How to Maximize Groups and Reduce Costs in Self-regulated Procedural Simulation?

Alexandre Lafleur[1], Gabriel Demchuk[1], Marie-Laurence Tremblay[2], Caroline Simard[1], Étienne Rivière[3]

[1]QMA-CMA-MD Educational Leadership Chair in Health Professions Education and Apprentiss Simulation Center, Faculty of Medicine, Laval University, Quebec city, Canada. [2] Faculty of Pharmacy, Laval University, Quebec city, Canada. [3] SimBA-S Simulation centre, Faculty of Medicine, Bordeaux University, City of Bordeaux, France.

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Context: *In self-regulated procedural simulation learners regulate their time and goals and decide which simulator they want to use. Instructors provide feedback and guidance, but most of the times, do not demonstrate the entire procedure.*

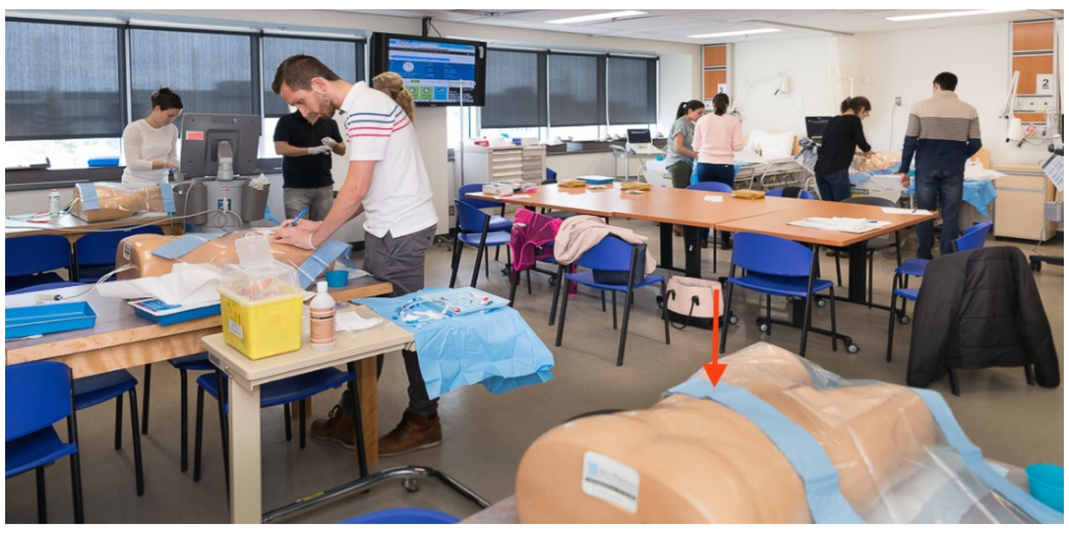
Results: *Based on the ratios calculated from time of use, the number of simulators was strategically reduced from 22 to 14. The utilization rate of simulators in phase two increased from 35.5 to 76.6 %, while accommodating 12 participants/group instead of 8.5.*

Problem: How many and which simulators to buy? For how many participants?

In an environment supporting autonomous practice of multiple procedures, current needs assessment hardly predict learners' use of simulators. Educators cannot make informed decisions about the optimal ratios of simulators to answer learners' needs.

Aim:

- *Measure participants' time of use of simulators using a practical and transferable method.*
- *Use and share this information with other programs to optimise material and human resources.*



Methods: *In this practical action research, we designed 90-minute self-regulated procedural simulation trainings for internal medicine residents (R1 to R5). Participants self-reported each simulator they used using standardised paper logbooks.*

Simulators of core procedures in internal medicine	Phase one (n=51) 8.5 participants/group 6 sessions of 90 minutes 24 Simulators			Phase two (n=24) 12 participants/group 2 sessions of 90 minutes 14 Simulators		
	Number of complete / partial procedures (SD)	Mean time of use of simulators, in minutes (SD)	Minimal ratio of simulator/ participant (SD)	Number of complete / partial procedures (SD)	Mean time of use of simulators, in minutes (SD)	Minimal ratio of simulator/ participant (SD)
US-guided jugular vein catheterization	1.7 (1.1) / 1.0 (2.0)	27.1 (12.1)	**0.30** (0.13)	1.3 (1.0) / 1.1 (1.5)	29.8 (19.1)	**0.33** (0.21)
US-guided femoral vein catheterization	0.7 (0.8) / 0.4 (0.7)	9.0 (9.7)	**0.10** (0.11)	0.5 (0.8) / 0.6 (0.7)	9.4 (9.1)	**0.10** (0.10)
US-guided subclavian vein	0.4 (1.0) / 0.5 (1.0)	6.3 (8.8)	**0.07** (0.10)	0.5 (1.4) / 0.2 (0.4)	5.3 (9.3)	**0.06** (0.10)
US-guided thoracocentesis	1.1 (0.9) / 0.2 (0.5)	13.4 (9.9)	**0.15** (0.11)	1.1 (0.8) / 0.6 (0.9)	16.3 (9.5)	**0.18** (0.11)
Lumbar puncture	0.9 (0.8) / 0.3 (0.6)	8.6 (8.0)	**0.10** (0.09)	0.1 (0.4) / 0.1 (0.4)	0.5 (1.8)	**0.01** (0.02)
US-guided paracentesis	0.5 (0.6) / 0.2 (0.5)	6.2 (6.5)	**0.07** (0.07)	0.1 (0.3) / 0.1 (0.3)	2.1 (4.8)	**0.02** (0.05)
Arthrocentesis	0.6 (1.3) / 0.5 (1.2)	4.8 (7.6)	**0.05** (0.08)	0.9 (1.0) / 0.8 (1.2)	11.4 (9.1)	**0.13** (0.10)
US-guided peripheral veins	1.0 (1.0) / 0.3 (0.5)	7.5 (6.8)	**0.08** (0.08)	0.5 (1.0) / 0.4 (0.6)	5.7 (7.7)	**0.06** (0.09)
All simulators	6.8 (2.7) / 3.3 (3.4)	82.8 (6.4)	**0.92** (0.07)	5.0 (2.8) / 3.8 (3.0)	80.4 (9.8)	**0.89** (0.11)

Using ratios to select simulators and maximize group size

Mean time of use of type of simulator x by participants / duration of the session (90 min in this study

E.g. You need 1 lumbar puncture simulator for 10 participants

Simulators of core procedures in internal medicine	Number of simulators	Utilization rate of simulators (%)	Number of simulators	Utilization rate of simulators (%)
US-guided jugular / subclavian vein catheterization	4	78.8	4	117.1
US-guided femoral vein catheterization	2	42.6	2	62.5
US-guided thoracocentesis	2	63.4	2	108.3
Lumbar puncture	6	13.5	2	3.6
US-guided paracentesis	2	29.2	1	27.8
Arthrocentesis	4	11.3	2	75.8
US-guided peripheral veins catheterization	2	35.2	1	75.6
All simulators	22 (69 925 $)	35.5	14 (48 720 $)	76.6

> 30 %
Cost
Group size
Utilization

Take-home messages:

- *By calculating the **time of use** of simulators in self-regulated practice you can strategically increase group size and/or buy new simulators based on empirical data.*
- *Expressed as **ratios** of simulator/participant, this information can be shared with similar programs to inform purchase decisions.*

How to do it at your institution?

- *Gather a **large number of simulators** for few pilots sessions (ask for demos, ask other programs).*
- *Or, have a **very small number of participants** for the pilots sessions.*
- *Then increase the number based on the ratios you measured. Your most popular simulator (highest ratio) will be the **limiting point**.*

Paper Logbooks used by participants

Type of simulator used

- US-guided jugular vein catheterization
- US-guided femoral vein catheterization
- US-guided subclavian vein catheterization
- US-guided thoracocentesis
- Lumbar puncture
- US-guided paracentesis
- Arthrocentesis
- US-guided peripheral veins catheterization

Time of arrival
_____:_____

Time of departure
_____:_____

I did:

_____ complete procedure(s)

_____ partial procedure(s)