SimRound, A novel approach to transitions of Junior Medical Students into Clinical Clerkships: Rationale, Development and Lessons Learnt

Jonathan Jia Jun Wong[1], Ranjana Archarya[2], Kwang How Mok[2], Kum Ying Tham[2], Endean Tan[2], Jennifer Ting[2], Wee Shiong Lim[2]

Corresponding author: Dr Jonathan Jia Jun Wong jonathan.wong@mohh.com.sg
Institution: 1. National Healthcare Group, 2. Tan Tock Seng Hospital
Categories: Educational Theory, Students/Trainees, Clinical Skills, Simulation and Virtual Reality, Undergraduate/Graduate

Received: 10/08/2018
Published: 21/08/2018

Abstract

Introduction
Junior students making the transition from pre-clinical to clinical years often struggle to integrate into ward teams during ward-round activities. The SimRound is a novel approach to facilitate embedding of junior medical students into incumbent ward teams through simulation rounds specially designed to replicate actual ward-round proceedings. Using the situated learning and cognitive load theories, this study aims to describe the rationale, processes and lessons learnt from our experience in developing the SimRound.

Methods
Third-year students undergo two SimRound sessions at weeks two and six during the eight-week General Medicine clerkship. There are four phases in each SimRound: Prioritisation and triage; pre-round; consultant round; and evaluation and feedback. Using framework analysis, we compared open-ended survey data from pre-SimRound and SimRound cohorts to develop descriptive and explanatory accounts of identified themes.

Results
Despite the benefits to learning from being embedded in the ward team, students reported challenges to learning arising from engagement and team identity; increased intrinsic load; and increased extraneous load. SimRound addresses this by enabling deliberate learning in a controlled and authentic setting with inter-professional participation. The reduction of cognitive load enabled students to assimilate the necessary knowledge and skills.

Conclusion
In conclusion, SimRound complements embedding and facilitates the integration of junior students into the community of practice of incumbent ward teams.

Keywords: Transitions; Simulation; Embedding; Cognitive Load Theory; Situated Learning Theory

Introduction

The transition between the pre-clinical and clinical phases is typically regarded as a daunting and stressful period for medical students. (Moss and McManus, 1992; Morrison and Moffat, 2001; Radcliffe and Lester, 2003) This transition has been described as being "at the precipice", whereby students look to experiences in their pre-clinical years to navigate the transition, yet look forward with anticipation to this watershed moment in their journey to become a physician. (Soo et al., 2016) This transition is also compounded by stress due to increased working hours and work load, as well as uncertainty about expectations of how students should function and behave in the ward. (Godefrooij, Diemers and Scherpbier, 2010) It is this stress and uncertainty that may hinder students in their learning, resulting in frustration at the inability to apply their knowledge to solve clinical problems in practice. (Pekrun et al., 2002; McConnell and Eva, 2012) Boshuizen described this experience as the "shock of practice", resulting in a temporary decrease in the ability to apply biomedical knowledge in clinical reasoning. (Boshuizen, 1996)

In clinical years, the ward round is often the primary activity around which student learning and socialization into the ward team are organized. The ward round is a complex clinical process during which patient-oriented tasks often compete with the training of students and trainees for the attending's attention. The result is that training is often given very little time during the ward round. (Stanley, 1998; Walton and Steinert, 2010) In addition, prior attempts to facilitate students' transition into the clinical phase are generic and not targeted specifically to enable students to learn during the ward round. Unsurprisingly, notwithstanding dedicated initiatives such as pre-clinical patient contact, problem-based learning and skills workshops, students continue to feel ill-equipped for this transition into the ward team, often in terms of professional socialisation, and to a lesser degree, clinical knowledge. (Prince et al., 2005; Godefrooij, Diemers and Scherpbier, 2010; Dube et al., 2015; Atherley et al., 2016)

The advent of simulation training has allowed unprecedented opportunities for the adoption of new approaches to bridge the transition between pre-clinical and clinical phases. In their review of simulation-based medical education research, McGaghie et. al. identified usefulness of simulation in the transfer to practice and curriculum integration. a (McGaghie et. al., 2010) Rogers et. al. showed that extended multi-method simulation is useful in clinical skills, in particular clinical reasoning and knowledge acquisition. (Rogers et. al., 2014) The use of simulated patients (SPs) in learning clinical skills with effective facilitation has also been shown to be effective. (Cheong et. al., 2015; McLean et al., 2015) Recently, novel simulation interventions centred around the ward round activity have been described. Thomas et. al. reported that simulated ward rounds with targeted feedback helped students manage ward-based distractions better and improved patient safety behaviour. (Thomas et. al., 2015)

This provided the impetus for our current study into the SimRound, a novel approach to facilitate the embedding of junior medical students into ward teams through simulation rounds specially designed to replicate actual ward rounds. In the conceptualization of SimRound, we were guided by pedagogical insights afforded by two learning theories, namely Cognitive Load Theory (CLT) and Situated Learning Theory (SLT).

Cognitive Load Theory

The CLT was proposed by John Sweller in 1988 (van Merrienboer and Sweller, 2010) and states that the human
The cognitive system has a limited working memory that can only hold $7 \pm 2$ pieces of information. This information can only be held on to for about 20 seconds, before it needs to be refreshed through rehearsal (Young et al., 2014). This applies only to novel information. Working memory may be affected by:

1. The intrinsic load: The load associated with the task, which increases with an increase in the number of information elements as well as with increased element interactivity.
2. The extraneous load: The load not essential to the task, which can be increased if there are distractions in the learning process or if information is distributed in space or time, making it necessary to divert working memory to other tasks that are not essential for learning.
3. The germane load: The load imposed as the learner refines existing schemata to enhance storage in long term memory, which is regulated by the individual.

CLT has been proposed as a framework which can be applied to curricular design and delivery in medical education, to reduce extraneous cognitive load, optimise the intrinsic load, and facilitate the germane load (Leppink and van den Heuvel, 2015; Young and Sewell, 2015).

Situated Learning

Proposed by Lave and Wenger, Situated Learning Theory (Lave and Wenger, 1991) suggests that learning occurs through the learners’ participation in the context of community activities. Learners transform their roles, understanding and responsibilities as they practice. The CoP, therefore, is where learners practice their art through a process of legitimate peripheral participation (LPP). LPP involves the learner observing and performing less vital tasks in the community, and as they progress in knowledge and experience, they take on more responsibility in the community and eventually become a part of it. These tasks that the learner performs must be authentic, and must contribute in some way to the community (Wenger, 2000).

Study Aim

At the National University of Singapore’s Yong Loo Lin School of Medicine (YLLSoM), embedding of students within functioning healthcare teams in the major public hospitals throughout Singapore was introduced as part of recent reforms to the undergraduate medical curriculum to improve clinical training for medical students (Jacobs and Samarasekera, 2012). In response, Tan Tock Seng Hospital developed initiatives such as the medical student case sheet and the SimRound to facilitate embedding of third-year medical students into ward teams during the General Medicine clerkship. In this study, we seek to explore the rationale, processes and lessons learnt from our experience in developing the SimRound, with particular focus on the leading role played by the situated learning and cognitive load theories.

Methods

Setting and Participants

The YLLSoM offers a five-year undergraduate medical program in which the first two years focus on the basic medical sciences, interspersed with clinical exposure to underscore the clinical relevance of the basic sciences, followed by three years of intensive clinical placements at public hospitals and clinics (Koh et al., 2015). To maximize opportunities for practice during the clinical years, medical students are distributed for clinical training at a variety of sites across the country. In 2009, YLLSoM introduced embedding as a means of integrating medical students into functioning healthcare teams. A “local” approach was adopted in its implementation, whereby each hospital was given the liberty to define the specific operational details of the principles of embedding, namely: embedding is safe for students and patients; students participate with independent thought and commitment, adding value to the team; and timely meaningful feedback is given (Jacobs and Samarasekera, 2012). Clinical clerkships,
especially in the senior years, were revamped as student intern rotations to shift students from the prior passive learning role into active contributing members of the healthcare team, thereby maximizing opportunities for practice and socialisation.

Tan Tock Seng Hospital (TTSH) is a large 1300-bed public hospital that serves as a major teaching hospital for various medical schools, including the YLLSoM. The department of General Medicine co-ordinates the clinical clerkships in internal medicine for rotating third and final-year students from YLLSoM. It was noted that whilst senior students have acquired sufficient clinical and functional experience to participate meaningfully as student interns, third-year students making the transition from pre-clinical to clinical years often struggled to integrate into ward teams. Thus, the department of General Medicine at TTSH introduced several programs to help junior medical students in their transition into ward-based teams during the clinical years. For this study, we evaluated the initial embedding cohort in academic year 2010-2011 (n=35), as well as the SimRound cohort in academic year 2013-2014 (n=72). Approval for this study was obtained from the Institutional Review Board of the National Healthcare Group, Singapore.

**Embedding**

In response to the embedding imperative issued by YLLSoM, the Medical Student Case Sheet (MSCS) was introduced in 2010 during the eight-week General Medicine clerkship to help ease third-year students into the ward round activity. The MSCS is a dedicated clerking sheet for the student that also serves as a repository of student participation and learning. To circumvent medicolegal considerations, the MSCS was considered separate from the official patient case-sheet. Each student was assigned two ward patients to clerk and follow up daily, and encouraged to present their patients at Morning Rounds at least once every two days, to gain feedback on their presentation skills. Besides charting relevant details from history, physical examination and investigation results into the MSCS, each student was expected to document an approach to the clinical problem, the differential diagnoses and the rationale for each investigation being carried out. Every patient entry is duly signed and verified by a senior.

**SimRound**

Feedback obtained indicated that students still experienced significant difficulty integrating their learning whilst being embedded within the ward teams (See results). To address these concerns, the SimRound was envisioned and launched in 2013 as an adjunct to complement embedding. The goal was to provide a safe yet authentic learning platform via a simulated ward round that affords students the opportunity to reprise and rehearse their roles as junior members of the ward team. In so doing, it was anticipated that SimRound will reduce the cognitive load associated with stressful transition into ward teams, thereby enhancing learning and knowledge application during ward rounds.(Fraser, Ayres and Sweller, 2015; Thomas et al., 2015) Additionally, motivated by the situated learning theory, we designed the SimRound processes to mimic the proceedings of a real-life ward round, so that students learn by observing and performing the required tasks in the ward round.

SimRound is conducted at the simulation training center of TTSH. It is planned as a learning activity to simulate a General Medicine morning ward round, but not to replace it. Faculty prepared individual case information comprising case history, physical examination findings and investigation results. Cases are selected based on common medical scenarios from the third-year core curriculum guidelines from YLLSoM, such as fluid overload, stroke, and geriatric syndromes. SimRound is conducted twice during the eight-week General Medicine posting, in tandem with the existing Embedding program. At the first session held at the end of second week of posting, one medical student interacts with a standardised patient (SP) for 20 minutes. At the second session held at the end of six weeks, nurses join the SimRound (one per SP) to simulate the doctor-nurse interactions. This progressive nature of the SimRound sessions is deliberate. To reduce cognitive load, the first session focuses on history taking and medical reasoning and is hence conducted without nurses. In contrast, for the second session – four weeks later in the posting
– students should be more comfortable interacting with nurses in the ward setting; the cases are also more complex, each with two to three diagnostic problems.

Each SimRound session lasts about two hours, with the first hour dedicated to pre-ward round preparation involving interactions with SPs and nurses, and the second hour comprising the consultant-led ward round where case presentation and discussion with feedback occur. There are four phases, as seen in Figure 1.

**Figure 1: SimRound Process Chart**

- **Prioritisation and Triage Phase**: Student Tasks: Review prepared in-patient folder/case sheets and huddle with nurses for handover of overnight events and updates.

- **Pre-Round**: Student Tasks: Synthesise information gained from the earlier phase, take a clinical history from standardised patient to arrive at possible diagnosis and differentials and management plan. Physical examination findings are provided separately.

- **Round**: Student Tasks: Case presentation and discussion with Ward Consultant, together with members of the nursing team

- **Evaluation and Feedback**: Student Tasks: Receive individualised feedback from the Consultant and simulated patients

**Evaluation and data analysis**
We analysed responses to open-ended questions in the end-of-rotation survey of the initial embedding cohort in academic year 2010-2011 (n=35), as well as the SimRound cohort in academic year 2013-2014 (n=72).

For embedding, we collected data based on replies to three open-ended questions that asked about what was useful, what was lacking, and what was needed to improve the system. The purpose of this pre-SimRound era analysis was to understand the rationale that prompted the development of the SimRound as a bridging activity to complement embedding. For SimRound, we collected open-ended feedback on the usefulness, shortcomings and improvements that can be made to the programme.
Qualitative data were analyzed via the framework approach (Smith and Firth, 2011) by a single member of the analysis team using the proposed three stages:

1. Data management, which involved becoming familiar with the data through re-reading the scripts, and identifying initial themes and coding;
2. Descriptive accounts, which involved developing "overarching" thematic ideas and abstract concepts; and
3. Explanatory accounts, which involved developing associations within concepts; as well as interpreting and explaining the concepts and themes.

**Results/Analysis**

**Results**
We surveyed third-year medical students who were doing their General Medicine rotation in TTSH for academic year 2010-11 (n=35) as the embedding cohort, and for academic year 2012-2013 and 2013-2014 (n=72) as the SimRound cohort. The respondents in the embedding cohort were predominantly Chinese (n=34, 97%), with an equal gender distribution [17 (48.5%) male, 18 (51.5%) female]. For the SimRound cohort, the respondents were predominantly Chinese (n=67, 93%), and had a slightly higher proportion of male students [38 (52.7%) male, 34 (47.3%) female].

**Embedding**
Emergent themes were classified as perceived benefits and challenges of embedding. Within these themes, several subthemes emerged (Table 1).

**Table 1: Embedding – Themes and Subthemes**

<table>
<thead>
<tr>
<th>Theme</th>
<th>Description</th>
<th>Subtheme</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Benefits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modelling</td>
<td>Clinicians actively demonstrate and explain skills and procedures to students</td>
<td>Positive example from senior staff Learning by observation</td>
</tr>
<tr>
<td>Scaffolding &amp; Coaching</td>
<td>Clinicians support student learning by tailoring teaching and delegated tasks to students' specific knowledge levels, and providing specific and concrete feedback on their performance</td>
<td>Learning by doing Targeted feedback Authentic learning</td>
</tr>
<tr>
<td>2. Challenges</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engagement &amp; team identity</td>
<td>The involvement of students in team processes during the ward round and the feeling of being part of the team</td>
<td>Passive participation Lack of team identity</td>
</tr>
</tbody>
</table>
Increased Extraneous Load

The cognitive load imposed by instructional procedures

Variability of experience
Inadequate access to the team
Unstructured learning experience.

Increased Intrinsic Load

The cognitive load imposed due to the nature of clinical work and the thought processes needed to form in order to function in the ward

Practical knowledge gap
Knowledge-theory divide

With respect to the benefits of embedding students in clinical ward teams using the MSCS, we identified the key themes of modelling and scaffolding for student learning. As for challenges encountered during embedding, we identified three main themes premised on: engagement and team identity; increased extraneous load; and managing increased intrinsic load.

A. Engagement and Team Identity

Several students felt that they were passive participants and disengaged from ward round proceedings, especially when the ward team is more focused on completing the round rather than teaching the students. This distinct lack of team identity is more palpable in large ward teams, where the sense of being integrated is even more remote:

"Not all teams are as keen on engaging the students, some consultants aren't as pro-teaching" – Student E3L2

"Integration is difficult especially if the team is large and has many doctors" – Student E1L8

B. Increased Extraneous Load

Students also felt that the extraneous cognitive load during ward rounds can be overwhelming. Several subthemes stand out:

I. Variability of experience

Learning occurred because of the scaffolding and coaching inherently present in embedding. However, due to the unpredictable nature of clinical work, the workload varied significantly during the posting, with students feeling less engaged during busy periods when clinical work took precedence. In addition, the learning experience during ward rounds was noted to be highly tutor-dependent, with some tutors perceived to be less pro-teaching and offering less guidance.

"Learning/teaching is dependent on how pro-teaching the consultant or team is" – Student E3L6

Students also discovered the influence of the hidden curriculum on learning, such as the ability to build rapport with seniors affecting the latter's enthusiasm to teach and provide guidance.

"[The] amount of learning is really dependent on the individual, and circumstances. [It] depends on how enthusiastic the HO is about teaching, could be because of personal lack of ability to establish good rapport with HO" – Student
E3L5

II. Inadequate access to the team

House officers were assigned to guide students throughout the MSCS as part of the team integration. However, due to competing demands of clinical workload, house officers are often unavailable to attend to the students. In return, the students felt guilty about troubling the house officers.

"[My] House Officer is very busy, and I don’t want to always disturb her with more questions" – Student E1L3

Over time, the combination of figuring out who they can consult and the accumulation of unanswered questions from lack of access to someone who can provide just-in-time answers greatly exacerbates extraneous cognitive load and hinders ability to engage in deeper learning.

"Sometimes, I cannot understand the case when there's no one to explain it to us" – Student E1L7

III. Unstructured learning experience

Students also expressed difficulty adjusting to the unpredictable nature of clinical work, in which cases that were assigned to them could be of varying complexity and difficulty. This can be especially daunting in the high-stress and time-sensitive setting of ward rounds, affecting the ability of students to apply their knowledge to clinical practice.

"Everything is disorganised and messy – [it is] difficult to consolidate learning" – Student E1L10

"[There is a] lack of time to understand [the] entire condition of patient[s]" – Student E1L13

Students thus express the wish for a more structured learning experience where there is less variability in the workload, case mix, and teaching quality.

"Standardize and make clear the expectations of the student House Officer pairing system, so that the quality of teaching/learning_interaction is less varied" – Student E3I3

C. Managing increased intrinsic load

Students struggle to cope with the cognitive load imposed by the complex volatile nature of clinical work and the attendant thought processes required to function effectively in the ward. For instance, acquisition of new problem-based approaches for evaluation and management of their assigned patients. This knowledge gap can be difficult to grasp quickly, especially during initial transition between classroom and ward. This is further compounded by a lack of time to pick up these practical skills in the ward due to competing demands from workload and scheduled tutorials that they had to attend to make up for this knowledge gap.

"A lot of effort [is required] to read up on approach, investigations and management since we have not been exposed to these areas.” – Student E1L5

"Not enough time! Ward rounds in the morning, tutorials in the afternoon, no time to see patients.” – Student E1L6

SimRound
We organised open-ended responses for SimRound into the categories of perceived benefits and areas for improvement. Four main themes emerged for the former, neatly categorized by the three elements of the cognitive load theory and active engagement. We identified subthemes within these broader themes (Table 2).

**Table 2: SimRound – Themes and Subthemes**

<table>
<thead>
<tr>
<th>Theme</th>
<th>Description</th>
<th>Subtheme</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Perceived Benefits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Optimises Intrinsic Load</td>
<td>SimRound decreases the intrinsic load of learning through enhancing coaching by clinicians</td>
<td>Personalised feedback Structured learning experience</td>
</tr>
<tr>
<td>Decreases Extraneous Load</td>
<td>SimRound decreases extraneous load due to the use of high fidelity simulation environment</td>
<td>Removing time pressure Psychological safety Streamlining functional tasks</td>
</tr>
<tr>
<td>Facilitates germane load</td>
<td>SimRound facilitates the mental processes necessary for integration of learning</td>
<td>Realism Deep learning</td>
</tr>
<tr>
<td>Active Engagement</td>
<td>SimRound causes students to actively &quot;engage&quot; and take ownership in the ward round</td>
<td>Learning by participation Finding a place in the team</td>
</tr>
<tr>
<td>2. Areas for improvement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Optimising Access</td>
<td>Access to tutors and resources</td>
<td>Unequal opportunities Optimal allocation of schedule and resources</td>
</tr>
<tr>
<td>Refining Learning Objectives</td>
<td>Incorporating relevant contextual factors into learning objectives</td>
<td>Differentiated objectives between 1st and 2nd SimRound sessions Integration of IPE objectives</td>
</tr>
</tbody>
</table>

**A. Optimises Intrinsic Load**

By serving as a bridge to embedding, SimRound enabled students to manage the intrinsic load related to learning through the provision of personalized feedback and structured learning experience.

**I. Personalised feedback**

During the ward round discussion as well as debriefing, each consultant provided personalized feedback in specific areas, such as case presentation, evaluation plan, diagnostic errors, and communication skills. Many students found the feedback extremely helpful in identifying their weak areas, and facilitating thinking and clinical reasoning.

Students also appreciated the SP-debrief session, whereby feedback was provided pertaining to softer skills such as verbal and non-verbal communication and professionalism issues.

"The feedback (given by the SP) was really good as well, included a lot of soft skills that patients in the ward do not
"The feedback the SPs provided really brought to consciousness certain lapses in my professional conduct. I have learned a lot. Continue to have SP-student debrief." – Student S22

II. Structured learning experience.

SimRound provided a structured and comprehensive learning experience through well-defined learning objectives, performance tasks, and workflow sequencing that covered essential skills and common patient scenarios. By allowing students to practice working as a junior member of the ward team in a safe and predictable environment, students can optimise the intrinsic cognitive load by bridging the practical knowledge gap and knowledge-theory divide.

"The simulated ward round is very useful and gives me a chance to really try to work as a doctor and more importantly highlights the areas of improvement or where I'm lacking." – Student S4

B. Decreases Extraneous Load

Through the use of a high-fidelity simulation environment, SimRound helps to decrease extraneous load in three ways: Removing time pressure, psychological safety, and streamlining functional tasks.

I. Removing Time Pressure

Time pressure was eliminated by giving student significantly more time than a normal ward round to reprise their roles, namely to clerk and examine a patient in detail, to assimilate investigation results, to formulate the initial assessment and management plan, and to document their findings. Furthermore, as the SimRound was designed as a learning activity with no requirement to proceed to post-round tasks or to attend to emergencies (which could happen as a matter of routine in actual ward rounds), an additional element of time pressure was removed.

"Very good way for students to get a sense of the ward round situations. Very good experience. ……we rarely get 30min to clerk a patient in ward/clinic/exam" – Student S2

II. Psychological safety

Psychological safety was present in the simulated environment as students were aware that mistakes that they made would have no bearing on patient safety, unlike in the ward setting where mistakes could directly affect patient management. Coupled with thoughtful feedback given in a non-threatening manner, these enabled students to enjoy the session and consolidate their learning.

"Really enjoyed the session. The feedback given by the consultant were very helpful in helping us to learn. Raised key issues that we should take note of." – Student S23

C. Facilitates Germaine Load

SimRound enhances the mental processes required for integration of learning via 2 main mechanisms, namely realism and deep learning.

I. Realism

Students appreciated the realism in terms of physical environment, workflow process, case scenarios, staff interactions, and stress of case presentation, to simulate the real-life ward round situation. This created an authentic
learning experience that afforded students a "realistic feel" of what to expect in a real-life setting.

"Good that we had the nurses to participate, realistic settings with good case scenarios, and in-depth discussion of management plan." – Student S50

"Very similar to a real ward round, stress present" – Student S37

"Patient scenarios were of suitable difficulty levels and had typical complications, correlating to what we have seen in our team rounds" – Student S36

II. Deep Learning

Students emphasized how SimRound serves to complement embedding by optimizing the necessary practical skills and knowledge in a safe, controlled and structured manner. This enabled students to integrate prior knowledge from the pre-clinical years as well as lessons learnt in SimRound, helping students engage in deep learning through developing their own critical thinking in terms of clinical reasoning and approaches.

"Have this earlier in the posting so that we won't be too lost during morning pre-rounds when we are clerking new cases" – Student S47

"Very useful; good feedback from SPs; questioning by consultant facilitates thinking and clinical reasoning; feedback for the rest of the students and advice from the doctors was also helpful; also help to build confidence in presenting" – Student S18

D. Active Engagement

Students highlighted the possible collateral benefit of SimRound in facilitating professional socialization into the ward team, thereby easing student transition into the clinical phase. By enabling students to actively "engage" and take ownership in the ward round, SimRound promoted learning by active participation as a junior member of the simulated ward team with a clearly defined role. Students also appreciated the opportunity to practise communicating with nursing staff during SimRound, which will facilitate subsequent interprofessional interactions in real-life settings.

"This is a good exercise to practice communication skills and interaction with nursing staff that otherwise would be missed in ward-based learning" – Student S11

Furthermore, by legitimizing student participation in the simulated role as 'house officer', SimRound helped bolster students' confidence in finding their place, first within the simulated team and later within the actual ward team as members who actively contribute to and participate in patient care.

"It lets us fill role of [a] House Officer and present at our own pace, which is good practice" – Student S33

Feedback for areas for improvement was categorized into two themes, namely optimising access and refining learning objectives.

A. Optimising access

Some students felt that the access to tutors and resources was not optimal, resulting in unequal learning
opportunities. For instance, not all the students were able to present their cases during the three-hour SimRound session.

"However, I feel that presentation is really important and hence those who could present had a lot more learning than those who were not able to present" – Student S14

Some students also suggested that beyond case presentation and discussion during the consultant round, tutors can observe their interactions with patients in the pre-round phase and provide feedback.

**B. Refining learning objectives**

Several students also felt that it was important to refine the learning objectives of SimRound to consider relevant contextual factors. Two contextual factors were highlighted. Firstly, to optimise learning in the two sessions, students felt that there was a need to differentiate learning objectives that are dove-tailed to the anticipated learning trajectory during the four-week interval between the two sessions.

"However, [the] objective for SimRound 2 is rather unclear to me in terms of student's participation. If it is still to prepare for ward rounds then week 5 is a bit too late. If it is to add in complexity, then perhaps it may not be indicative enough to have a 2nd SimRound. Perhaps make 2nd SimRound's objectives more clear and tailored to the students?" – Student S12

Secondly, some students also felt that the nurses' role in SimRound was not well-defined, and suggested more explicit integration of inter-professional education.

"Limited interaction with nurses – perhaps we do not have clear objectives for interacting with the nurses. Our focus was more on history-taking and diagnosing the patient versus management” – Student S13

**Discussion**

Through the lenses of the situated learning theory and cognitive load theory, this study explicates how SimRound complements embedding to support students during the stressful transition from pre-clinical to clinical environments. While students felt that embedding was beneficial in terms of modelling as well as scaffolding and coaching, challenges such as a lack of engagement, lack of team identity, increased extraneous load and increased intrinsic load were present. SimRound addresses these challenges through facilitating the germane load via realism and deep learning, and causing active engagement through learning by participation, helping students find a place in the team.

One of the challenges that we faced in embedding was that of the 'hidden curriculum', which refers to the set of influences that function at the level of organisational structure and culture. (Lempp and Seale, 2004) In our institution, these included building rapport with the House Officers and being accepted into the "inner circle" of the ward team. The knowledge-theory divide also featured prominently in student's feedback, as while they had sufficient theoretical knowledge, they experienced great difficulty applying this knowledge practically.

SimRound addressed this transition by optimising the intrinsic load that students face through reducing the number of elements that students had to deal with through a structured learning experience. For instance, eliminating the need to perform a physical examination or to discuss management allowed students to focus wholly on learning the art of targeted history-taking and presentation. The extraneous load was decreased by removing the time pressure...
that is typically present in a ward round. SimRound provided a secure environment as students knew that mistakes made would ultimately have no bearing on patient safety. Functional tasks, such as using the computerised system to take notes or ordering medications, were eliminated. The authenticity of the SimRound experience also helped to facilitate germane load by allowing deep learning to take place. Students picked up relevant core skills that they could subsequently transfer to the real-life ward setting, helping them "connect the dots" and develop their own critical thinking. Finally, SimRound promoted active engagement of students in the virtual ward round, helping them identify their place in the ward team, providing an avenue for LPP to take place.

Lessons learnt
We learnt several lessons from the development of SimRound. Firstly, ward-based teams function as a CoP. For students to integrate into this CoP and learn via LPP, they need to find a role in the team, which necessitates them having the necessary skills to function effectively in the ward round. SimRound thus functions as an adjunct to embedding, equipping students with the relevant skills needed to facilitate integration into the team.

Secondly, it is important to optimise the extraneous and intrinsic cognitive load. This allows for the management of working memory during learning, helping the learner develop the mental processes such as schemata formation and automation that assist in learning.(van Merrienboer and Sweller, 2010)

Lastly, we note that SimRound still has several areas for improvement. Clarity in learning objectives between both sessions was a common theme noted in our results. The simulation environment is also limited in its realism as compared to the ward environment, which is something we continue to strive to improve. Ultimately, a point will be reached where there is a need for a trade-off between realism and managing the cognitive load of the participants. As a learning tool, we recognise that the primary aim of SimRound is to assist students in their learning, hence this balance needs to be consciously made.

Limitations
Our study of SimRound for a third-year internal medicine rotation was based on the experience within a single institution in Asia over a single period of eight weeks. As a result, the generalizability of our results to other settings remains to be established. In addition, our study was designed to explore the rich source of student feedback to provide clarification insights to a novel intervention(Lim, 2013), and did not include study outcomes to demonstrate the efficacy of the intervention. Our study design also does not permit us to ascertain the longer term longitudinal impact of SimRound in helping students integrate into their ward-based teams. Outcome studies are thus needed to explore the efficacy, applicability and feasibility of SimRound. In this regard, further studies are needed to ascertain if SimRound is able to provide applicative support for learning to take place during the transition between pre-clinical and clinical phases through a process of double transfer,(Schwartz, Bransford and Sears, 2005) such that students "transfer in" knowledge learnt in the pre-clinical setting to SimRound, and then "transfer out" the knowledge that they acquired during SimRound into a ward-based setting. The final limitation is the aspect this study has not addressed: the role that consultants play in structuring the ward round into "powerful work-based learning" for students.(Walton and Steinert, 2010)

Conclusion
Using the situated learning and cognitive load theories, we described the rationale, processes and lessons learnt from our experience in developing the SimRound. We found that SimRound is a useful adjunct that helps embedding of junior students into ward teams during the stressful transition between pre-clinical and clinical environments. By enabling deliberate learning in a controlled and authentic setting with inter-professional participation, SimRound optimises cognitive load and active engagement to facilitate their integration into the CoP of incumbent ward teams.
Take Home Messages

- Junior medical students face challenges in their progression from the classroom to the clinical environment, specifically, the inability of students to integrate themselves into incumbent ward teams.
- SimRound builds enabled students to learn in a controlled and authentic setting with interprofessional participation through the use of the Situated Learning Theory and the Cognitive Load Theory.
- Skills that are learnt within SimRound are transferred into the ward setting through the use of legitimate peripheral participation, allowing students to better facilitate into the community of practice of incumbent ward teams.

Notes On Contributors

Dr Jonathan Wong is a Resident in Internal Medicine with the National Healthcare Group.
Dr Ranjana Archarya is a Consultant in General Medicine at Tan Tock Seng Hospital.
Dr Mok Kwang How is an Associate Consultant in Cardiology at Tan Tock Seng Hospital.
Dr Tham Kum Ying is an Associate Professor and Assistant Dean of the Lee Kong Chian School of Medicine, and is a Senior Consultant in the Emergency Medicine department of Tan Tock Seng Hospital.
Dr Jennifer Ting is an Associate Consultant in General Medicine at Tan Tock Seng Hospital.
Dr Lim Wee Shiong is an Adjunct A/Prof of Yong Loo Lin School of Medicine, National University of Singapore and is a Senior Consultant in the Geriatrics Department of Tan Tock Seng Hospital. He is a teaching faculty of the Massachusetts General Hospital Institute of Health Professions as well as the Maastricht-Singapore Masters of Health Professions Education Programme.

Acknowledgements

The Authors would like to express their gratitude to the staff of SIMTAC, as well as the Simulated patients who have made this program possible.

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**Appendices**

None.
Declarations

The author has declared that there are no conflicts of interest.

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Ethics Statement

Ethical approval for this research was sought from the Domain Specific Review Board of the National Healthcare Group (Reference 2015/01043) and was determined that no such approval was required. The work was carried out in accordance with the Declaration of Helsinki, including, but not limited to, there being no potential harm to participants, that the anonymity of participants was guaranteed, and that informed consent of participants was obtained.

External Funding

This paper has not had any External Funding

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