A Smartphone Application for the Implementation of Self-Driven Learning of Laparoscopic Skills for Surgeons

Lina Ngao, Jennifer Schultz, Zachary Plona MD, Hunter Hutchinson, Benjamin Monteagudo, Josh Nakka, Youseph Yazdi PhD, Soumyadipta Acharya MBBS

Center for Bioengineering Innovation and Design, Biomedical Engineering, Whiting School of Engineering

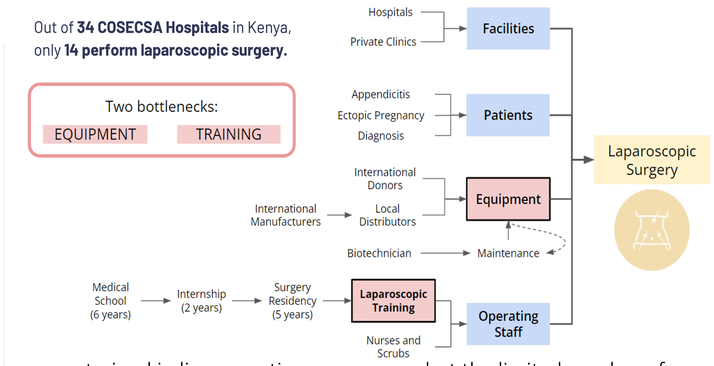
Johns Hopkins University

Introduction

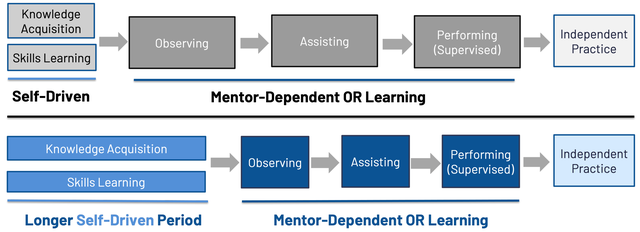
Laparoscopic surgery, or minimally invasive surgery (MIS), is a type of surgical procedure which allows surgeons to access the internal abdomen and pelvis without creating a large incision. Laparoscopic surgery has numerous known benefits compared to open surgery, including cost-effectiveness to the health system, faster patient recovery times, and decreased scarring, morbidities and complications. Accordingly, it is the standard of care in many countries around the world.

LaparoscopiX is working in collaboration with mentors from COSECSA (College of Surgeons of East, Central, and Southern Africa) to achieve its mission of increasing global access to safe and effective surgery by initially expanding upon laparoscopic surgical training in Kenya.

There are numerous bottlenecks in place stifling the adoption of MIS in Kenya, with the two most prominent barriers being the lack of equipment and the lack of laparoscopic surgical training, specifically trained mentors to teach the next generation how to perform MIS.



Traditionally, surgeons are trained in live operating room cases, but the limited number of cases and mentors inhibit the number of surgeons that can be trained using this apprenticeship model. Consequently, simulation and skills training to amplify the self-driven learning period and decrease the mentor-dependent period in the operating room has been increasingly utilized as part of surgical training.



Methods

Half the team travelled to Kenya to perform ethnographic research and gain an in-depth understanding of the landscape in order to develop a suitable solution to the lack of MIS adoption in Kenya.
The trip revealed a number of key insights:

1. There is a lack of incentive to perform laparoscopic training in the free time
2. There is a high learning curve to becoming proficient at MIS
3. It is difficult for residents to gain enough confidence to perform MIS on their own

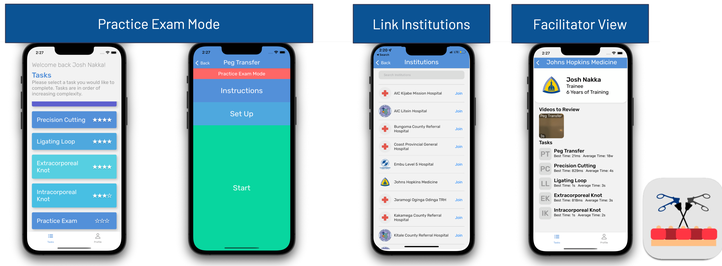
A solution landscape analysis was performed in order to determine the gaps in the existing solutions.

	FLS Curriculum	Homemade Trainer	Training Camps	Touch Surgery	YouTube	LAPAROSCOPI
Fun to Use	×	×	✓	✓	×	✓
Retains Users	×	×	×	×	×	✓
Low Cost	×	✓	×	✓	✓	✓
Teaches Surgical Skills	✓	✓	✓	×	×	✓
Tracks Progress	×	×	×	×	×	✓

Results

LaparoscopiX is an app that acts as a companion for trainees by virtualizing the apprenticeship model and enabling self-driven learning of key laparoscopic skills. It guides users through a gamified version of the FLS curriculum to build their practical skills by tracking their progress and improvement over time, thus reinforcing regular practice habits.

The app consists of key features such as a “facilitator view” to provide feedback, Practice Exam Mode, and the linkage of their account to their hospital to share results with peers. Completion of the FLS skills that has been mentor-approved with LaparoscopiX grants trainees with a recognized certificate which can serve as a proof of competency for laparoscopic surgery, as well as potential prizes and benefits to their institution, such as new equipment, to further incentivize users to stive for completion.



Conclusion & Acknowledgements

In conclusion, LaparoscopiX aims to increase access to laparoscopic training by decreasing the number of cases needed to gain competency through skills training. A global IRB application is currently in process for the next CBID team inheriting this project and perform a LaparoscopiX usability study with surgical residents in Kenya. Finally, future iterations of the app plans to incorporate automated skills tracking and evaluation of key surgical skills by using artificial intelligence to analyze performance of key maneuvers. This would provide more feedback, help solve the issue of lack of mentors and take the burden off mentors.

We want to extend a special thank you for your help and support to our advisors Dr. Harshad Sanghvi, Dr. Pankaj Jani, Dr. Rafique Parkar, Dr. Lance Mayabi, Dr. George Orerah, Dr. Raymond Price, Dr. John Varallo, Dr. Daniel Rhee, Dr. Youseph Yazdi, and Dr. Soumya Acharya.

Please contact Jennifer Schultz for any questions at jschul37@jhu.edu.