies, such as observing students' personality and using specific languages when asking students questions/giving feedback, when they want to promote SDL and learning in general. Building relationships with students is as necessary and important as imparting knowledge to them. Clinical teachers can contribute to the step of climate setting in Knowles' SDL model.

The contextual dimension of SDL has both universal and unique themes and subthemes. As previously mentioned, a learning environment with education orientation, psychological safety, student engagement and less sense of urgency will facilitate SDL. Among these subthemes, psychological safety seems intangible, but in fact, it can be promoted using a tool like CENTRE in a group setting. [25] This tool also helps clinical teachers build relationships with medical students.

In a performance-oriented learning environment like medical schools, the impression management becomes a big issue when students, especially those in the U.S., want to do SDL. Both groups of student interviewees have the pressure of application for residency and want to get a good evaluation in their clinical rotations. In the previous researches, the impression management tactics, like image creation and protection, were noted in both the residency interview and the clerkship. [26,27] In our study, the equivalent tactics, looking good and not seeming disinterested, were being used by medical students every day in their training hospitals and could be exhausting. To mitigate the unnecessary emotional burden of evaluation, a pass-fail system had been helpful for students in the U.S.

We can further examine the group differences to have a better understanding of SDL in both contexts. Although there were more females than males in the group of U.S. students, we did not find any gender differences in terms of codes and themes. A previous study also showed no significant effect of gender on the medical students' SDL scores. [28] As for learning preferences, eleven (73%) of the students in the U.S. and nine (60%) of the students in Taiwan recognized themselves as proactive students. Each group had two students who recognized themselves as reactive, and the rest of the students could be either proactive or reactive depending on the situations. In both groups, those reactive students had similar strategies in SDL as their proactive peers did.

To find learning resources, students in Taiwan put more emphasis on peer learning pertaining to SDL, compared to the students in the U.S. As one study in Australia pointed out, students may do peer learning, either formally or informally, up to 5.2 hours per week. [29]

Students in Taiwan spent more time on informal peer learning and the interviewees stated that if they could receive guidance from the residents or the attendings, they would have more benefits in learning. In clinical rotations, engaging students in peer learning may reduce passivity and maximize their chances of SDL.

In the group of students in the U.S., four (27%) of them were second generation Taiwanese or Chinese, whose parents might educate them with Confucianism. However, their responses did not differ from their American classmates. In the group of students in Taiwan, some students discussed their avoiding standing out in the group learning culture, which is a norm of Confucian Relationalism and may sometimes contradict their intention to learn better. Taiwanese medical students' focus on social relationships rather than individualism was also reported in the study of Ho et al. [30] This seems to be one of the cultural dissonance examples when an East Asian educational culture meets the Western standards. [30,31]

Hierarchy is highly emphasized in Confucianism. Surprisingly, the students in Taiwan had fewer concerns about hierarchy in their clinical training, while the students in the U.S. were more aware of the existence of hierarchy, especially in the surgical departments, and its possible negative influences on SDL. This might be explained by the fact that clinical teachers were dedicated to building a student-friendly learning environment at NTUCM. An illustrative instance was that a student was assigned to a general surgeon who would keep close contact with and inform the student every time when there is a learning opportunity. The close relationship between students and clinical teachers may lower the impact of hierarchy.

Our cross-cultural study reinvented Knowles' SDL linear model and enriched the PPC model of SDL proposed by Hiemstra and Brockett. We delineated the new six major steps of SDL and the essential themes in each dimension of SDL in the contexts of both the U.S. and Taiwan. Medical students can use cognitive, social-emotional, and peer learning strategies to enhance their SDL. They characterized the learning environments that fostered SDL as those in which faculty and residents demonstrated an educational orientation, promoted psychological safety, invited student engagement and reduced the sense of urgency.

The study also revealed that during the core clerkship, students in the U.S. focus more on individual performance and put effort into impression management, while students in Taiwan tend to learn more collaboratively, share resources with and support their peers. For specific contextual considerations, lowering the anxiety caused by evaluation and encouraging peer learning may promote SDL in the U.S. As for medical schools in Taiwan, moderating students in group learning will help facilitate SDL. Our study paves the way for improving medical students' SDL and making them lifelong learners in the field of medicine.

3.2. Future Research

Comparing student perspectives of SDL in different educational culture settings yields new insights into the Western model of SDL and enables schools in East Asian countries to formulate contextually and culturally appropriate adaptations. Based on the specific themes of SDL we identified, further studies should be focused on how interventions pertaining to these themes are implemented and we can examine what benefits in SDL they may bring. A qualitative assessment of SDL can also be developed using our conceptual model. We can combine the qualitative assessment with the existing scales of SDL to either predict medical students' learning outcomes or give students extra guidance if needed.

3.3 Limitations

This study has some limitations. Although this was a cross-cultural study, we had a single institution in each country. The two institutions were one of the top medical schools in their own country. These may limit the generalizability to other institutions. The two institutions were not totally comparable in many aspects although both fulfilled the similar accreditation standards. Besides, we recruited students and took their perspectives only, while the faculty and the team members may provide some other thoughts. In our findings, SDL may vary across specialties and levels of training. However, we focused on students who had the first year of clerkship and did not specify the specialties. Lastly, there was no intervention or intended outcomes in this study. We built the conceptual model and need further studies to make any causal inference.

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Appendices

Appendix A: Interview Guide

(Self-directed learning in clinical training, for medical students)

Today we are interested in learning about the clinical learning experience from you. We would like to know the general approach to learning adopted by yourself, namely the self-directed learning. Thank you for your willingness to share your experiences and thoughts with me today. We will keep the whole interview in confidentiality. What you say will be recorded and used only by the research team members. None of the faculty at HMS or your clerkship director will know about the interview. Please feel free to talk here.

Before we start, do you have any questions about the interview?

1. Please describe for me how you learn an unfamiliar case by yourself recently.

- How do you think about your learning?

(Purpose: Students have more opportunities to learn in a self-directed fashion when handling an unfamiliar case. This warm-up question helps interviewees recall the clinical situations and answer the rest of the questions more smoothly.)

2. Can you describe for me a time during your clerkship when you felt you were learning well by yourself?

- What contributed the most?

- Any other strategies in self-learning?

(Purpose: This question aims for the facilitating factors of SDL. Interviewees may also talk about their specific SDL strategies.)

3. Has there been a time when you felt that it was difficult for you to learn the necessary clinical skills by yourself? When was that?

- What would have helped you at that time?

(Purpose: This question aims for the inhibiting factors of SDL. Asking what would have helped them will inform our understanding of the facilitating factors of SDL and the measures that promote SDL.)

4. Do you prefer to take the initiative in learning if you encounter a new case? Or do you prefer to wait and see? Tell me about it.

(Purpose: In this question, we would like to know the personal dimension of SDL. When the interviewees answer their learning preferences, they may also share in what kind of a situation they behave that way, which will show how the dimensions of person, process, and context are interrelated.)

5. Here is an example of a self-assessment in self-directed learning. A student was on her internal medicine rotation. She felt a lack of knowledge of some common diseases and used the web-based database for learning. The database also provided MCQs for students to assess their own understandings of every topic. She took the MCQs and was correct on almost all the questions. Therefore, she had a sense that she learned well about those topics.

- How did you get an assessment on your self-learning?
- Can you give me a good example of an assessment? / How about a bad one?
- How did you feel about interacting with those who assessed you?

6. Here is an example of feedback in self-directed learning. A student took care of a patient with urinary tract infection. He was eager to know the empiric antibiotic and its adequate dosage. He looked up the guide to antimicrobial therapy, chose one kind of antibiotics and calculated the dose. He then asked the attending physician to see whether the treatment was appropriate. The attending physician thought he picked the right antibiotic, but the dose was not enough for that patient. The attending physician thus corrected the dosage and taught the student how to adjust the dose according to the patient's body weight.

- How did you get feedback on your self-learning?
- Can you give me a good example of feedback? / How about a bad one?
- How did you feel about interacting with those who gave feedback to you?

7. Here is an example of supervision in self-directed learning. A student was interested in intravenous catheter insertion. She watched the demonstration video online many times and bore in mind all the steps. She then came to a senior resident in the ward and asked for a chance to perform the intravenous catheter insertion on a patient. The senior resident agreed to supervise her, and she successfully completed the procedure.

- Have you been supervised when you learn a clinical skill by yourself?
- Can you give me a good example of supervision? / How about a bad one?
- How did you feel about interacting with those who supervised you?

(Purpose: Assessment, feedback, and supervision are the three common approaches in clinical learning. We used vignettes in questions 5-7 such that interviewees can easily understand what the specific terms mean and how they can relate to SDL. A set of probing questions will be asked to understand fully how students utilize each approach. We will also gain information about how person, process, and context are interrelated in SDL.)

8. Please share with me your own definition of self-directed learning.

(Purpose: This is one of the core questions in my study. After the interviewees go through all the questions related to SDL, they will be able to have a clear idea about what SDL is.)

9. Do you have in mind any specific measure that can promote self-directed learning in core clerkship?

(Purpose: This question encourages the interviewees to think outside the box. They will address not only the measures but also the factors which they think may foster SDL.)

Finally, is there any other thing you want to tell me about your clinical learning experience?

Appendix B: Phases of Framework Method

Phases of Framework Method	Description of Implementation
Phase 0: Interviewing & Transcribing	The researcher (THL) conducted all the interviews face-to-face with quality audio recording, made the field notes, and proofread the transcripts verbatim. Digital files were uploaded to commercial software.
Phase 1: Familiarizing with the data	All research team members independently familiarized themselves with two to four transcripts and made notes in the margin about their thoughts and wrote memos.
Phase 2: Generating initial codes/themes	Team members met weekly, read transcripts line-by-line together, discussed comments, potential codes, and the importance of topics.
Phase 3: Developing an analytic framework	After coding several transcripts, team members met and compared their open codes and agreed on a set of codes to apply to subsequent transcripts.
Phase 4: Applying the analytic framework	Pairs of researchers (THL and AS; THL and KKL) coded transcripts and discussed and reached consensus on codes. Software and spreadsheet were used to assist with analysis.
Phase 5: Reviewing codes/themes	The research team examined, defined, and categorized all the codes. Some codes were combined or split for clarifications. Themes were developed from the renewed codes.
Phase 6: Charting data into a matrix	All transcripts were reviewed and re-coded. A case chart was created to reduce data and retain meaning from each interviewee.
Phase 7: Building the conceptual framework	The research team revisited and cross-checked the themes, provided deeper thoughts of codes, and drew preliminary diagrams to depict relationships among the codes.
Phase 8: Producing the report	The research team discussed themes of interest in-depth, wrote thick descriptions of context, and found illustrative quotes. A diagram was developed to capture meanings of the themes thoroughly.

Appendix C: Trustworthiness of Analysis

Criteria of Trustworthiness	Means of Establishing Trustworthiness
Credibility	<ol style="list-style-type: none"> 1. Prolonged engagement: in-depth interviews of a sufficiently large, representative sample 2. Researcher triangulation: experienced researchers from different institutes and cultural backgrounds; cross-checking the other team members' coded transcripts 3. Inter-rater reliability checks in paired coding teams: almost perfect Cohen's kappa (0.82 and 0.85) 4. Peer debriefing on codes and themes with other medical education experts who did SDL studies 5. Member checking: illustrative quotes with interpretation sent to interviewees for their comments
Transferability	<ol style="list-style-type: none"> 1. Thick descriptions of interviewees and contexts 2. Using direct quotes from interviews and specify the differences in themes between two institutions
Dependability	<ol style="list-style-type: none"> 1. Phases of Framework Method (See Appendix B) 2. Audit trails: records of raw data, field notes, transcripts, and analytic memos
Confirmability	<ol style="list-style-type: none"> 1. Extensive audit trails: records of raw data, field notes, transcripts, and analytic memos, plus the project proposal, IRB applications and documents, interview guide, codebook, analytic framework, case chart, and manuscript draft. 2. Explaining the reasons for theoretical, methodological, and analytical choices throughout the entire study 3. See means to ensure the other criteria of trustworthiness

Appendix D: Case Chart

Case	Definition of SDL	SDL Evidence	Main Emphasis	Major factors related to SDL		Note on Interactions
				Facilitating	Inhibiting	
No. 1 HMS Female Tai/Chinese Old curriculum Non-CHA	SDL is most useful when students know what they don't know. Students need to determine what and how to study.	She was respectful of other people's time but often took the opportunity to ask an extra question. The question could be specific for feedback.	The attendings who are good at giving an overview and help students layer on details to the framework are the ones students easily do SDL with.	Building the framework in learning, Big picture for learning, Social emotional strategies, Interaction with preceptors	Sense of urgency in a learning environment	Being able to read people is her strategy to ask questions. Also, if the attending knew her long enough, she would ask when having questions in mind.
No. 2 HMS Male Non-Tai/Chinese New curriculum Non-CHA	When there is a topic that students are independently curious about, they dedicate their time to research, often with the goal of sharing in the hospital the key points they found.	He spent a lot of time on question banks and used it as a self-assessment tool. He also built his own database for all the medical knowledge he had learned.	When students work with someone that is not evaluating them, they can feel vulnerable and learn. Educators should find a balance between assessing students and allowing them to make mistakes.	Preparing for shelf/board exams, Cognitive strategies, learning from peers: word of mouth, motivation in patient care	Impression management: being constantly evaluated and looking good, competing with peers	Sometimes students are paired with another student. It heightens everything and can be very stressful because attendings can't help but compare one student to the other.
No. 3 HMS Female Non-Tai/Chinese New curriculum Non-CHA	SDL requires proactive learning from others. It is thinking about gaps in either knowledge or skillsets and then seeking out ways to address those gaps.	She kept a list of unasked questions on rounds and looked it up when she had time. She also quizzed herself on things she wanted to learn well.	When the hierarchy is pronounced (e.g. in OR), it is difficult to ask the attendings questions. If the residents/attendings are open to teaching, there will be less of a barrier to learning.	Education orientation in learning environment, Cognitive strategies, Preparing for shelf/board exams	Impression management: being constantly evaluated, Hierarchy in workplace, Sense of urgency in a learning environment	Asking for feedback is a sign of a good learner; however, students thought it might be annoying and could negatively impact evaluations.
No. 4 HMS Male Non-Tai/Chinese	For SDL, the systemic framework of learning is something that needs	He believed more of the learning would come from himself. He looked deeply	Patients come with symptoms, not diagnoses. The attendings should	Building the framework in learning, Responsibility for	Impression management: looking good	He got more informal feedback from interns, because they were closer in age,

New curriculum Non-CHA	to be designed, relevant for trainees about what they will see in practice.	into patients' chart, review all the notes, and tried to piece things together with resources he had.	teach students in a way that they are actually going to do for the patients.	own learning, Motivation in anticipating future work as doctors		just in his shoes, and easier to connect with and ask dumb questions.
No. 5 HMS Female Non-Tai/Chinese New curriculum Non-CHA	SDL is trying to find resources when it seems there are none, gathering folks together, talking with people, and then researching on your own.	She tried to be a helpful contribution to the team by looking up the arising questions on rounds and getting back to the team the next day with a short teaching talk.	When pressure and stakes are high in the environment, students are less likely to speak up, show their own vulnerability or lack of knowledge, and ask questions uninhibitedly.	Collaborative learning and education orientation in learning environment, Generating learning topics, Teach to learn, Motivation in patient care	Sensitivity to how they are perceived	When students join a new team, the first things they assess are like "Who is the right person to ask questions? What and where to ask?" This social recognition helps students find the go-to people.
No. 6 HMS Female Non-Tai/Chinese New curriculum Non-CHA	In SDL, students first realize their gaps in knowledge and recognize what they need to learn. Second, students know what resources they can go to. Lastly, students take the initiative and fill in those gaps.	She looked up and went in depth on some topics related to her own patients. She also dug in what social concerns the patients had, such as post-discharge care.	The evaluation does help but after time, students get tired of it. It takes so much the joy out of doing what students are doing because they constantly feel they have to perform. It also adds to general fatigue and burnout.	Collaborative learning and student engagement in learning environment, Motivation in patient care	Impression management: looking good	Not only one measure allows for SDL, but some work better than others. Things that engage students less are less helpful. Things are more helpful when they engage more.
No. 7 HMS Female Non-Tai/Chinese New curriculum Non-CHA	SDL is a process that students intentionally seek out learning opportunities, evaluate things they don't understand, look for ways to get interactively stepwise better.	She always tried to think of three diagnoses in her case: the most likely one, the one she can't miss, and one that she needs to read and figure out.	To promote SDL, students should be encouraged to look for opportunities outside the formal ones, hold up their student cards and ask questions about what they don't know.	Cognitive strategies, Learning from peers: peer teaching, Motivation in patient care	Sense of urgency in a learning environment	She had attendings, either busy or not interested in teaching, who had rounds really quickly. She could only turn to her residents and ask questions.
No. 8 HMS Male Non-Tai/Chinese	SDL is identifying a deficit in knowledge and then finding the appropriate resources	He took advantage of the online video platform to boost his learning. He was not	On rounds, an attending asked everyone to take an aspect of a rare case	Psychological safety in learning environment, Social emotional	Hierarchy in workplace, Sense of urgency in a learning	If attendings have very little interaction with students or don't establish a good

New curriculum Non-CHA	and the best (or the most efficient) way to learn what students need to learn.	fearful of asking questions, and he always asked himself whether he could easily look it up before he asked his team members.	and teach each other briefly. It took the hierarchy away because everyone knew they needed to keep learning.	strategies	environment	rapport, students feel more fearful when being asked questions and not comfortable to ask questions.
No. 9 HMS Male Tai/Chinese New curriculum Non-CHA	Students have the ability to see a new problem that they've never seen before and know what resources to go to, how to ask for help, and how to translate what they learn to patient care.	He read textbooks one month before each rotation and review articles on 3 or 4 specific topics every day. He also used flashcards very often to solidify his memory.	For novice students, pretending to know what they didn't know is stressful and not helpful. Students should realize that asking a lot of questions actually doesn't harm them in any way.	Cognitive strategies, Psychological safety in learning environment, Social emotional strategies, Building the framework in learning	Impression management: looking good	He did not like being assessed when he barely got to know a team. The team member didn't really know much about him and gave an assessment based on first impression and not representative.
No. 10 HMS Female Non-Tai/Chinese Old curriculum Non-CHA	Students are responsible for determining what gaps in knowledge are and figuring out the ways to best fill those gaps, whether by books, questions, or talking to people.	She was good at identifying her own gaps and wrote down a lot of questions that she needed to ask or look up. She also relied on question banks to learn efficiently.	She was more comfortable talking with attendings who didn't seem to evaluate her, asking them questions, and trying to get a better understanding of things.	Time management: efficiency in learning, Cognitive strategies, Education orientation in learning environment	Competing with peers	She felt there was a fair amount of competition on the wards. Peers didn't talk much about their learning difficulties and strategies even when they probably should have.
No. 11 HMS Female Non-Tai/Chinese New curriculum Non-CHA	When students have a piece of knowledge that they are lacking or a question that they don't know the answer to, they find an answer using their own devices.	She used question banks to attain knowledge of the classic way that diseases present. For ambiguous cases, she looked up the online summaries and ran her plan by residents.	It is so easy for students to get very concerned about performance and not ask fundamental questions. If they ask, they would learn a lot more.	Psychological safety in learning environment	Impression management: looking good	Performance-oriented teams are more formal but have no emphasis beyond being right; while learning-oriented teams are usually smaller in size, more informal, and safer to ask casual questions.
No. 12 HMS Female Non-Tai/Chinese	One large part of SDL is being able to identify students' own weakness and	She picked one or two resources which she could learn more from and didn't go	It is very hard for brand-new students to identify important things. The role of	Navigating the student's learning, Time management: efficiency in	Impression management: looking good	Some of the learning gets lost when students want to show they are part of

New curriculum Non-CHA	trying to reinforce those.; another part of SDL is just following students' own interests.	overboard. She also picked one thing to read about every day and went through the basics which a novice must know.	instructors is to help guide students to choose topics that are developmentally appropriate for them.	learning		the team and willing to work hard. They end up developing the administrative skillsets and being an assistant to residents.
No. 13 HMS Female Tai/Chinese New curriculum Non-CHA	SDL is a lot about students' own interests and motivation to learn. Students find their own resources, understand and interpret them in a way that is applicable to the patients.	She developed a systematic approach so that she could look through charts and labs. She also talked to her peers about specific questions and used flashcards for self-assessment.	Students have ownership by knowing the patients the best out of the team. They are able to teach the team what they learned for a case where no one knew what it is.	Motivation in patient care, Building the framework in learning, Communication with team, Learning from peers: peer teaching	Impression management: being constantly evaluated	The biggest barrier to learning is figuring out what attendings want. It is all about how students get along with people higher above. It is also difficult to figure out the expectations in different teams.
No. 14 HMS Female Tai/Chinese Old curriculum Non-CHA	Students are able to identify their own goals and objectives for a rotation or a general clinical year and use their own resources to achieve those goals.	She wrote down what she did every day and tracked all the patients that she had seen. She had a mission statement for her clinical year, set tangible goals, and reflected on her goals periodically.	Residents should always let students know what they are doing and provide opportunities to see more. Attendings should acknowledge that students are there and direct things at them.	Education orientation in learning environment, Preparing for shelf/board exams, Growth mindset, Self-reflection	Impression management: being constantly evaluated	A lot of evaluation in medicine is based on behavioral interaction with the team and patients. It takes a bit of time to develop rapport. Once students feel comfortable, they are able to show more.
No. 15 HMS Female Non-Tai/Chinese New curriculum CHA	SDL refers to learning the most from the patients to improve their care and also ensuring that students learn thoroughly the fundamental aspects of their phase.	She tried to see as many patients as she could and worked with the attendings to get real-time feedback in clinics. She used question banks for self-exams and small reference books for clinic visits.	In the longitudinal integrated clerkship, students have multiple preceptors across the board. They are all invested in students' learning and create a kind of feeling of community support.	Interaction with preceptors, Collaborative learning and education orientation in learning environment	Impression management: Not seem disinterested	In traditional blocks, there was potentially long hours where there is no active role for students. Students may feel anxious to study because they want to look engaging in clinical care.
No. 16 NTUCM Male	Students have the autonomy in learning rather than being	He always asked the residents for supervision before he	Supervised training with feedback is an essential step for med	Student engagement in learning	Sense of urgency in a learning environment	The preceptor in surgery kept the student informed of

New curriculum	regulated by attendings.	went to see a patient. He also asked the surgeons a lot of questions at OR.	students to acquire clinical skills.	environment, Learning from peers: shared resources		the changing schedule, so the student can maximize his learning chances with the preceptor.
No. 17 NTUCM Female New curriculum	Students are able to learn the cases through data collection and actively seek feedback from the seniors.	She wanted to perform an ECG on a patient and was not familiar with the procedure. She invited a partner, and they figured out how to do an ECG and interpret it together.	Sometimes the residents may be too busy, so they neglect the students. The students would be aware of the situation and become less willing to ask questions.	Patient case preparation, Learning from peers: peer teaching, Collaborative learning in learning environment	Sense of urgency in a learning environment	The chief resident at AIR department prepared students well in doing patient care, trusted the students, and created their ownership.
No. 18 NTUCM Male New curriculum	Students need to identify the learning topics from their cases and study these specific topics in a timely fashion.	He used OneNote to keep most pieces of knowledge he learned in clinics and was able to retrieve them when needed.	One of the motivations of SDL comes from the anticipation to be a future doctor with its social responsibility.	Building the framework in learning, Generate learning topics, Social emotional strategies	Competition with peers, Psychological unsafety in learning environment	Students feel easy to learn from colleagues who are close to them in training years. The learning experience would be even better if the student knew someone already.
No. 19 NTUCM Female New curriculum	Students can always find something they do not know and learn more as they seek more feedback from others.	She favored asking her peers questions first and sharing learning resources with each other. She felt comfortable to ask seniors questions one-on-one.	In some rotations, students had fewer interactions with attendings/residents. Students could hardly learn well when they were not fully engaged.	Generate learning topics, Learning from peers: peer teaching	Time management: Imbalance between work and life	The chief residents at internal med dept. arranged lectures or training sessions tailored to the students' needs and created better learning outcomes.
No. 20 NTUCM Female New curriculum	Students develop the skills that they can search for a topic, read the materials, ask questions, discuss plans with seniors, and do patient care just in time.	She tested herself by making differential diagnoses and treatment plans ahead of being told the answers. Self-assessment increased her confidence in patient care.	The attendings give students precious feedback on how clinical knowledge is connected to practice which students may not be able to learn by reading texts.	Cognitive strategies, Education orientation in learning environment, Learning from peers: shared resources	Sense of urgency in a learning environment	As the student knew the chief resident at OR better, she sought more feedback from him. Whereas, she rarely asked her assigned resident because he was not interested in

						teaching.
No. 21 NTUCM Female Old curriculum	SDL happens most when students interact with the seniors. Students observe the personalities of seniors before asking them questions.	She had great skills in interacting with the people and seeking feedback. She often showed curiosity and engaged attendings to share more about what they knew.	During rounds, students will learn better if they are engaged, encouraged to ask questions, and given time for individual feedback.	Student engagement in learning environment, Situational awareness	Avoiding standing out in a group	The learning culture is that students expect themselves to be equally good, not lagged behind in a group and don't feel comfortable when one is outstanding from others.
No. 22 NTUCM Female New curriculum	Students learn self-directedly by reading and asking seniors questions. They are motivated by patient care and want to make sure everything is on the right track.	She previewed the course materials before a rotation started. She also managed her time well and joined other teams to learn different cases.	There are often differences between guidelines and ward routines. It is necessary for med students to find these differences and ask questions with an intention to learn.	Education orientation in learning environment, Navigating the student's learning, Seeking other learning opportunities	Challenge due to the gap between reading and actual patient care	There is some blank time in rotations. Students can get the information from their peers/seniors and join additional learning activities, like informal lectures on a special topic.
No. 23 NTUCM Male New curriculum	Students can find learning resources related to the topics introduced by seniors. They follow up on the topics and learn by discussing with seniors.	He practiced making the diagnosis of cases with peers whenever they were free at wards. He also built sonography exam skills with peers and sought feedback from residents.	Attendings/residents who view teaching as their own job would spend more time discussing with students and are more welcomed by students.	Education orientation in learning environment, Learning from peers: peer teaching, Seeking other learning opportunities	Sensitivity to how they are perceived	Students are less willing to ask seniors questions because they don't want to bother anyone. Letting students know the hospital is education-oriented will be helpful.
No. 24 NTUCM Male New curriculum	Students read the cases in depth and find whatever they don't know. They then ask seniors about it and learn accordingly.	He did researches on patient care issues and was able to answer the questions of attendings and give comments on management plans.	Timing is important. Students have to grasp the chance to talk with attendings on rounds and find the appropriate time to receive instruction from residents.	Time management: efficiency in learning, Situational awareness, Motivation in patient care	Sense of urgency in a learning environment	Students may try to ask for more learning opportunities from team members. However, if people show reluctance, students will avoid learning from them.
No. 25 NTUCM Male	Students observe their role models (e.g. residents) and find out competency	He made notes with illustration on clinical pearls he learned. He assessed	Students have preferences in their own learning and future practice.	Cognitive strategies, Motivation in patient care,	Challenge due to the gap between reading and actual patient care	Students grow their knowledge and skills in order to make some contributions to

New curriculum	they don't have. They learn from the role models to achieve the competency.	his clinical judgment by constantly seeking feedback from attendings/residents.	Allowing some autonomy in course arrangement will facilitate the students' SDL.	Autonomy in learning		the patients or the team. This has little to do with the evaluation.
No. 26 NTUCM Female New curriculum	Students identify unfamiliar topics, read the materials, and go back to the case. In this process, students ask seniors questions and learn how to handle cases.	She previewed the common diseases before each rotation, shared with seniors what she had known about cases, and quizzed herself on diagnostic and management plans.	Students can learn collectively in groups and inform each other of what to learn. However, the group may have negative effects on individuals if it is less learning-directed.	Learning from peers: words of mouth and peer teaching, Education orientation in learning environment	Challenge due to the gap between reading and actual patient care, Sense of urgency in a learning environment, Avoiding standing out in a group	She often joined the seminars she had interests in. She connected with those speakers, who may be instructors in her rotations, so she could have a better learning experience.
No. 27 NTUCM Male New curriculum	Students need to develop their own framework in learning and continue the accumulation of clinical knowledge either by reading or discussing with residents/attendings.	He asked good, thought-provoking questions by doing research on related topics. He also actively sought feedback from seniors on his clinical reasoning.	A few students want to perform well (not learn well) and make good impressions. Most students can have good evaluation as long as they invest time in learning, so it is better to focus on learning itself.	Motivation in patient care, Interaction with preceptors	Impression management: looking good	Students have a sense of achievement in clinical learning when they contribute to patient care and get persistent, positive feedback from experienced seniors.
No. 28 NTUCM Male New curriculum	Students build their own standard operating procedure of patient care and keep refining it based on the clinical experiences and feedback.	He made electronic notes for each specialty in a comprehensive way. He also integrated learning objectives into his notes so that he can track his progress in learning.	Students seek more feedback from people whom they feel safe to talk with. These people can be peers or seniors that students know quite well and won't be too judgmental.	Building the framework in learning, Cognitive strategies, Psychological safety in learning environment	Avoiding standing out in a group	He intentionally sat at the station near residents all the time to have more first-hand experiences, while the student norm is staying in a room doing their own studies.
No. 29 NTUCM Female New curriculum	Students grasp every opportunity to ask seniors questions and seek feedback from them. This can be motivated by caring	With an aim to be a competent doctor in the future, she critically thought about how each patient should be	Some students may be concerned with their evaluation, but the best mindset in learning is focusing on growth rather than	Motivation in patient care and anticipating future work as doctors, Student engagement in	Impression management: looking good	She reflected on situations that she asked questions in a way that might challenge and offend attendings/residents.

	the real patients.	managed and sought feedback from experienced seniors.	grade. Students get more relaxed and learn more if they have that mindset.	learning environment, Communication with team, Growth mindset		She then tried to be tactful when talking to team members.
No. 30 NTUCM Female New curriculum	Students develop and set their learning goals in each rotation by reading ward instructions or asking seniors. They then do adequate readings and seek feedback to attain these goals.	She improved her physical exam skills through peer supervision and feedback. She also gained a lot of information from peers and better prepared herself in each rotation.	Knowing that the attendings/residents are welcoming questions is helpful to students' learning. Protected time for questions/feedback, which need not be long, ensures the learning outcomes.	Learning from peers: peer teaching, Education orientation in learning environment, Navigating the student's learning	Sense of urgency in a learning environment	She was at first afraid of being with the patients. However, as the attendings included her as a team member in decision making, she had the ownership of patient care and was more engaged.