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*Abstract*

# Insights into a student-managed surgical simulation laboratory - SimLab

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Teaching surgical skills remains a recognized area for improvement in medical education. At the University Medical Center Hamburg-Eppendorf, the student-managed simulation laboratory SimLab – Students for Surgery complements curricular teaching by offering an educational platform that supports the acquisition of basic surgical skills, facilitating the transition to clinical internships and residency for medical students. The SimLab – students integrate 3D printing and silicone casting to realistically simulate surgical scenarios such as appendectomies, and congenital anomalies. This interdisciplinary approach enhances extracurricular teaching and preoperative preparation through clinical collaboration.

This study evaluates the efficacy and impact of this student-centered approach —including models and curricula—on surgical education, student motivation for surgical careers, and clinical utility. It particularly explores how active student involvement in simulation design and teaching influences learning outcomes and the development of professional identity, offering insights into the creation of similar laboratories.

SimLab offers a peer-taught laparoscopic skills course. Advanced surgical simulations are developed by students using expert feedback following ethical approval (2023-300376-WF). Patient-specific models are derived from CT data or designed with open-source software (3D-Slicer, Shapr3D, Fusion 360). These are either 3D-printed (BambuLab, Creality Ender) in PLA or cast in silicone (Ecoflex), incorporating continuous clinical feedback. Final prototypes are integrated into peer-teaching and evaluated through subjective student feedback and objective metrics.

Over 150 students have completed SimLab's basic laparoscopy training, demonstrating clear improvements in surgical skills and reporting high satisfaction with training quality and feasibility. Initial impressions suggest that students involved in development and instruction gained a stronger sense of ownership and confidence. Likewise, the clinical use of 3D-printed preoperative models appears to support surgical planning and patient communication, though these observations are not yet validated by systematic data.

SimLab represents a scalable, ethically sound, and cost-effective model for surgical education, serving both as an educational platform and as a catalyst for cross-faculty exchange and the broader integration of technologies across all areas of medical education. Through the integration of peer-led learning, the application of production techniques and clinical collaboration, it can serve as an example for similar initiatives in other medical institutions seeking to improve student teaching and self-efficacy, as well as surgical preparation and patient care outcomes.

**AUTHOR'S STATEMENT**

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