Transforming the Healthcare Simulation Spectrum:
Now, Next and Beyond

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Game on! An Innovative Sight on Cannulation

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Introduction

Performing peripheral intravenous (IV) cannulation is an essential core skills competency that all new registered nurses and enrolled nurses must learn when they joined the organization. Skills-based simulation training and assessment requires the nurses to demonstrate both knowledge and skills and require an assessor face-to-face to provide immediate feedback. In view of COVID-19 outbreak, the training curriculum has shifted from classroom based teaching to online e-learning wizlearn platforms in Singapore General Hospital (SGH). The skills based training and assessment have to be suspended as we could not minimize the social interaction between the trainer and nurse. Therefore, the team from Alice Lee Institute of Advanced Nursing (IAN) streamlined the IV cannulation training and assessment to minimize training hours and social contact without compromising on the quality of the training.

Aim of the study

The aim of the study was to reduce the training time taken for IV cannulation training and assessment for all newly hired SGH nurses. At the same time, we investigated their confidence level and success rate of cannulation post training during the study.

Methods

The 5 Why was used to identify possible causes for the key problem in the project and the team brainstormed the major categories of the root causes (RC) of problem.

Long duration to conduct IV cannulation training for the newly hired SGH nurses

Trainers need more time to engage the trainees using traditional method.

Newly hired nurses require a lot of prompting and coaching from the trainers during current training.

Only didactic teaching and no real patient responds in current traditional classroom setting.

Traditional training arm lacks efficiency in different type of skin textures assessment.

Trainers require more time to transcribe observation and feedback on checklists based on the current assessment criteria.

Trainers need time to act as simulated patient and create various cases scenarios.

RC 1: Traditional method lacks innovation in training the newly hired nurses

RC 2: Feedback are collected manually and has to be collated and transcribed.

RC 3: Lack efficient practical and assessment and no simulated patient response.

Based on the root cause identified, IAN team had worked closely with Nursing Quality, Research and Transformation Unit at Nursing Division to improve on the existing method of training newly hired nurses. Together, the team had collaborated with 2 external vendors who specialized in pressure sensors and game-based technology and embark on an innovation project to improve the current training and assessment of IV cannulation (**RC 1**). The team also managed to secure funding from Singapore University of Social Sciences to build a game-based technology for training.

The team did many rounds of pilot testing on various designs from January 2021 to June 2021. In July 2021 the team finalized on a prototype called IV Nursing Innovation in Mobility-based Learning (NIMBLE) cannulation integrating a pressure sensor glove with a virtual standard patient, enabling efficient assessment of nurses' dexterity while simulating patient response as they cannulate on a 3D printed arm cannulation game (**RC 3**). The game play from this prototype was captured and summarized in a performance dashboard that the learner can access immediately (**RC 2**).

Total 204 newly hired nurses participated the study from June to July 2021. 84 Nurses (control group) used traditional approach using mannequin. 120 new nurses (NIMBLE group) used IV NIMBLE game.

Each participant was timed on the total duration they spend on practicing and assessment of IV Cannulation. On top of that, all participants were given a pre and post training survey on their confidence level score and success rate of cannulation on a real patient to assess the efficiency and quality of the new IV cannulation training.
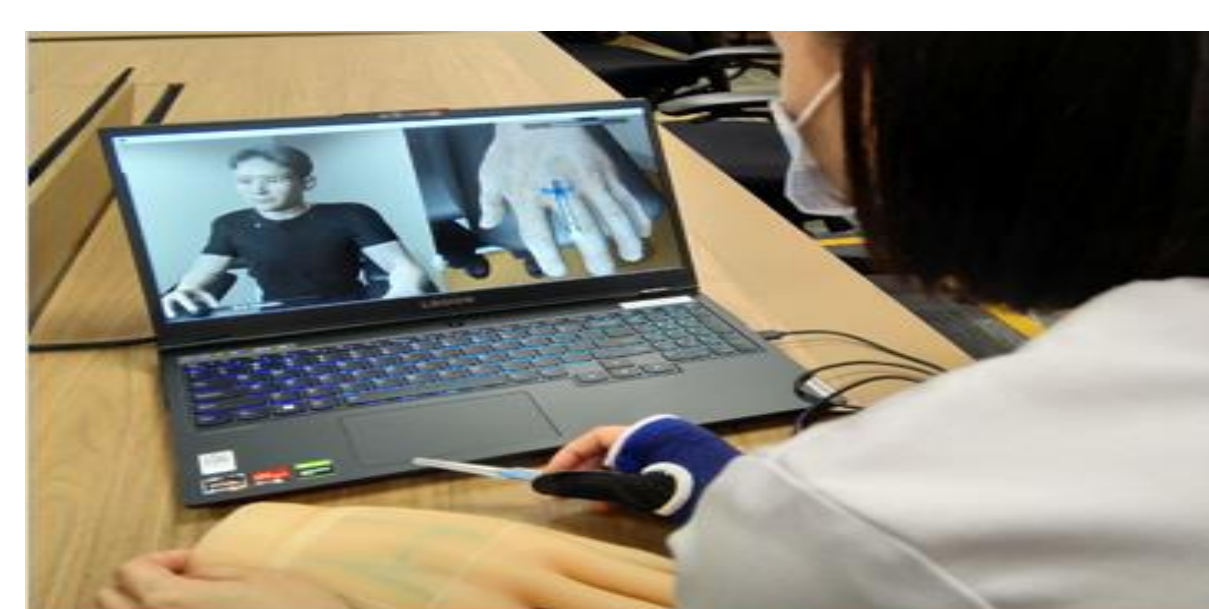

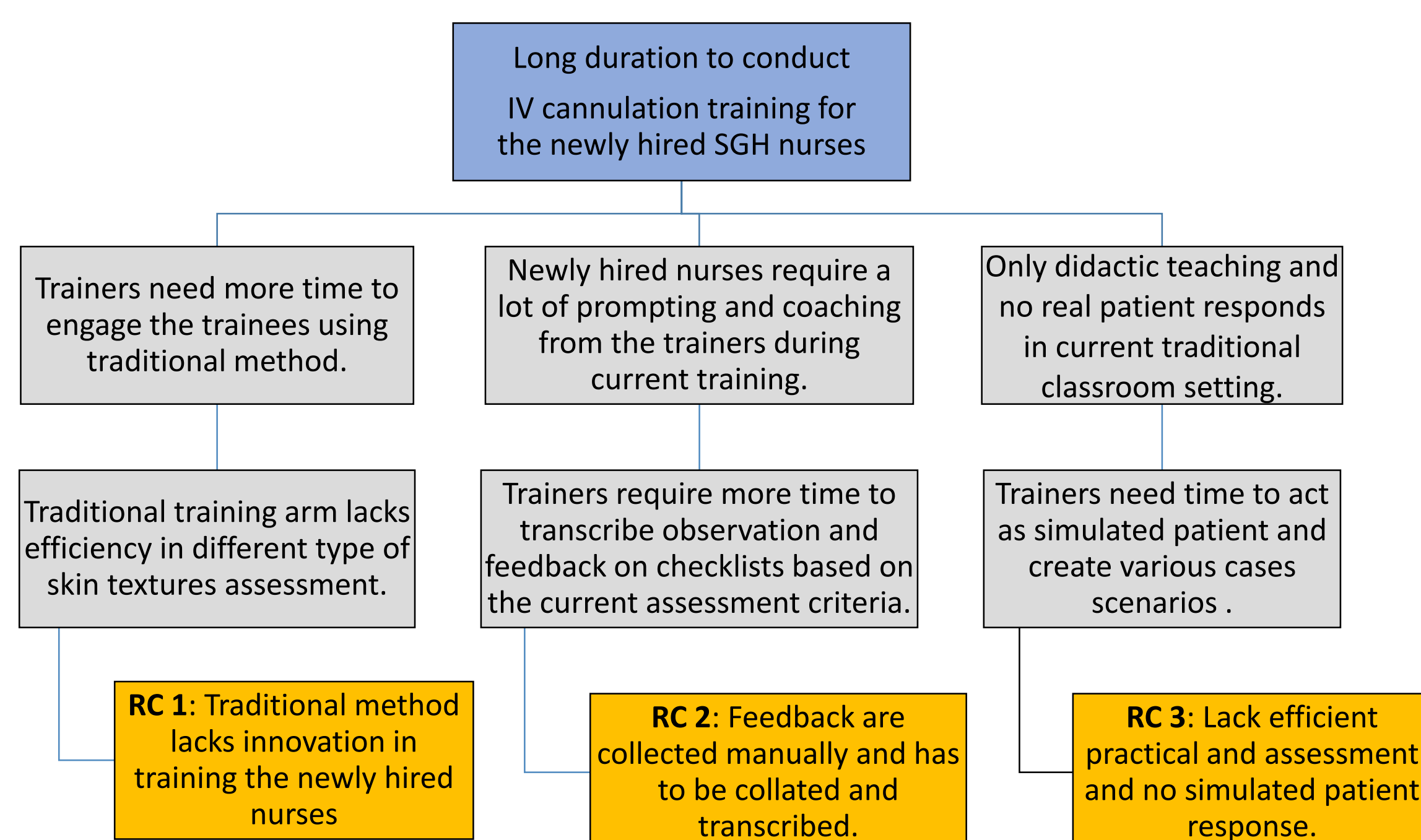**Photo 1**: IV Nimble Cannulation game

Photo 2-5: IV NIMBLE cannulation game was tested with newly hired nurses
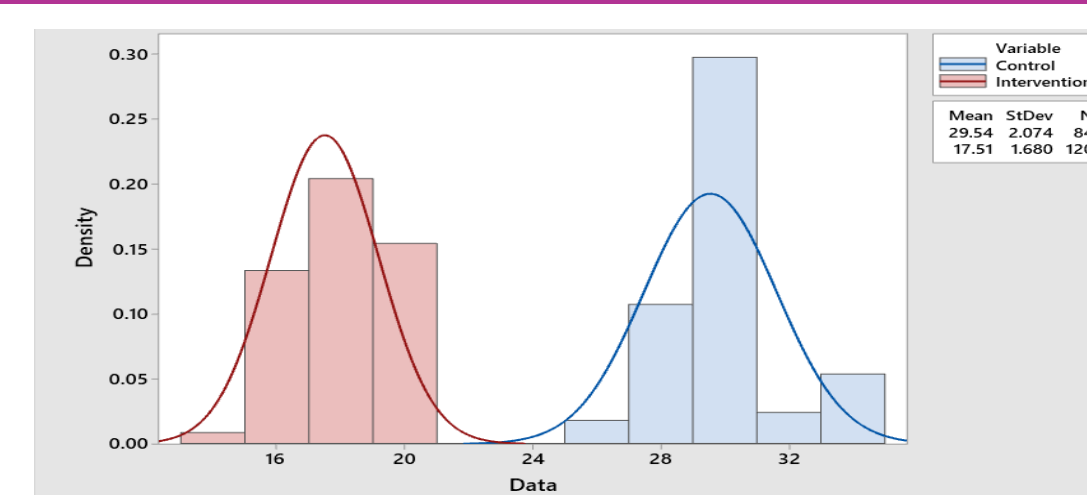
Results

Figure 1: Left shift in time taken shown In Distribution Chart for training and assessment of newly hired nurses (pre-implementation in Blue; post-implementation in Red)

The result was analyzed through a 2 sample t-test. We concluded that the IV NIMBLE cannulation game had resulted in a significantly faster IV cannulation training and assessment, where the total duration for training and assessment had improved from an average of 30 minutes to 18 minutes ($p < 0.05$).

The team also compared the confidence level and success rate of the different cohorts using a Paired T-Test. Both groups' level of confidence increased significantly post training and had similar mean confidence score post training (IV NIMBLE: 7.2, Control: 7.5) ($p < 0.05$). Both groups also showed similar success rate on their first cannulation on a real patient (IV NIMBLE: 76.9%, Control: 74.4%). This showed that the IV NIMBLE cannulation game is as effective as the traditional teaching method.

Based on the Quality Improvement Saving calculator, 6480 minutes per annum time savings from this implementation is estimated to be around $4276.80 per annum. With the success of IV NIMBLE, the cost had been significantly reduced, which enhances the training outcome and enables optimization of resources.

	Pre-Implementation	Post-Implementation	Savings
Time taken per assessor and trainee (mins)	30	18	12
Total time taken per session for 3 assessors & 15 trainees (mins)	540	324	216
Numbers of training runs / year (based on 2021 runs)	30	30	30
Total Time Taken (mins)	16200	9720	6480

Sustainability & Limitations

During the study, the team needed to troubleshoot and restart the game multiple times due to the disruption of the WIFI connectivity. Team worked together and made the experience smooth. It was the cohesiveness of the team members that allow us to overcome the challenges.

The IV NIMBLE cannulation game would be incorporated into the formal orientation program, which is known as "Graduated Nursing Integrated Programme" (GNIP).The team will also be expanding and building different patient profiles to have a variation of the scenarios into the game.

In line with the safe management measurements, number of trainers and training timing can be adjusted to allow for small group practice. Multiple Scenarios with assessment dashboards can be used as well, adapting well to different cases and different medical fields can also be explored further with different scenarios. A bigger sample size and data can further enhance this training and assessment kit to make it a gold standard assessment tool kit in Singapore General Hospital.