GAMIFICATION OF FLS PEG TRANSFER: INITIAL PERFORMANCE AND SATISFACTION EVALUATION

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Introduction

- Minimally invasive techniques revolutionized surgical practice, offering benefits such as reduced hospital stays, lower postoperative complications, and quicker recovery times.
- Despite its advantages, Minimally Invasive Surgery (MIS) posed significant training challenges due to the need for specialized skill sets, high simulator costs, and institutional variability in access to training tools.
- Integrated simulation methods such as box trainers and virtual reality simulators are utilized to enhance technical skill acquisition in trainees and attendings.
- The **Fundamentals of Laparoscopic Surgery Peg Transfer (FPT),** developed by SAGES, is the gold standard for laparoscopic skill training with numerous studies validating its effectiveness in improving surgical performance. Although FPT is well-validated for skill assessment, there is no error monitoring.
- This study introduces **"Cylinder Transfer" (CT)** - an error-monitoring gamified version of FPT. We conducted an initial performance evaluation by comparing the two modalities and additionally assessed participants' initial impressions.

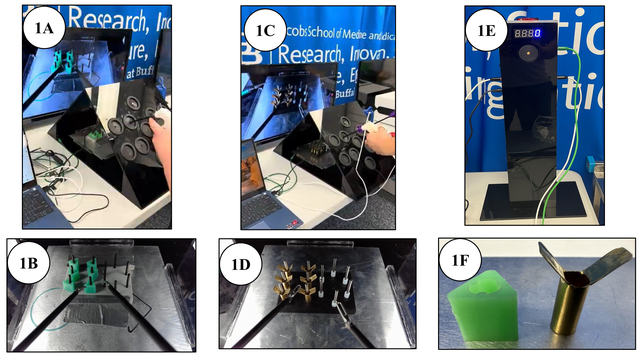


Figure 1: FPT set-up (Fig. 1A) and display (Fig. 1B) compared to CT set-up (Fig. 1C) and display (Fig. 1D). The tabletop error scoreboard (Fig. 1E) is connected to the CT set-up, creating a gamified training environment. The conductive metal cylinders have a different targeting area than the rubber FPT game piece (Fig. 1F).

Methods

Similarities	Differences
• Peg board set-up • Performance arena • Laparoscopic instruments • Peg transfer technique • Game piece heights	• Live-error monitoring digital scoreboard • Immediate auditory (buzzer) and visual (red LED light) feedback • Cylinder has 45 degree angled wings to grip • Use of duckbill grasping tips

Table 1: Characteristics of CT and FPT

- Cohort A: SAGES 2024 Participants
  - SAGES 2024 in Cleveland, Ohio
  - Annual Top Gun Skills Shootout
  - Completed 1 full repetition of FPT (non-dominant to dominant side and return)
  - Completed 1 half repetition of CT (non-dominant to dominant, no return)
- Cohort B: Top Gun Laparoscopic Skills and Suturing Program (TGLSSP) 2024 Participants
  - Six courses occurred from March to September 2024
  - Participated in 1 two-day traditional TGLSSP course
  - Completed 3 full repetitions of FPT
  - Completed 3 full repetitions of CT
- Assessment:
  - Demographic information was collected prior to completion of the trials
  - Performance data was collected within the parameters set for each cohort
  - All participants completed the same satisfaction survey after their trials

Results

Participant Demographics

In Cohort A (n=57), the average age was 31.7 years, with 74% males, 11% (6) attending surgeons, 3.5% (2) fellows, 68% (39) residents, 16% (9) medical students, and 2% (1) other medical professionals. In Cohort B (n=50), the average age was 24.2 years with 54% males, 4% (2) attending surgeons, 24% (12) medical students, 12% (6) other medical professionals, 44% (22) college students, and 16% (8) high school students.

- The average adjusted completion time is calculated by multiplying the number of errors (A: 77/B: 97) by five and adding this number to the original completion time, thus emphasizing the impact of accuracy over speed
- Cohort A performed an abbreviated version of CT (non-dominant to dominant, no return), while Cohort B performed the full maneuver (non-dominant to dominant and return)
- Cohort B has higher average completion times for CT and FPT as well as a higher error rate on CT leading to a higher adjusted CT completion time (Fig. 2).

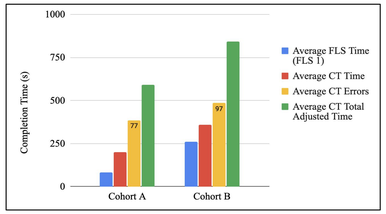


Figure 2: Cohort A and B Completion Times

- In Cohort A, 48% strongly agreed or agreed with the statement "The light and buzzer motivated me to perform better" versus Cohort B (72%), which is represented by the "Motivation" bars below (Fig. 3).
- In Cohort A, 60% strongly agreed or agreed with the statement "The registering of errors enhanced my training experience" versus Cohort B (78%), which is represented by the "Experience" bars below.

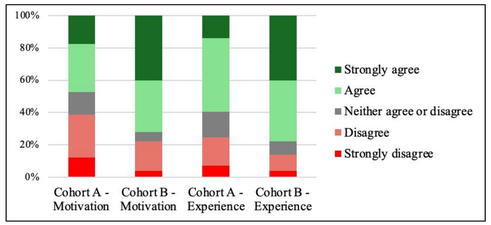


Figure 3: Cohort A and Cohort B Motivation and Experience

- 70% (40/57) of Cohort A had previous experience with FPT compared to 22% (11/50) of Cohort B (Fig. 4).

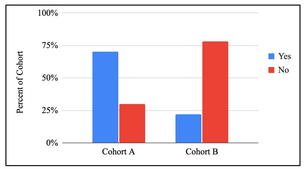


Figure 4: Previous Experience with FPT

- In Cohort A, 16% (9/57) perceived their FPT capability as below average, 58% (33/57) as average, and 26% (15/57) as superior (Fig. 5). In Cohort B, 28% (14/50) rated their capability as below average, 56% (28/50) as average, and 16% (8/50) as superior.

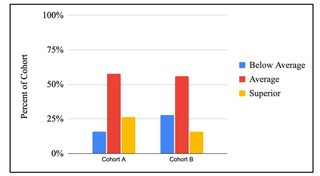


Figure 5: Perceived Capability of FPT

- In Cohort A (Fig. 6), 53% (30/57) believed FPT will have greater impact on skill development versus in Cohort B, 76% (38/50) believed CT will have greater impact.

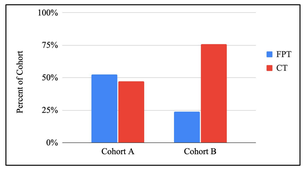


Figure 6: Exercise with Greatest Impact on Skill Development

Conclusion

The gamification version (CT) of FPT was positively received by both cohorts. It was most embraced by the younger group with the least experience with FPT and surgical training.

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