

# Artificial Intelligence in Laparoscopic Simulation

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# ¿What do we need to learn practical skills?

- 1 **Space and infrastructure & necessary hardware**  
(Simulator, room/space, cameras, etc.)
- 2 **Training program (Validated)**
- 3 **Teaching, network of instructors**  
(who will do the feedback?)

3 pillars for  
practical skills  
training



## Pillar 1

Most training centers have some sort of Pillar 1

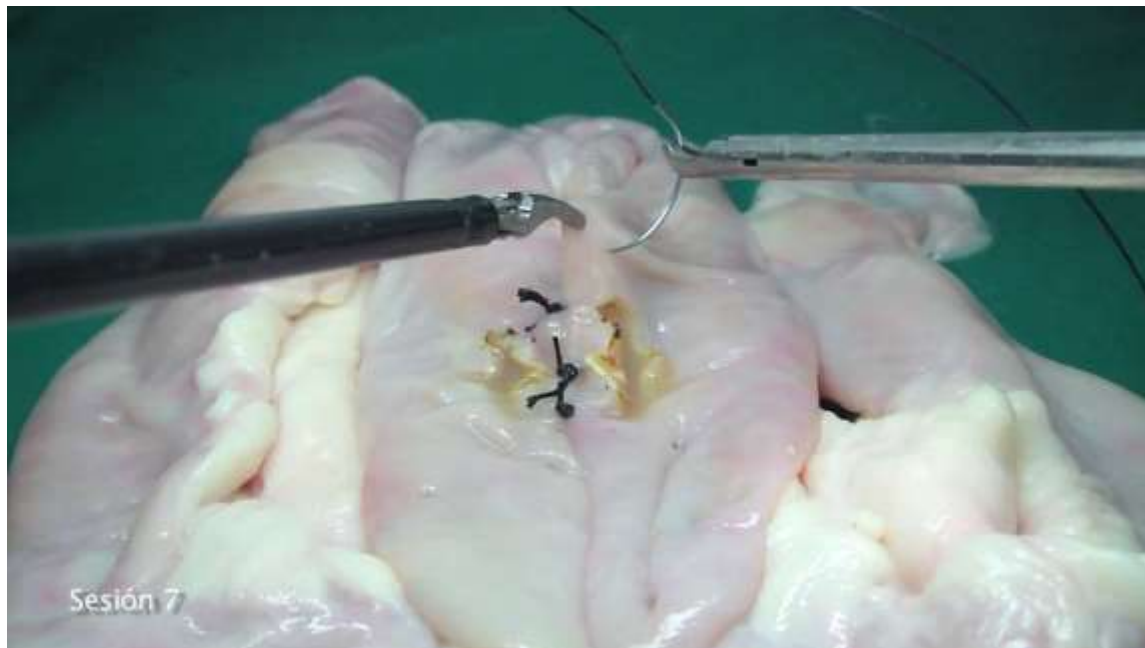
To have the first pillar doesn't mean you have a complete simulation training center (You are missing pillars 2 & 3)





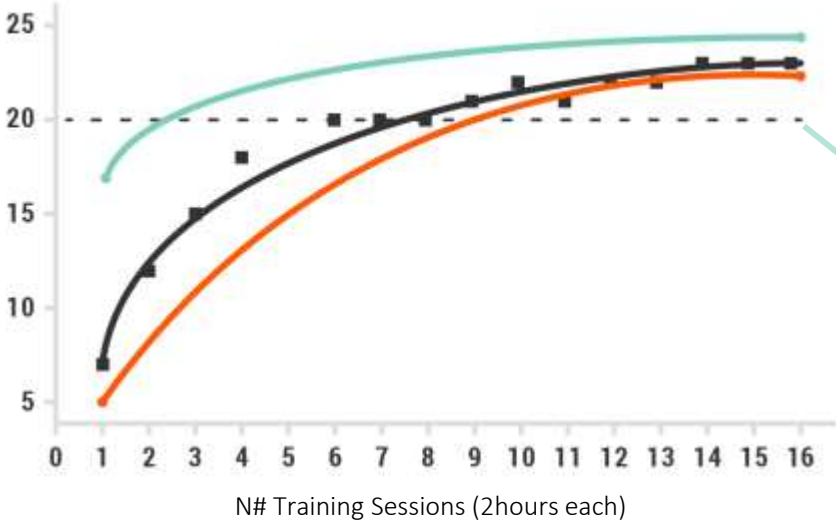
## Pillar 2

## Training Program

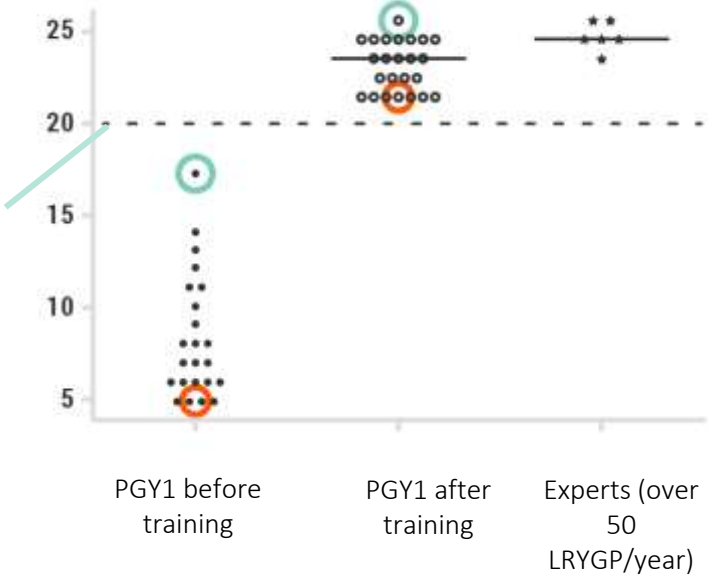


# Pillar 2

Eg. Advanced laparoscopy training program



Expert Level



In this validation experiment, all students (n = 25) acquired skills above the expert threshold \*

\*Varas J et al (2012) Significant transfer of surgical skills ..... feasibility of learning advanced laparoscopy in a general surgery residency. Surg Endosc

Skills obtained with the advanced program are transferred to the Operating room

Surg Endosc  
DOI 10.1007/s00464-016-4942-6



## **Simulation-trained junior residents perform better than general surgeons on advanced laparoscopic cases**

**Camilo Boza<sup>1</sup> · Felipe León<sup>1</sup> · Erwin Buckel<sup>1</sup> · Arnoldo Riquelme<sup>2</sup> ·  
Fernando Crovari<sup>1</sup> · Jorge Martínez<sup>1</sup> · Rajesh Aggarwal<sup>3,4</sup> · Teodor Grantcharov<sup>5</sup> ·  
Nicolás Jarufe<sup>1</sup> · Julián Varas<sup>1</sup>**

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# Trained junior residents perform better than general surgeons on advanced cases

Comparison between

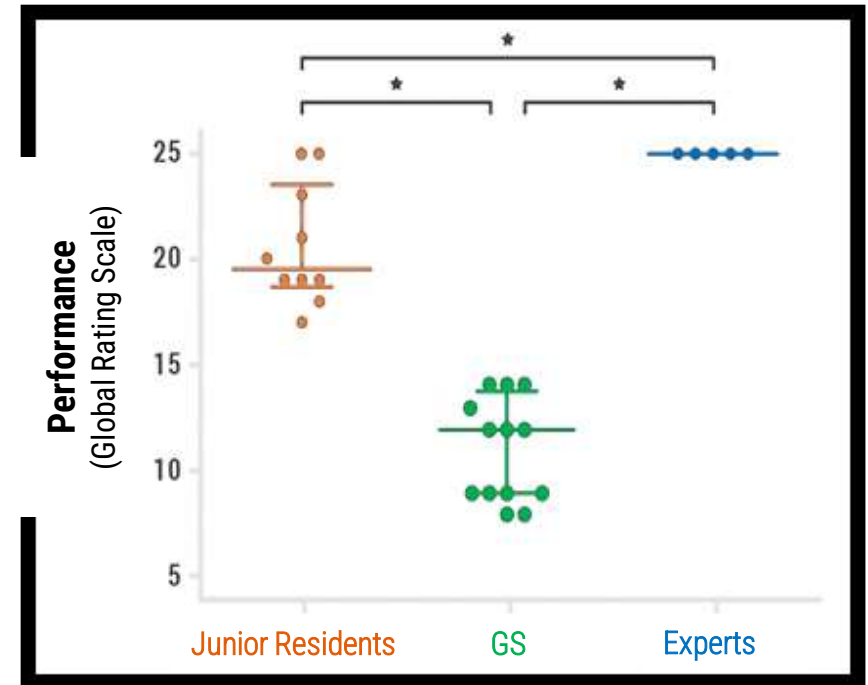
Simulation trained **Junior Residents**

Vs

**General surgeons (GS)** with no Simulation training

Vs

**Experts** (surgeons with over 60 cases a year)



## Pillar 3

Who does the teaching?



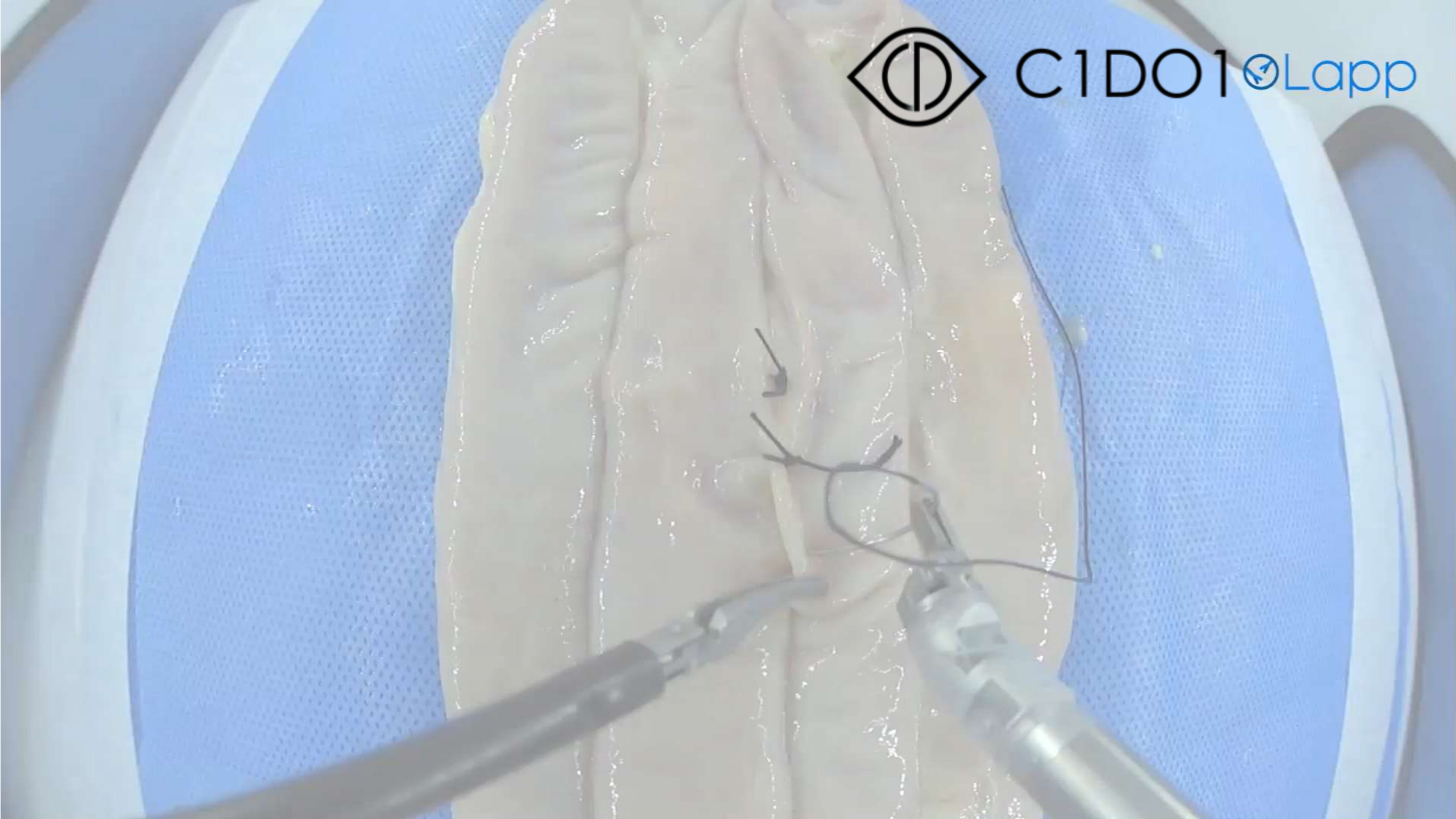




C1D01  
Lapp





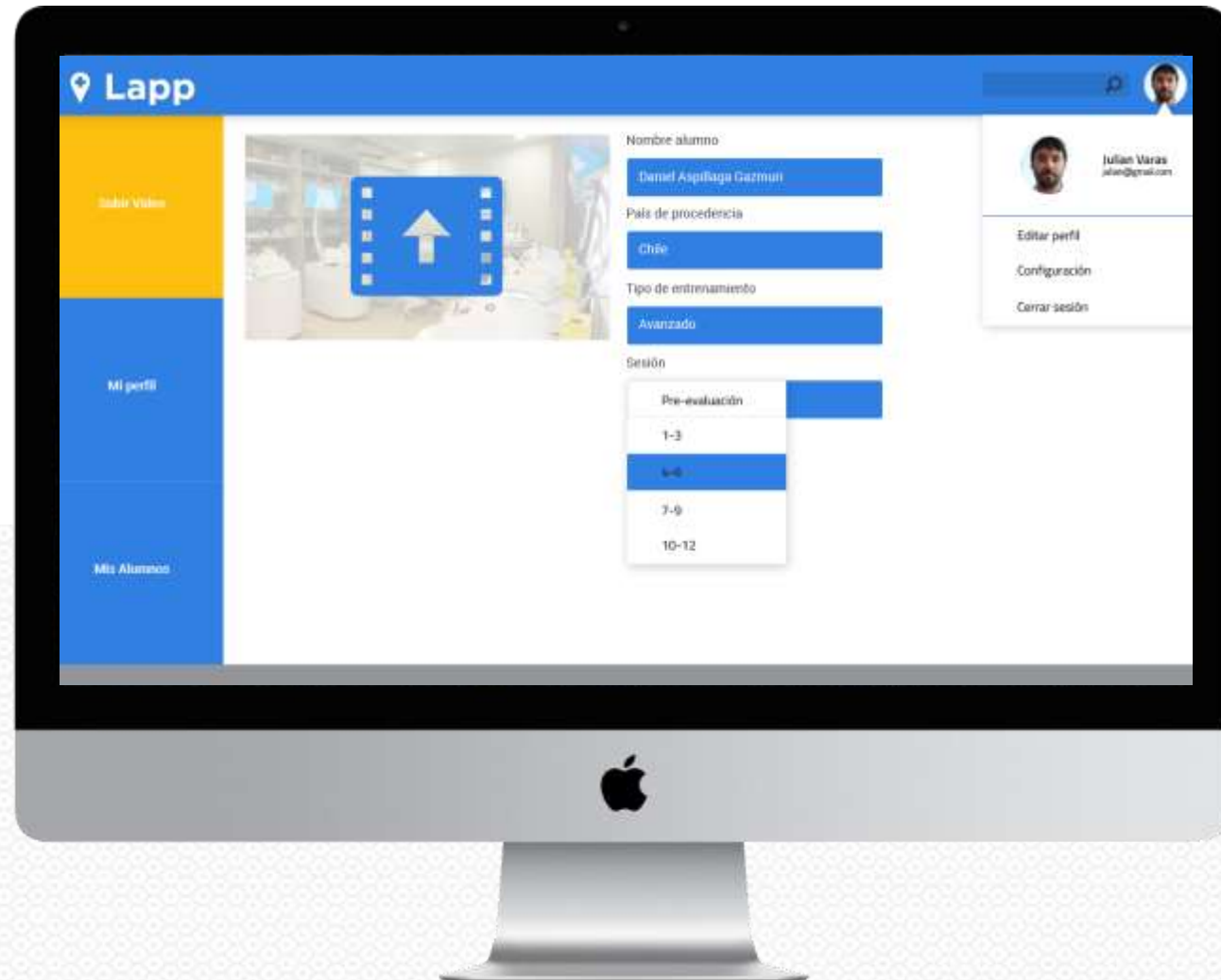
C1DO1  Lapp



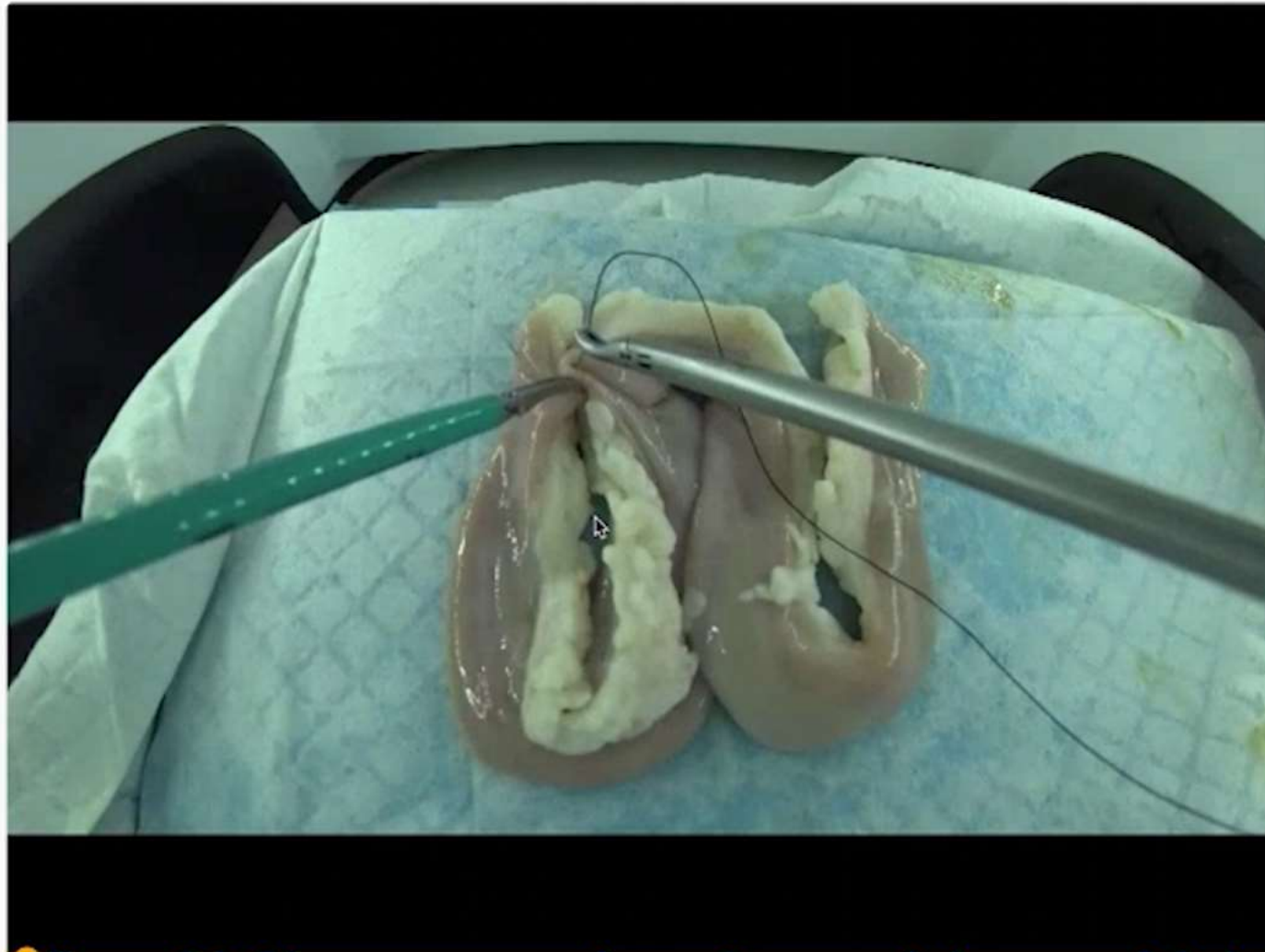




Video gets uploaded to the  CIDO1 **cloud**  








Student Nathan Brand

Administrator Establishment UCSF

Teacher Julian Varas

Level Session 5

Institution UCSF

Country United States

Exercise Session 5: Five groups of approximation stitches (three per group) + enterotomies.

RECORD

PASS FAIL

Evaluation OSATS score/ Minimum Total Duration required 17/17 01:05:52:700

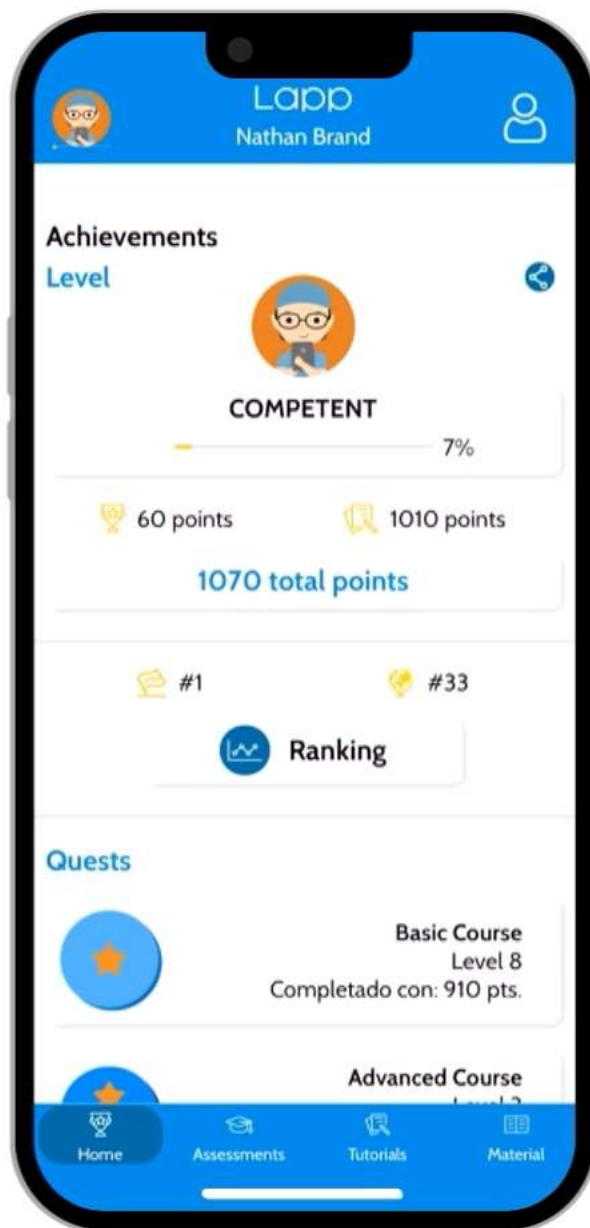
General OSATS scale

Category	1	2	3	4	5	Times
Respect for the tissue	36:23	35:36	34:54	34:13	33:14	36:52 - 29.6 seconds (00:30) 36:01 - 24.4 seconds (00:24) 35:25 - 30.6 seconds (00:31) 34:34 - 20.3 seconds (00:20) 33:47 - 32.2 seconds (00:32)
Time and movements	27:48	27:48	32:42			294.2 seconds (04:54)
Instrument Management	20:39	26:43				364.4 seconds (06:04)
Operational Flow	14:22	19:47				324.8 seconds (05:25)
Knowledge	07:47	13:11				324.6 seconds (05:25)

Total Score: 17

A certified expert trainer evaluates the video and provides personalized digital feedback inputs

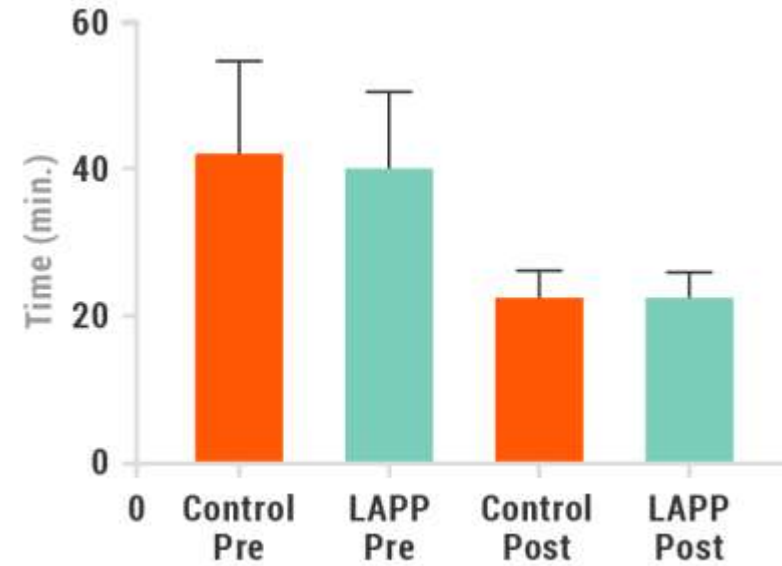
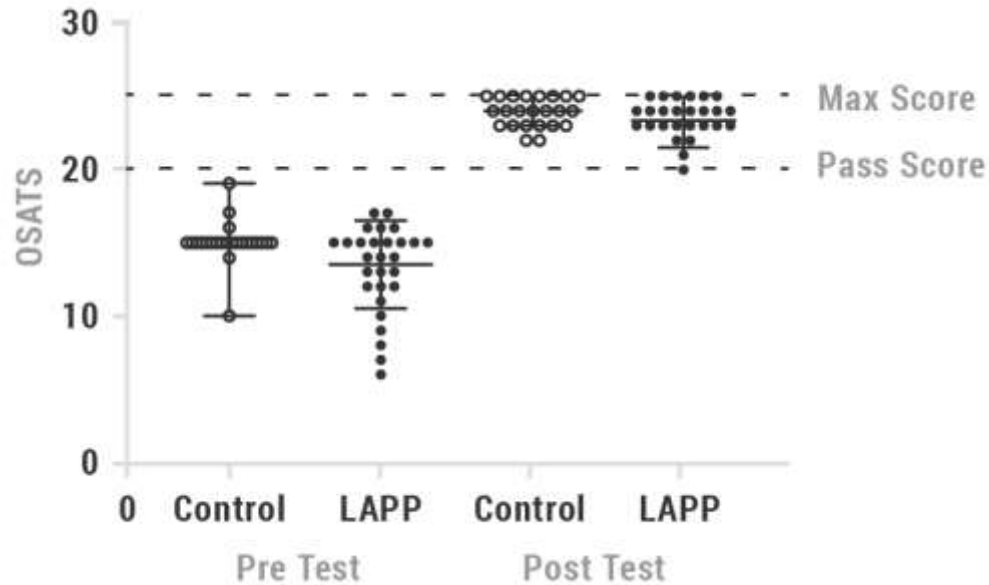






# C1DO1: as good as in-person feedback\*

Lapp



- Comparison of both groups: in-person feedback (control) and remote deferred feedback (Lapp group).
- **A Performance global rating scale** on initial and final evaluation
- **B Procedure time** at the initial evaluation (Pre) and final evaluation (post)

## Remote and asynchronous training network: from a SAGES grant to an eight-country remote laparoscopic simulation training program

María Inés Gaete<sup>1</sup> · Francisca Belmar<sup>1</sup> · Matías Cortés<sup>1</sup> · Adnan Alseidi<sup>2</sup> · Domenech Asbun<sup>3</sup> · Valentina Durán<sup>1</sup> · Gabriel Escalona<sup>1</sup> · Pablo Achurra<sup>1</sup> · Ignacio Villagrán<sup>1</sup> · Fernando Crovari<sup>1</sup> · Fernando Pimentel<sup>1</sup> · Julián Varas<sup>1</sup>



369 Trainees

→ 29% Completed the Basic Program

→ 13% Completed the Advanced Program

### Fourteen Institutes:

- 7 in Chile
- 1 in the USA
- 1 in Bolivia
- 1 in Brazil
- 1 in Ecuador
- 1 in El Salvador
- 1 in Paraguay
- 1 in Perú



33 Administrators  
and 8 Trained  
Instructors in 8  
Countries



6,729  
Uploaded Videos

3%   26%  
 56%   15%


28,711  
Feedback Inputs





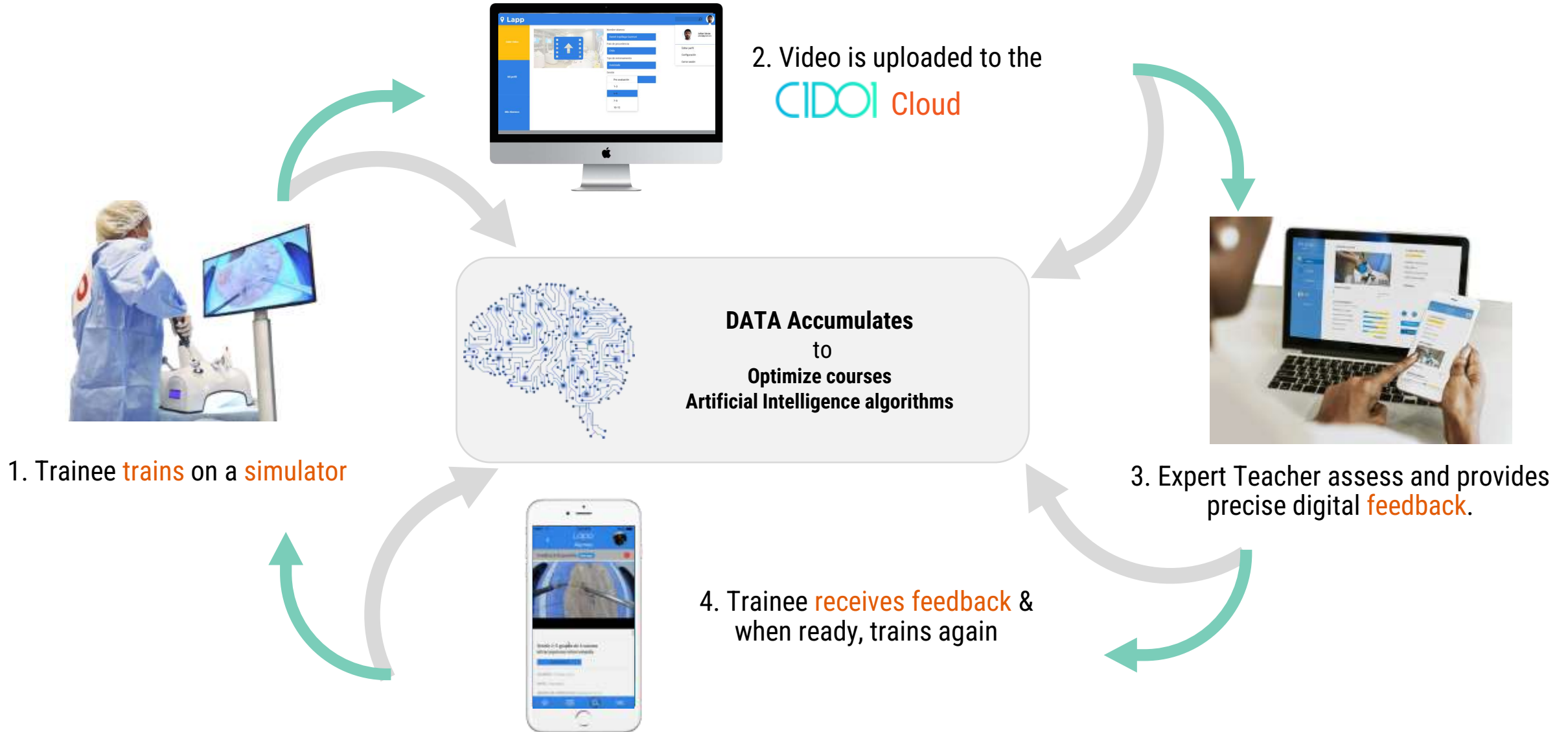
2022 SAGES ORAL

## Remote and asynchronous training network: from a SAGES grant to an eight-country remote laparoscopic simulation training program

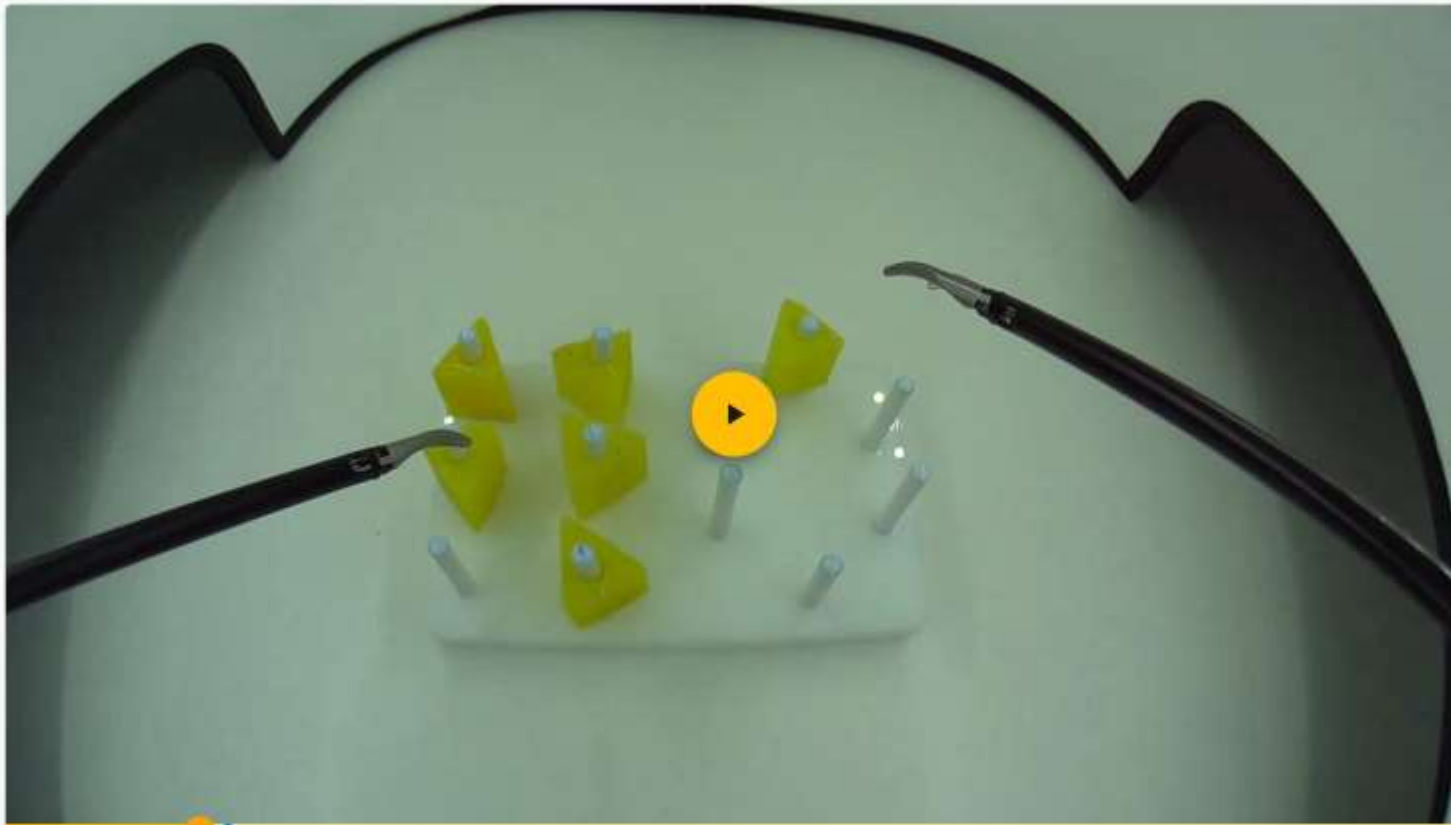
María Inés Gaete<sup>1</sup> · Francisca Belmar<sup>1</sup> · Matías Cortés<sup>1</sup> · Adnan Alseidi<sup>2</sup> · Domenech Asbun<sup>3</sup> · Valentina Durán<sup>1</sup> · Gabriel Escalona<sup>1</sup> · Pablo Achurra<sup>1</sup> · Ignacio Villagrán<sup>1</sup> · Fernando Crovari<sup>1</sup> · Fernando Pimentel<sup>1</sup> · Julián Varas<sup>1</sup> 



# Learning Cycle with data inputs



# Automation in Basic Curricula



Student



Alexis Sanchez

Administrator Establishment

Carlos Martinez

Teacher

Julian Varas

Level

Group 1

Institution

UC

Country

Chile

Exercise

Object transfer - Part 1

PASS

FAIL

COMPLETE

FEEDBACK

Evaluation

Total

Duration /

Maximum

03:37:700

/ 00:55

Times

00:07 - 03:45 : 217.7 seconds

(03:38)

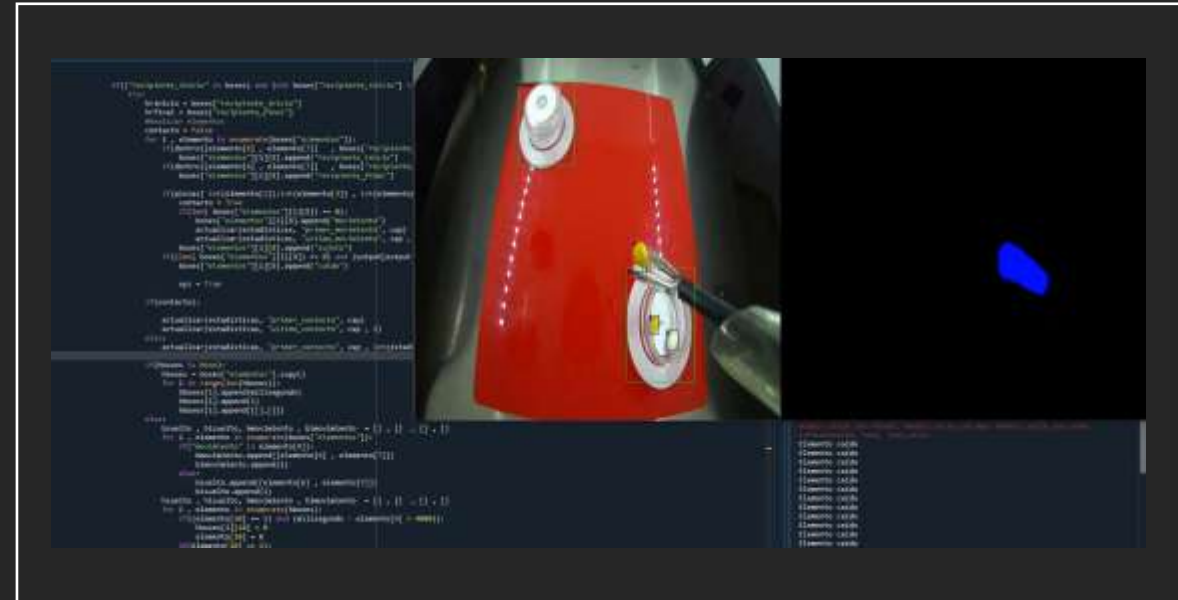
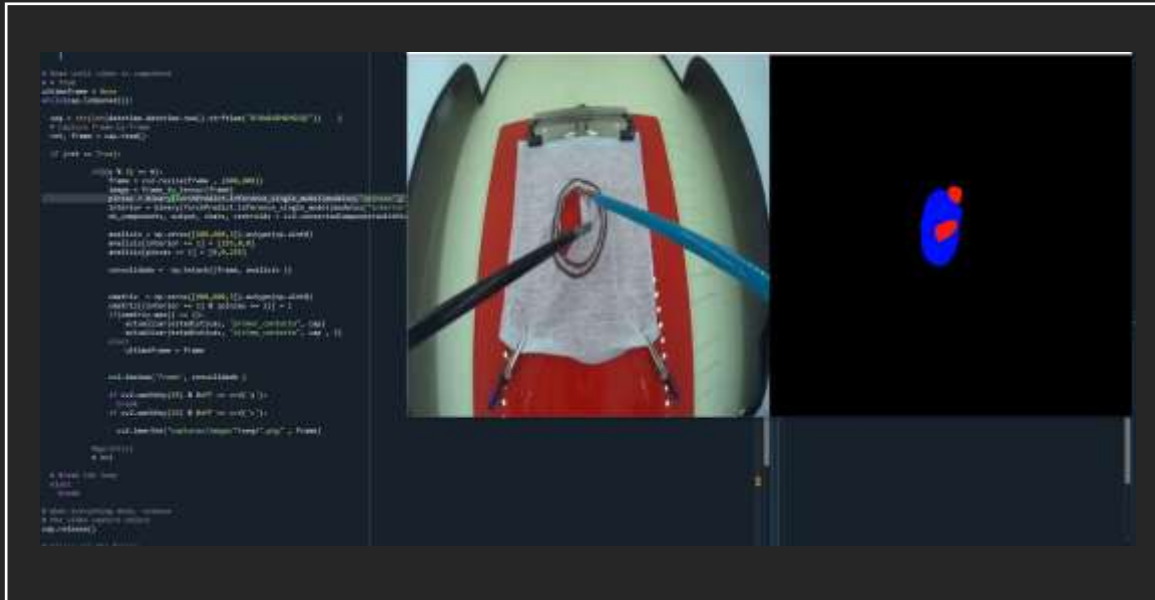
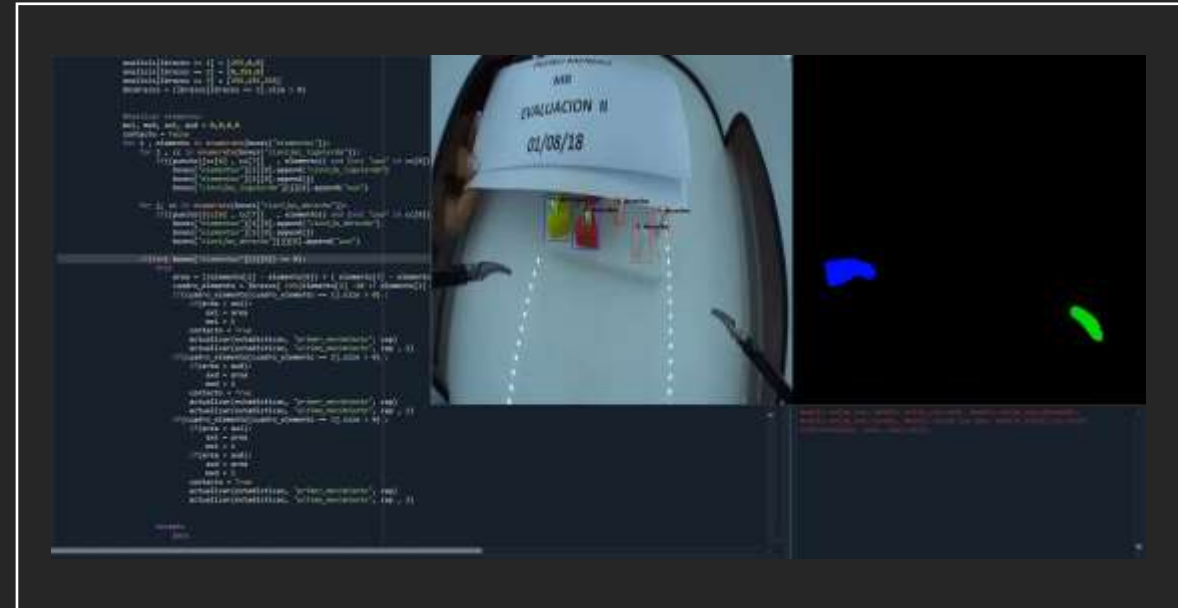
Feedbacks

00:35



# Artificial intelligence in laparoscopic simulation: A promising future for large-scale automated evaluations, Surgical Endoscopy 2022.

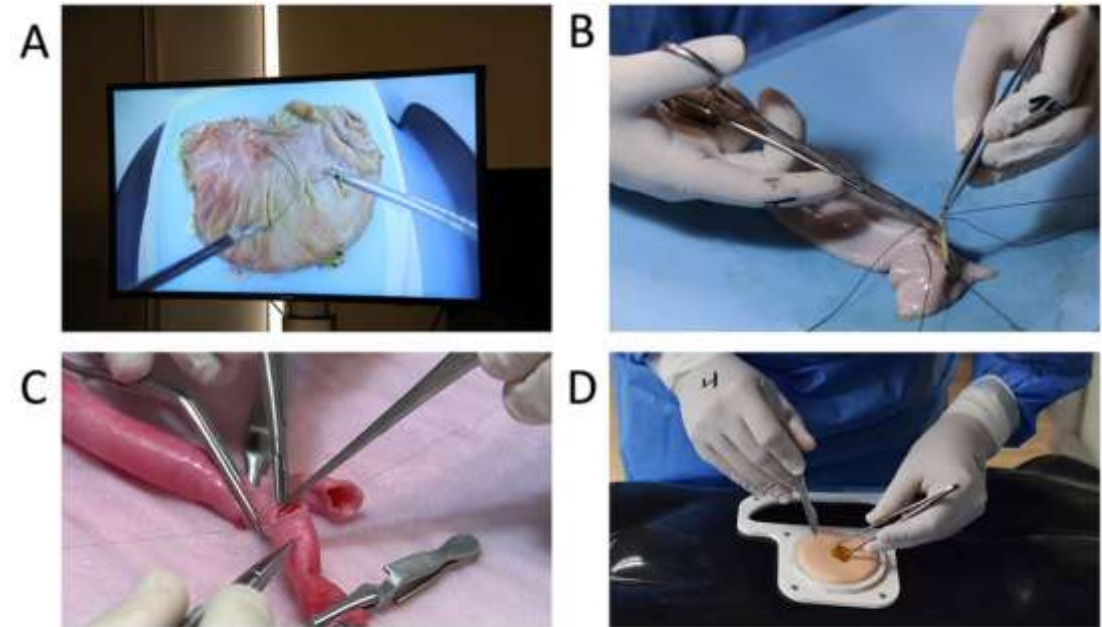
Belmar F, Varas J et Al.





## Towards online global certification of technical surgical skills: a viable and scalable method for assessing technical surgical skills objectively using remote technology

Francisca Belmar<sup>1</sup> · Iván Paul<sup>1</sup> · Catalina Ortiz<sup>1</sup> · Javier Vela<sup>1</sup> · Caterina Contreras<sup>1</sup> · Domenech Asbun<sup>2</sup> · Adnan Alseidi<sup>3</sup> · Gerald M. Fried<sup>4</sup> · Jeffrey Wiseman<sup>4</sup> · Gabriel Escalona<sup>1</sup> · Nicolas Jarufe<sup>5</sup> · Pablo Achurra<sup>1,5</sup> · Julián Varas<sup>1,5</sup>



**Fig. 1** Four of the seven OSCE stations: **A** Basic and advanced laparoscopic skills. **B** Intestinal anastomosis. **C** Vascular anastomosis. **D** End colostomy confection





# CIDOI Facultad de medicina UC

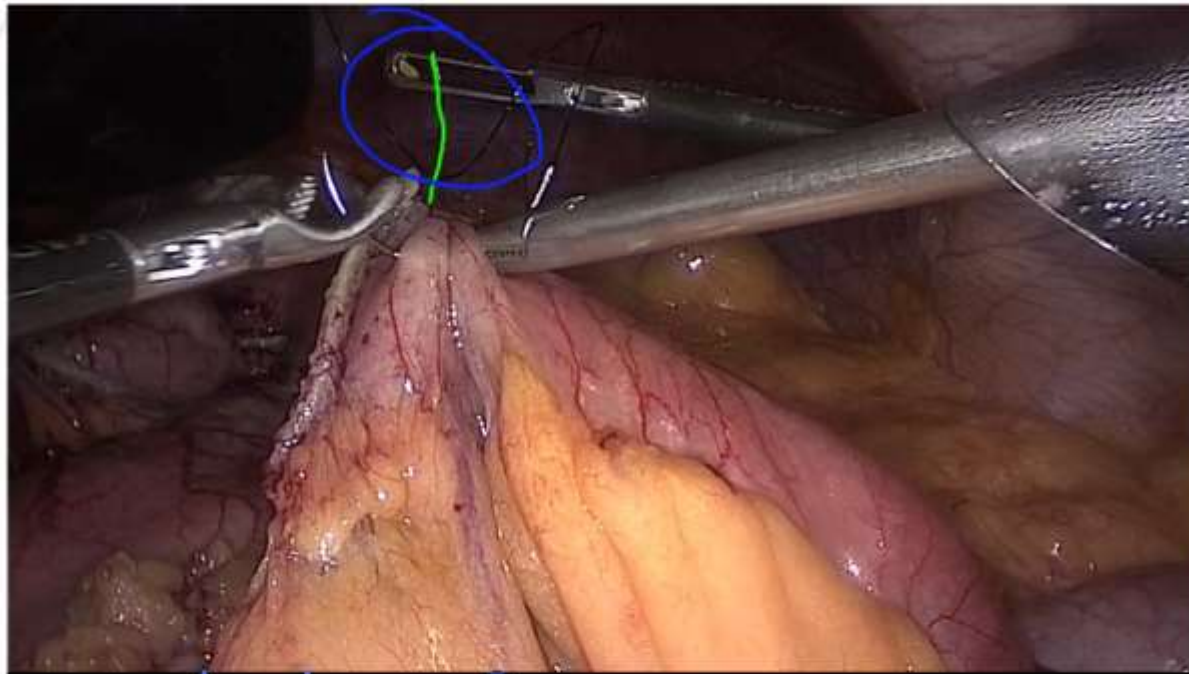


00:00:12/00:16:44



00:00:20/00:16:53





▶ 10 10 1+ 🔊 📺 00:38:13 / 01:32:28

### Score

### Feedback

- 1 00:15:36:156 📄
- 2 00:23:35:152 📄
- 3 00:38:13:811 📄 🏹

Consider techniques to retrieve the thread independently, reducing reliance on a helper.

🏹 ✖

Total 📄 0 📄 3 🏹 0 🏹 1

### Tiempos

🗑️ DELETE EVALUATION

💾 SAVE EVALUATION

📧 SEND EVALUATION







00:04:13/00:09:00



### Score

### Feedback

- 00:01:37
- 00:02:02 *20*
- 00:03:37
- 00:03:49 *20*
- 00:04:13 *20*

Buena tracción, la aguja entra casi en los 90°

*20*

- 00:04:33 *20*





# **Innovations in surgical training: exploring the role of artificial intelligence and large language models (LLM)**

***Inovações no treinamento cirúrgico: explorando o papel da inteligência artificial e dos grandes modelos de linguagem (LLM)***

JULIAN VARAS<sup>1</sup> ; BRANDON VALENCIA CORONEL<sup>1</sup> ; IGNACIO VILLAGRÁN<sup>2</sup> ; GABRIEL ESCALONA<sup>1</sup> ; ROCIO HERNANDEZ<sup>3</sup> ; GREGORY SCHUIT<sup>3</sup> ; VALENTINA DURÁN<sup>1</sup> ; ANTONIA LAGOS-VILLASECA<sup>4</sup> ; CRISTIAN JARRY<sup>1</sup> ; ANDRES NEYEM<sup>3</sup> ; PABLO ACHURRA<sup>1</sup> .



PENDIENTE



00:00:52 / 00:02:27

### Evaluación

### Feedback

4 00:00:44:232



5 00:00:52:744



Correcta posición del estabilizador, pero es importante que esto no haga que la toalla se quede casi fuera de la camilla. La toalla debe estar completamente apoyada en la camilla.



6 00:01:10:206



7 00:01:15:454



BORRAR EVALUACIÓN

GUARDAR EVALUACIÓN

ASISTIR

ENVIAR EVALUACIÓN





### Evaluación

### Feedback

6 00:01:10:206



Adecuadas instrucciones para el paciente, para realizar el ejercicio. ¡Esto es muy relevante para que pueda realizar el ejercicio de buena forma!



7 00:01:15:454



8 00:01:51:643



9 00:02:15:343



10 00:02:27:390



BORRAR EVALUACIÓN

GUARDAR EVALUACIÓN

ASISTIR

ENVIAR EVALUACIÓN

# C1DO1 LAPP

## Unsupervised Simulation with Remote & Asynchronous Feedback

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