Multi-continent Validation Study of the Camera Navigation Simulation Task

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Introduction

Operating angled endoscopes is challenging for novices but crucial in endoscopic surgery. Due to limited high-fidelity simulations, we developed a novel simulator and its task with clear metrics to enhance camera navigation skills.

This multicontinental study collects data from surgeons and trainees in diverse training environments to investigate the validity of the novel simulation task and metrics.

Methods

1. Pre-test familiarization
   - After informed consent, participants were allowed 3 minutes to use the simulator before the test
2. Camera Navigation Task
   - Participants completed an alphabetical 14-target (A to L, with the center target at the beginning and end) capture task twice with a simulated 30-degree scope system. Target acquisition accuracy, including proper size and alignment, was evaluated based on a monitor template.

Primary outcome

Difference in Scores Between Novice and Experienced

Score = 300 – [Time to Complete (s) + (Error Count × 10)]

3. Questionnaire

Agreement: 7-Point Likert Scale

Task difficulty
Clinical relevance
Performance improvement
Competence assessment

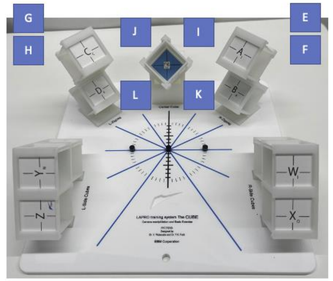
NPS: 11-Point Net Promoter Scale

User loyalty and satisfaction

NEW

Design and Configuration of Targets in the Novel Camera Navigation Task

We analyzed the required surgical views in GI surgery, as well as thoracic surgery, GYN, and urology for endoscopic procedures, and arranged the targets in a highly versatile configuration. The targets are not permanently fixed but are embedded into the board in a manner that allows future modifications. This design also simulates scope-to-organ contact during manipulation, enabling users to recognize errors when the camera collides with and displaces a target.



The target images are designed to be easily replaceable, allowing for simple swapping by inserting and removing them as needed. Additionally, the target spacing has been optimized to facilitate training with a flexible scope.



LAPCO training system
mobile endoscopic camera simulator

To support advanced training, the system includes challenging target positions that were not utilized in this study.

The task board can be easily mounted onto the box of the LAPCO training system and is also designed for compatibility with various other commercially available simulator boxes.



59% of participants responded that the task's difficulty was similar to that of clinical practice [Difficult: 10 (%); Easy: 31 (%)].

97% agreed that the task reflects skills required in clinical practice.

93% agreed that the task improves laparoscopic navigation performance in the OR.

97% agreed that the task can be used to assess competence.

NPS14.3, indicating a generally positive reception.

The Net Promoter Score (NPS) measures user loyalty by asking, "How likely are you to recommend this simulator to others?" on a scale of 0–10. Respondents are categorized as Promoters (9–10), Passives (7–8), or Detractors (0–6). NPS is calculated by subtracting the percentage of Detractors from Promoters, resulting in a score ranging from -100 to +100, where higher scores indicate stronger user loyalty. An NPS between 0 and +30 is generally considered good, reflecting user satisfaction with room for improvement. Scores from +30 to +70 indicate strong loyalty, while scores above +70 are seen as world-class, representing exceptional satisfaction. However, benchmarks vary by industry, so NPS should be interpreted within the relevant market context.

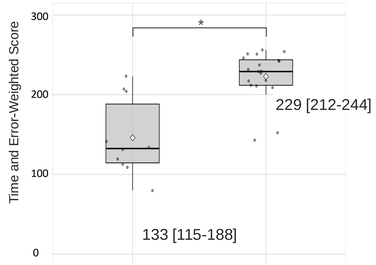


This study provides substantial validity evidence for the novel camera navigation task. The task can help assess and improve camera navigation skill and better prepare assistants for practice.

Results

Demographics	Participants n = 30
Gender, *n (%)*	
Female	9 (30.0)
Male	21 (70.0)
Country, *n (%)*	
Japan	15 (50.0)
Canada	15 (50.0)
Training Level, *n (%)*	
Novice (≤ PGY2)	10 (33.3)
Experienced (PGY 3+)	20 (66.6)
Specialty, n (%)	
Gen Surgery	25 (83.3)
MIS	1 (10.0)
Thoracic	2 (3.3)
GYN	2 (3.3)
Annual scope operation experience, *n (%)*	
≤10 cases	9 (30.0)
11-25 cases	5 (16.7)
26+ cases	16 (53.3)

Scores Between Novice and Experienced Surgeons



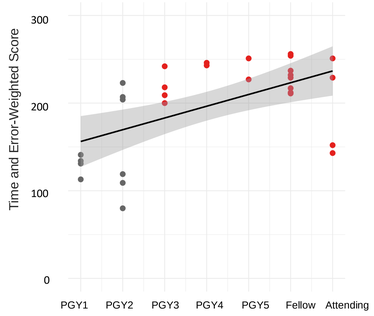
There is no significant difference between Japan and Canada (152 [125 - 225] vs 215 [205 - 232], p = 0.135).

Among the Novice group, all three outliers with high scores were Canadian residents.

The two attending surgeons with low scores had recent camera experience of 11-25 cases and more than 26 cases in the past year, respectively.

Data are presented as Median [IQR].
* $p < 0.001$, Mann-Whitney U test

Correlation Between PGY levels and Score



Training Levels
- Novice
- Experienced

$\rho = 0.577$, $p < 0.001$

Task scores and training levels were analyzed using Spearman's correlation.