

A Cross Sectional Study on Determining the Perception of Fourth Year Medical Students Towards Their Surgical Training Conducted Through an Enriched Virtual Mode-Hybrid Learning in a Philippine Medical School



Kayne Irish P. Hernandez, Lianne Gabrielle R. Hernandez, Timothy Matthew S. Hernandez, Ma. Veronica M. Holganza, Joaquin R. Ignacio, Ida Marie M. Tabangay-Lim, MD, Charles Abraham Villamin, MD, Jan Michael Lleva, MD, Angelica Guzman-Hernandez, MD, Warren Bacorro, MD

ABSTRACT

Practice-based learning is the key objective of postgraduate education. COVID-19 has revealed that medical institutions may need to adopt adaptive strategies to guide their students. The aim of this study is to describe the perception of Philippine medical clerks towards their surgical preparedness with an Enriched Virtual Mode (EVM)-Hybrid Learning during the pandemic. A cross-sectional survey was conducted among 176 fourth-year students using a 21-item 4-point-Likert questionnaire. Descriptive

analysis showed that students sustained a strong enthusiasm for surgery (composite mean = 2.83 ± 0.62), with the highest ratings given to skill-oriented subjects, such as practical minors (3.05 ± 0.82) and clinical surgery (3.03 ± 0.78). Preparedness was similarly high (3.17 ± 0.46): practice was regarded as essential (3.50 ± 0.68) and operating-room exposure useful (3.22 ± 0.68), though time for hands-on practice was adequate (2.84 ± 0.74). Preference scores revealed a desire for richer tactile experience (3.36 ± 0.37), with scrubbing, suturing and live surgery observation receiving most support (>3.50). Overall satisfaction reached a moderate-to-high level (2.99 ± 0.48) but lagged behind interest and preparedness, indicating that limited physical immersion tempered fuller contentment. These suggest that while a blended curriculum can preserve enthusiasm and sense of readiness, emphasis on protected skills laboratories and increased exposure to the operating room may be needed to translate conceptual competence into experiential fulfillment.

✉ Lianne Gabrielle Hernandez
liannehernandez98@gmail.com

Department of Clinical Epidemiology, Faculty of
Medicine and Surgery, University of Santo Tomas,
Manila, Philippines

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RESEARCH QUESTION

What is the perception of fourth year medical students who received surgical training under Enriched Virtual Mode-Hybrid Learning during the COVID-19 pandemic on their surgical preparedness and skills during surgical rotation?

INTRODUCTION

Practice-based learning is one of the key objectives of medical school teaching and training. According to the World Health Organization, social accountability of medical schools is defined by their obligation to direct education, research and service activities in addressing priority health concerns of the community, region and nation they serve.[1]

The current pandemic has affected the quality of medical teaching and training courses due to the shift of teaching methods to an online platform. Disruption in training could disadvantage medical trainees if online teaching methods are deemed insufficient, causing inadequate practical experience and training. The fast spread of the virus has impeded lectures delivered in physical classrooms, causing a dwindle in education, which consists mostly of lecture and patient-based processes and the pandemic has revealed that medical institutions and universities may need to adopt flexible and adaptive training strategies to guide medical students.[1]

Another viewpoint, however, argues that online education may be beneficial in medical education. The use of technology and its advancements has evolved along with growth of the surgical curriculum leading to the incorporation of internet platforms and pioneering devices in novel teaching methods. This has pioneered its way for professional training such as surgical procedures, which is also described to be inexpensive and decreases distance restraints. [2]

Enriched Virtual Mode (EVM)-Hybrid Learning, a form of blended learning, is an educational platform consisting of online and onsite teaching with physical presence of the instructor and students. This has been claimed to be more effective than non-blended instruction or as effective in acquiring knowledge in the health-professional education. Education in this field is also aided by the use of social networks to disseminate peer-to-peer information and for the management of institutional knowledge.[2]

According to a study conducted by AlQhtani, et al.,[3] in 2021, a large number of students were satisfied with virtual-based lecture classes, however, this cannot completely replace in-person classes due to phenomena like Zoom fatigue. Despite the availability of learning materials online for students to access, there are significant challenges presented by the pandemic that decreased the confidence of students in the materials that they have learned. It was also mentioned that the majority of students who had virtual clinical rotations did not agree that the course content that they were learning was sufficient to prepare them for clinical practice. A majority disagreed that the skills and content learned while

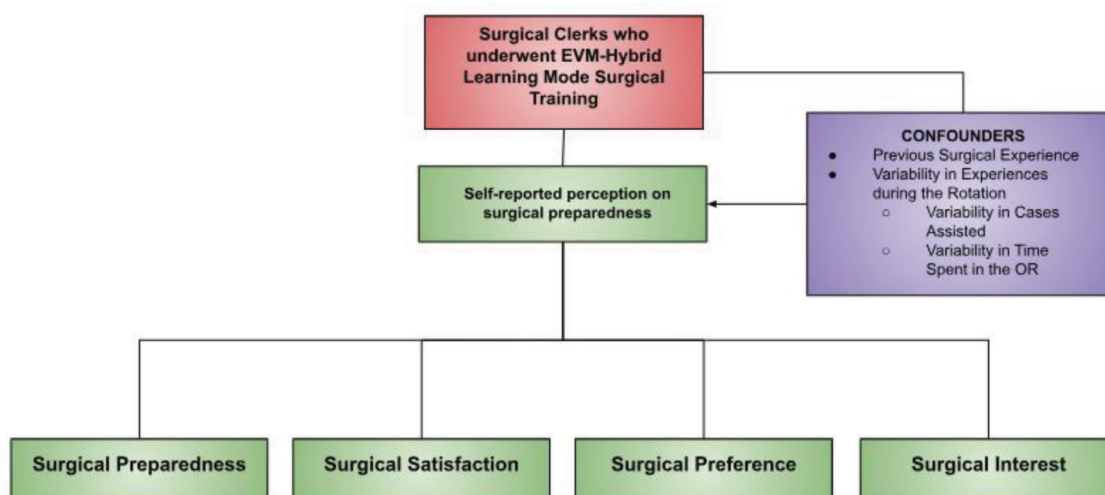


Figure 1: Conceptual Framework of the Study

on clinical rotations would help them discern their desired specialty.

The aim of this study was to determine the perception of medical students towards their surgical preparedness with an EVM-Hybrid Learning during the COVID-19 pandemic. It opts to determine the level of interest and preference of surgical clerks towards hands-on practice in teaching surgical training during the COVID-19 pandemic, level of satisfaction of surgical clerks towards EVM-Hybrid Learning mode surgical training and determine the level of surgical preparedness of clerks with regards to their surgical rotation.

The COVID-19 pandemic has greatly caused a shift in learning from the traditional classroom setup to an online platform of delivery. Even with limitation of exposure, students are still able to learn anatomy and surgical education through distance learning. [4] However, practice-based learning is still the foundational objective of postgraduate teaching and this would enhance the skills and competencies of healthcare professionals in the time of the pandemic. New learning modalities that involve use of the internet may be used to deliver lectures or tutorials via laptops or smartphones. Training programs may also include teleconferencing, webinars, online videos, while participants may involve themselves in online discussions which may strengthen their learning.

The pandemic has revealed that medical institutions and universities may need to adopt flexible, creative and responsive training strategies to guide the next generation of doctors.[1] With the unforeseen worldwide disruption of education, medical schools quickly shifted to a virtual mode of teaching system. However, despite an exponential innovation throughout the decades, information and technology remains to be challenging, particularly in medical students who are required to adapt to the rapidly evolving informatics competency requirement.[5] Clinical subjects, like surgery, greatly depend on the conventional teaching methods like bedside and classroom teachings. This plays a vital role in honing higher-order cognitive skills. On the other hand, online learning assumes a big role in medical teaching, especially in the future. The virtual resources for medicine have expanded rapidly, with mobile and computer tools for learning being more accessible.[3]

Studies have shown that basic surgical skills such as incision, suturing and knot-tying can be taught effectively through online means, with no significant differences between the online-teach group and those who received education face-to-face.[6] Furthermore, the perception of students for online learning was mostly positive, as they found it to be an effective and good alternative, with no difference in postsurgical course exam results between the two groups.[7] Skills proficiency in basic surgical skills were also determined to have no significant difference between the two groups, thus establishing video-based education as equivalent to face-to-face in terms of confidence and satisfaction rates, with additional benefits of video-based learning including convenience, accessibility and efficiency.[8] On the contrary, in a study conducted by Sansoni, et. al.,[9] surgical students were seen to prefer hands-on practice, as their overall attitude included the possible additional benefit of inclusion of suturing, scrubbing and good surgical practice workshop, along with OR experience that would facilitate better learning of surgery.

Cultural and socioeconomic differences, as well as discrepancies in how the COVID-19 pandemic was handled in relation to other countries and the Philippines could be a differentiating factor in the perception of online surgical education among students. There is a gap in knowledge on how these outcomes would apply in a Philippine context, or if these types of questions would be valid in the Philippine education setting. Thus, a study to validate the content of this questionnaire in a Filipino setting is necessary to shed light upon the impact of online surgical training on the performance of current surgical clerks.

METHODS

Study Design

The appropriate research design for this study was a quantitative descriptive observational cross-sectional study. The objective of this study was to determine the perception of fourth year medical students towards their surgical training conducted through enriched, virtual mode-hybrid learning.

This study design fits as the researchers will be using the questionnaire to assess the perception on surgical readiness and skills of 176 surgical clerks of

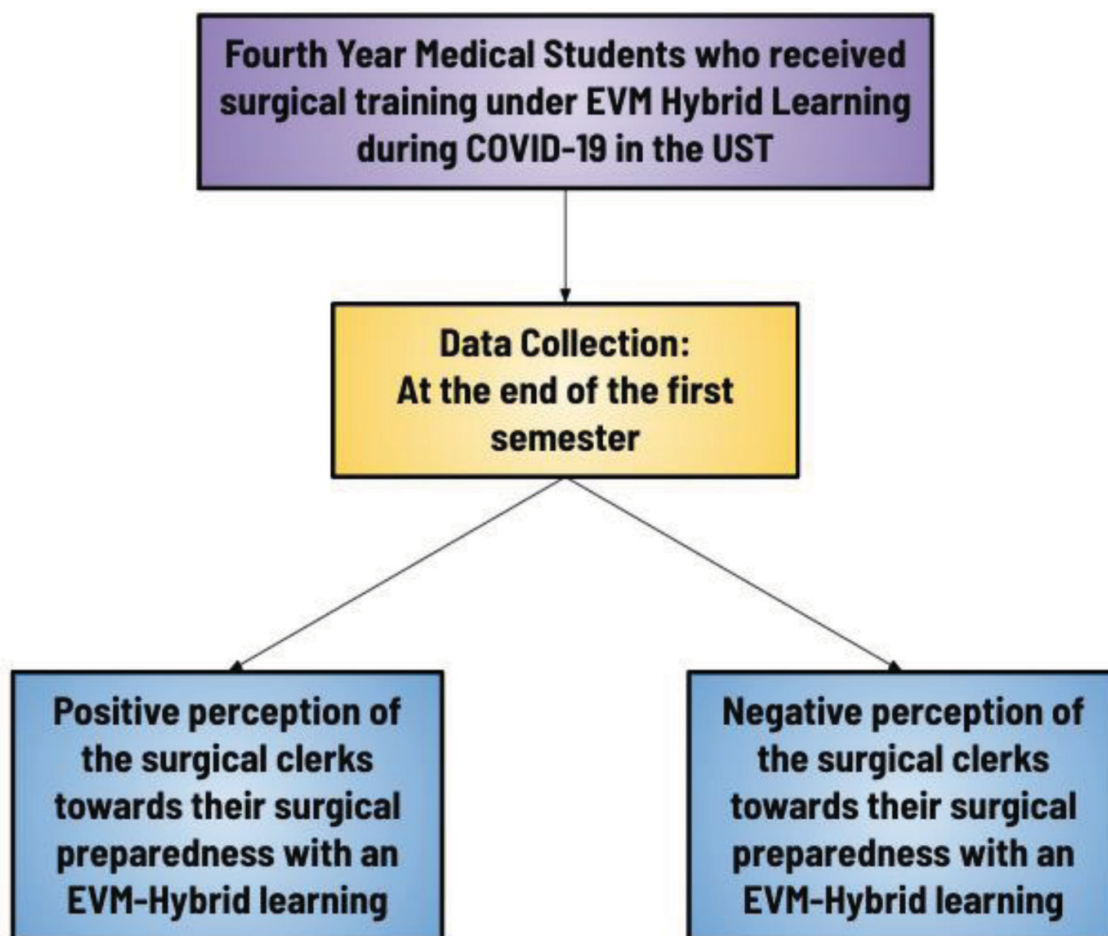


Figure 2: Quantitative Descriptive Observational Cross-sectional Study Design

the university. The data will be collected at one point in time, specifically at the end of the first semester, after the clerks have undergone their rotations in the surgery department. An observational type of study was chosen, as opposed to an interventional type, mainly due to it being a more ethical and feasible approach. Moreover, a cross-sectional design was utilized as data will be directly recorded and obtained at present. Cross-sectional studies are non-experimental in nature, which means that it has a low potential to be harmful and unethical.

Study Population

The study's population would revolve around a single Philippine university's medical students who are in their fourth (4th)/clerkship year and experienced EVM-Hybrid Learning of Surgery I and/or II courses during the pandemic. Survey questionnaires will be disseminated among the fourth year clerks Batch 2025.

Participants will be included in the study if they meet the following inclusion criteria: (a) Batch 2025 fourth

year medical student in their clerkship, (b) enrolled in the Philippine medical school under study, and (c) underwent Surgery I and/or II course/s via EVM-Hybrid Learning. On the other hand, participants will be excluded if they are: (a) not a fourth year medical student in their clerkship, (b) not enrolled in the Philippine medical school under study, and (c) underwent purely onsite/face-to-face learning for the Surgery I and/or II course/s.

Operational Definitions

POPULATION

Surgical Clerk: Fourth year medical student from Batch 2025 who has undergone surgical clerkship at the university under study and underwent Surgery I and/or II course/s via EVM-Hybrid Learning.

INTERVENTION

Enriched Virtual Mode-Hybrid Learning (EVM): Alternating online and face-to-face mode

of instruction as implemented by the medical school under study

Onsite/face-to-face (F2F) learning:

Traditional mode of learning in which course and training was delivered fully in-person

OUTCOME

Surgical Preparedness: Participant perception on the usefulness of knowledge learned via EVM-Hybrid mode of instruction of surgery I and II courses when applied to their surgical clerkship.

Surgical Satisfaction: Participant perception on their contentment with the EVM-Hybrid Learning mode of instruction of surgery I and II courses, sufficiency of the surgical clerkship program as a whole and the overall impact of the COVID-19 pandemic on their perceived quality of surgical education.

Surgical Preference: Participant perception or liking for certain elements relating to their surgical training experience via EVM-Hybrid mode of instruction and their experience during the surgical clerkship program.

Surgical Interest: Participant perception on their level of intrigue regarding surgery as an overall topic before and after partaking in surgical clerkship.

Sampling Design and Sample Size Calculation

To ensure both completeness and compatibility of data to be gathered over time, considering cost-effectiveness, feasibility and limitation of time during data collection given that the study population consists of fourth year medical students from Batch 2025 at the time of their clerkship, non-probability purposive sampling would be used. Purposive, non-probability sampling is a technique wherein the subjects to be surveyed are selected according to the expert opinion of an investigator or researcher as to who they deem could be the best samples in the study, rather than through random selection. This method aims to select people who serve a certain purpose or reason in the completion of the study. In this case, the research would mainly focus on comparing surgical preparedness of surgical clerks who underwent hybrid surgical training and with clerks who underwent their surgical training face-to-face.

The OpenEpi Sample Size: Cross sectional, Cohort and Randomized Clinical Trials software was used to calculate the sample size for this study. The

following parameters were used in the calculations: two-sided significance level = 95, power = 80, ratio of sample size = 1, percent of unexposed with outcome = 5, percent of exposed with outcome = 20, odds ratio = 4.8, risk/prevalence ratio = 4, risk/prevalence difference = 15. The values for parameters of percent unexposed and exposed with outcome was taken from a study included in literature review.[9] The calculated total sample size resulted in 176 surgical clerks.

Study Procedure

The study's population would revolve around medical students who are in their fourth year or clerkship period and experienced (EVM)-Hybrid Learning of Surgery I and/or II courses during the pandemic. The participant will be asked to answer a revised version of the questionnaire constructed by Sansoni, et. al.,[9] in 2022. Revisions were made based on the jurisdiction of the research group that made it applicable so that the results would be reported on a 4-point Likert scale. The questionnaire will then be disseminated online via Google Forms.

Participants will be included in the study if they meet the following inclusion criteria: (a) Batch 2025 - fourth year medical student in their clerkship, (b) has undergone their surgical clerkship rotation, (c) is from the Philippine medical school under study, and (d) underwent Surgery I and/or II course/s via EVM-Hybrid Learning.

Participants will be excluded from the study if they are: (a) not a fourth year medical student in their clerkship, (b) has not yet undergone or are currently undergoing their surgical clerkship rotation, (c) not from the Philippine medical school under study, and (d) underwent purely onsite/face-to-face learning for the Surgery I and/or II course/s.

The recruitment process for the study targeting fourth-year medical students involves several key steps. Initially, an announcement was made detailing the study's objectives and participant criteria, which was mainly disseminated through social media platforms. Once eligible participants were identified, they were approached by the researchers, either through face-to-face interaction or online social media and briefly made aware of the study objectives and informed consent process, ultimately leading to completion of the survey questionnaire. Participants were required to provide informed

consent before proceeding to complete the survey questionnaire constructed by Sansoni, et. al.,[9] in 2022, which was disseminated online via Google Forms. Researchers would ensure that participants understood the study's objectives, procedures and their rights as participants before they consent to take part. Survey responses were collected within a specified timeframe, and thorough data analysis conducted to identify trends and insights regarding participants' experiences with EVM-Hybrid Learning for surgical courses. Lastly, following data collection and analysis, the study findings were compiled into a comprehensive report or manuscript.

The information collected would be handled as recommended by the Data Privacy Act of 2012. The data would be stored in a private Google drive that will only be accessible by the researchers. Furthermore, once the study has been concluded, permanent deletion of the data will be done.

Outcome to be Measured

The participants would be asked to answer the survey assessing the preference and satisfaction on how surgical topics are taught in the university among medical clerks who underwent the EVM-Hybrid Learning setting implemented by the institution. The main outcome to be measured would be the perception of fourth year students or medical clerks towards their surgical preparedness with an EVM-Hybrid Learning implemented by the medical school's curriculum. The main parameters involved in the study would be the surgical clerks' opinion on their surgical training and their interest towards surgery, all of which would be reflected in the questionnaire given.

The questionnaire was adapted from the study by Sansoni, et. al.,[9] in 2022. The items of the questionnaire were paraphrased to include a 4-point Likert scale and reorganized into four main parts, namely: (1) Surgical Preparedness, (2) Surgical Satisfaction, (3) Surgical Preference, and (4) Surgical Interest. The revised questionnaire was made up of 21 questions that include 2 questions regarding the age and sex of the patient. The rest of the items were categorized under Part 1: Surgical Interest, Part 2: Surgical Preparedness, Part 3: Surgical Preference, and Part 4: Surgical Satisfaction. The original 5-point Likert scale was changed into a 4-point scale to

avoid bias that comes with using a neutral midpoint. The rest of the questions were paraphrased in order for it to be answerable using the Likert scale. The questions were reworded in such a way that it would still reflect the content of the original questions. Based on our current study, the decision to remove two questions was made as they were specific to an Italian population (eg, "Are you an Italian citizen", and "At what region is the university located?"). We will instead be substituting these questions with "Are you a Filipino citizen?" and "Are you a student of this institution?", respectively. Alterations to the questionnaire were based on acquiring the interrater reliability between three surgical faculty members of the medical school, who rated the relevance of the questions as relevant or non-relevant. Fleiss coefficient revealed a value of 0.113, which proved slight agreement during this first round. A second round of rating by the surgical faculty members was done with the adjusted questionnaire, which showed an almost perfect strength of agreement with unanimous results.

Statistical Analysis

Data collected from the online survey were encoded and processed using Microsoft Excel. The analysis was limited to descriptive statistics, in accordance with the IRB-approved protocol. No inferential statistical tests were conducted.

Measures of central tendency and variability were computed for each survey item and each of the four pre-identified domains: surgical interest, surgical preparedness, surgical preference and surgical satisfaction. Specifically, mean scores were used to represent the average perception of respondents per item, while standard deviations were used to reflect the dispersion of responses around the mean.

Composite mean scores and standard deviations were calculated for each domain by averaging responses across all items that fell under the respective category. This allowed for comparison of overall trends across domains, although no statistical comparisons between groups were made.

Likert responses were interpreted based on a 4-point scale, with higher scores reflecting greater levels of agreement, interest, satisfaction, or perceived preparedness, depending on the item. The verbal interpretation of scores followed pre-

established cutoffs specific to each domain as defined in the questionnaire rubric.

considerations are rigorously met and participant welfare prioritized.

Data Collection

The chosen method for data collection was to use a quantitative self-reported questionnaire via Google Forms. Specific measures will be enforced to ensure safety and privacy of participants. The data collected from this research will be handled as recommended by the Data Privacy Act of 2012. The data will be kept in a private Google drive that will only be accessible by the researchers. No personal information will be shared to anyone outside of the research team. Furthermore, once the study has been concluded, permanent deletion of digital data will be implemented, as well as shredding of physical data containing information given by the participants, if any. The data collected will be kept private. Any information will be submitted in an encrypted format, identified with a number on it instead of their name. The researchers will only know what the designated number is and will lock the information in a private Google drive.

Ethical Considerations

The study will ensure participants’ anonymity and confidentiality by securing informed consent, using no personal identifiers in reports, storing data on password-protected and cloud-backed systems, and allowing subjects to skip questions or withdraw their responses. Our study had been approved by the Institutional Review Board of the medical school participating in the study, ensuring that all ethical

RESULTS AND DISCUSSION

This study sought to describe the perceptions of fourth-year medical students regarding their surgical training under the EVM-Hybrid Learning framework during the COVID-19 pandemic. The analysis focused on four key domains: surgical interest, surgical preparedness, surgical preference and surgical satisfaction. These dimensions were evaluated using a self-administered questionnaire adapted from Sansoni, et. al.,[9] in 2022, revised to reflect the local academic context and measured on a 4-point Likert scale.

Descriptive statistics were employed to assess central tendencies and variability in responses, in alignment with the study’s approved design and objectives. No inferential statistical tests were performed. The results presented below reflect the aggregated perceptions of 176 respondents, who had completed their surgical clerkship rotations and participated voluntarily in the survey.

As shown in Table 1, participants consistently reported high levels of interest in surgery. At the time they entered medical school, respondents already demonstrated considerable interest in the discipline, which was sustained—and slightly increased—following completion of their surgical rotation. Practical minors/skills and clinical surgery emerged as the most engaging subdomains, both scoring above 3.0 on average.

The sustained high levels of interest observed throughout all measured aspects suggest that

Table 1: Descriptive Statistics – Surgical Interest

	Mean	SD	Interpretation
How interested were you in surgery when you started medical school?	2.6705	1.03340	Very Interested
How interested are you in surgery now that you are done with your surgical rotation?	2.7330	.92720	Very Interested
How interested are you in the surgery course Principles of Surgery?	2.7159	.86782	Very Interested
How interested are you in the surgery course Practical Minor/Skills?	3.0455	.81988	Very Interested
How interested are you in the surgery course Clinical Surgery?	3.0341	.78484	Very Interested
How interested are you in pursuing a career in surgery after your experiences in the OR?	2.7955	.94608	Very Interested
Composite Domain	2.8324	.61654	Very Interested

Scale: 1.00-1.50 Not at all interested; 1.51-2.50 Somewhat interested; 2.51-3.50 Very interested; 3.51-4.00 Extremely interested

the hybrid format was effectively perceived by students as maintaining their initial enthusiasm. This observation aligns descriptively with previously documented experiences from other hybrid-learning settings discussed in recent medical education literature, reinforcing the idea that medical students remain positively engaged with surgical topics even in modified educational environments.

Similar findings were noted by Wu, et. al.,[6] in 2021 and Pintér, et. al.,[7] in 2022, where distance and video-based learning methods were shown to retain student engagement when combined with meaningful surgical content. In contrast, Sansoni, et. al.,[9] in 2022 reported a stronger preference among students for hands-on exposure despite being satisfied with theoretical instruction. The consistency of interest in this study—particularly the high scores for practical minors/skills and clinical surgery—suggests that the experiential elements of the university’s hybrid model may have been critical in keeping surgical topics engaging. Although the current study does not explore causality or long-term career outcomes, the observed interest levels may be useful in gauging how hybrid learning formats could influence future specialty inclinations, particularly if supported by strong clinical reinforcement. The findings highlight the importance of preserving immersive surgical content, even in restructured or remote formats, to sustain enthusiasm that might eventually translate into career pathways in surgery.

In Table 2, the data revealed that students generally found their hybrid surgical training experience to be very useful. Many respondents strongly agreed that practice was essential to learning surgery, and most viewed both their surgical rotation and OR activities as notably useful in preparing them for clinical responsibilities. Although the sufficiency of practice

hours received slightly lower scores, the average response still reflected a favorable perception.

The overall mean score of 3.16 across this domain indicated that participants found the hybrid curriculum very useful in preparing them surgically. The descriptive results highlight that while respondents highly valued practice-oriented elements, such as OR participation, there was acknowledgment that improvements could be made in the number of practical hours provided. These findings closely mirror descriptive reports from international literature where medical students frequently express appreciation for the practical components of their curricula and similarly suggest areas that might enhance their hands-on experience.

This pattern is consistent with the WHO’s directive on the role of medical schools in addressing community health needs through education that emphasizes practical competence.[1] In that light, the high rating for practice being essential reflects not just a student preference, but alignment with global expectations for hands-on clinical readiness. The study by AlQhtani, et. al.,[3] in 2021 further reinforces this, as their respondents—despite access to virtual learning—expressed reservations about the sufficiency of clinical training, with many reporting diminished confidence in their preparedness.

Similarly, while students in this study rated their hybrid training positively, their slightly lower score for the sufficiency of practice hours could be seen as a parallel concern. Although causality cannot be inferred, findings may serve as a signal that while the current hybrid structure supports surgical learning to a considerable extent, future implementations may benefit from deliberately reinforcing procedural exposure to ensure that students feel fully equipped for real-world clinical demands.

Table 2: Descriptive Statistics – Surgical Preparedness

	Mean	SD	Interpretation
To what extent do you agree that practicing is essential for learning surgery?	3.5000	.67612	Very Useful
How useful was the surgical rotation you have completed in your learning experience?	3.1023	.70976	Very Useful
To what extent do you feel that your surgical courses have provided sufficient hours of practice to prepare you effectively?	2.8352	.73376	Very Useful
How useful was your participation in University-organized operating room (OR) activities in enhancing your surgical preparedness?	3.2216	.67763	Very Useful
Composite Domain	3.1648	.46196	Very Useful

Scale: 1.00-1.50 Not at all useful; 1.51-2.50 Somewhat useful; 2.51-3.50 Very useful; 3.51-4.00 Extremely useful

Table 3: Descriptive Statistics – Surgical Preference

	Mean	SD	Interpretation
The lectures included in the curriculum should be more interactive.	3.3068	.59249	Agree
The surgery courses in the university should increase the number of credits dedicated to surgical courses.	2.9830	.71294	Agree
The curriculum should increase the frequency of attendance to surgical wards.	3.1534	.75160	Agree
The number of opportunities to observe live surgeries should be more frequent.	3.5114	.53440	Strongly Agree
The curriculum should include suture courses.	3.5455	.54320	Strongly Agree
The curriculum should include scrubbing and OR good practice training.	3.5568	.54212	Strongly Agree
There should be more surgery related electives and/or extracurricular activities.	3.4602	.61282	Agree
Composite Domain	3.3596	.37401	Agree

Scale: 1.00-1.50 Strongly disagree; 1.51-2.50 Disagree; 2.51-3.50 Agree; 3.51-4.00 Strongly agree

Table 4: Descriptive Statistics – Surgical Satisfaction

	Mean	SD	Interpretation
How satisfied are you with the amount of time you spent in the OR?	3.0568	.60205	Satisfied
How satisfied are you with the topics taught to practice surgical skills in the curriculum?	3.0682	.56154	Satisfied
How satisfied are you with the number of hours of practice included in your surgical courses done so far?	2.9943	.62790	Satisfied
How satisfied are you with the quality of teaching of surgical topics during COVID-19 pandemic?	2.8466	.71257	Satisfied
SURGICAL SATISFACTION (Composite Domain)	2.9915	.47577	Satisfied

Scale: 1.00-1.50 Very unsatisfied; 1.51-2.50 Unsatisfied; 2.51-3.50 Satisfied; 3.51-4.00 Very satisfied

Table 3 outlines the participants' preferences regarding potential improvements to the surgical curriculum. The strongest agreement was observed for proposals to include scrubbing and OR good practice training, the addition of suture courses and increased opportunities to observe live surgeries—all scoring above 3.50. This suggests that students strongly agreed with the need to expand hands-on experiential components within the hybrid learning environment. Meanwhile, statements advocating for more interactive lectures, additional ward exposure and increased elective offerings also garnered broad agreement, though slightly lower in magnitude.

The composite domain mean of 3.36 indicated a clear agreement among participants regarding proposed curriculum enhancements. Students specifically expressed stronger support for activities emphasizing practical surgical skills and direct OR exposure compared to suggestions related to increasing credits or theoretical teaching methods. These descriptive findings resonate with earlier reports from surgical education studies during the pandemic, which noted similar student preferences

for integrating more hands-on clinical training within existing curricula.

The results align closely with the findings of Sansoni, et al., [9] in 2022, where students strongly endorsed the inclusion of additional skills-based modules such as suturing, scrubbing and structured OR practice. Similar sentiments were echoed in El Boghdady, et al., [2] in 2019, who advocated for blended learning models that integrate emerging technology with real-time, immersive training. The high agreement observed in this study reinforces the idea that students place substantial value on physically engaging components of surgical education. Such a pattern suggests readiness among students to engage more deeply with surgery when given tactile, participatory opportunities—something that creators of the curriculum may consider in future reforms or enrichment efforts to balance theoretical instruction with active clinical immersion.

As shown in Table 4, student satisfaction with their surgical training through the EVM-Hybrid model was consistently moderate to high. Respondents expressed general satisfaction with the amount of

time spent in the OR, relevance of surgical topics taught and availability of practice hours. While the quality of teaching during the pandemic received slightly lower ratings, students were still satisfied on average, suggesting no marked discontent in any single aspect.

With an overall mean satisfaction rating of 2.99, participants generally expressed satisfaction with their surgical training experience under hybrid conditions. While the data clearly indicates overall contentment, slight variations across specific items such as lower satisfaction with teaching quality compared to time spent in the OR highlight specific descriptive areas that may merit attention for future program enhancement. This level of satisfaction, reflecting general acceptance, aligns with other hybrid-learning scenarios reported during COVID-19.

AlQhtani, et. al.,[3] in 2021 similarly noted moderate satisfaction among medical students undergoing virtual training, with concerns raised about limited clinical exposure and emotional fatigue associated with online platforms. In the current study, although satisfaction did not reach the highest possible rating, the presence of consistent “satisfied” responses across all items implies that structural elements of the hybrid format were still able to provide students with meaningful educational engagement. This trend was consistent with prior findings by Srivastava, et. al.,[5] in 2020 and El Boghdady, et. al.,[2] in 2019, who emphasized that structured hybrid programs could support medical learning even when traditional formats are disrupted. The inclusion of OR time and skills-related topics may have played a stabilizing role, offering enough experiential structure to preserve student morale and a sense of continuity in their surgical training.

Across the four domains, a clear picture emerges: the hybrid, pandemic-era curriculum succeeded in holding students’ attention and delivering core competencies, yet it left them wanting more of the tactile experiences that traditionally anchor surgical training.

First, interest remained strong. Students entered medical school with genuine enthusiasm for surgery and reported slightly higher enthusiasm after their rotation, especially for skill-oriented courses such as practical minors and clinical surgery. That continuity suggests the blended format preserved, rather than

blunted, their motivation to engage with surgical content.

Second, scores for preparedness were high. Learners saw real value in their rotation and opportunities to assist or observe in the operating room. Even so, their relatively lower rating for “sufficient hours of practice” signals that quantity—not just presence—of hands-on exposure still matters. The curriculum appears to have delivered conceptual readiness, but students sensed the limits of abbreviated clinical time.

Third, the preference data sharpen that message. The most strongly endorsed improvements were those that would place students physically at the table: scrubbing practice, suture workshops and more live surgery observations. Support for changes in lecture style or credit allocation was positive but less emphatic, underscoring that learners considered procedural immersion as the real missing piece.

Finally, overall satisfaction was evident, but not exemplary. Students were content with OR time and skills topics, yet less impressed by remote teaching elements. Satisfaction seemed to track directly with the dose of structured, hands-on exposure—in other words, the more tangible the activity, the more gratifying the experience.

Taken together, these patterns point to a curriculum that delivered on fundamentals, but could climb higher by expanding live, skills-based opportunities. Because this study is descriptive, single-centered and cross-sectional, it cannot predict performance or specialty choice. Still, it offers a useful snapshot: when face-to-face time is scarce, students value every minute of it and are quick to notice its absence. Future iterations of hybrid surgical education may be most successful when they protect, and if possible expand, the moments that let trainees feel, suture and scrub—experiences that no virtual platform can fully replace.

CONCLUSIONS

Originally a pandemic response, hybrid learning was not meant to define surgical education, yet this study shows that a well-designed model can preserve its core strengths. Students sustained interest in surgery throughout their rotation, indicating that engaging online content can nurture curiosity. Encouragingly, respondents also felt clinically prepared, suggesting

that a mix of virtual demos, strategic in-person sessions and supervised OR exposure fostered a genuine sense of readiness.

These successes, however, sit beside a quieter message of limitation. Across every domain, the items that demanded direct, tactile participation elicited the strongest reactions, whether as the highest levels of preference or main source of “could-be-better” sentiment in satisfaction scores. Put simply: students believe that surgical skill matures in the grip of one’s own fingers. Their only moderate satisfaction highlights a gap between feeling conceptually capable and feeling experientially fulfilled. That gap matters, because professional identity in surgery is forged not solely through knowledge but through repeated, sensory engagement with tissue, instruments and team dynamics.

The implications therefore extend beyond the pandemic. If blended delivery continues, whether for flexibility, resource optimization, or future public-health contingencies, medical schools must decide which learning moments cannot be virtualized without sacrificing the formative ethos of surgical training. The data suggest that procedural repetition, physical presence in the operating room and guided psychomotor practice constitute that non-negotiable core. Conversely, lectures, case discussions and certain forms of preoperative planning adapt well to the digital realm, freeing scarce face-to-face hours for tasks that truly demand embodiment.

Although these findings derive from a single cohort in one institution and rely on descriptive statistics alone, they reflect an inflection point for curricular strategy: the challenge is no longer whether hybrid education works in principle, but how to engineer its proportions so that knowledge delivery, hands-on mastery and student satisfaction rise together rather than in partial trade-off.

To optimize surgical education, the medical school can retain the efficiency of blended

learning by keeping didactic content online while prioritizing in-person sessions for psychomotor skill development. Face-to-face hours should focus on high-frequency skills labs where students repeatedly practice suturing, knot-tying and instrument handling using synthetic models, animal tissue, or simulators, ensuring early, repeated exposure and building baseline competence. Authentic OR time should increase through distributed “micro-rotations” across the year, balancing student access with capacity constraints while fostering real-world skills like sterile technique and team communication. Simulation centers with after-hours access to trainers and virtual reality (VR) rigs can further support autonomous skill consolidation without overburdening faculty.

A responsive surgical curriculum requires a two-way feedback system, with structured reflections after hands-on sessions and surveys to monitor whether the balance between virtual and practical training effectively addresses student preparedness and satisfaction. The faculty must also be equipped to bridge both modalities through development programs that enhance their ability to teach in both environments. Institutional support is crucial—funding for consumables, simulation hardware upkeep, and OR access aligned with clerk schedules are small investments compared to the payoff: graduates who are technically skilled and motivated for surgical practice. Long-term tracking into internship and residency will determine if these educational gains translate into real-world performance and influence specialty choice, enabling the hybrid curriculum to evolve from a pandemic-era adaptation into a sustainable, learner-centered model.

DECLARATION OF CONFLICT OF INTEREST

This study was self-funded by the researchers themselves. No external financial support was used. The authors declare no conflict of interest.

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DUTIES OF RESEARCH PERSONNEL

The duties of the principal investigators include, but are not limited to: obtaining Institutional Review Board (IRB) approval or exemption determination before conducting research involving human subjects, participant recruitment, complying with

the current protocol/s as approved by the IRB, dissemination and obtaining participant informed consent, educating participants on details of the research study, assessing participant eligibility and maintaining participant confidentiality and security per protocol.

APPENDIX A
REVISED VERSION OF THE QUESTIONNAIRE

REVISED QUESTIONNAIRE

QUESTIONS	CHOICES
Kindly mark only one answer unless otherwise stated.	
1. What is your age?	<input type="checkbox"/> 19 years old or younger <input type="checkbox"/> 20 to 23 years old <input type="checkbox"/> 24 to 27 years old <input type="checkbox"/> 28 years old or older
2. What is your biological sex?	<input type="checkbox"/> Female <input type="checkbox"/> Male

**APPENDIX A
REVISED VERSION OF THE QUESTIONNAIRE**

REVISED QUESTIONNAIRE

QUESTIONS	CHOICES			
PART 1: SURGICAL INTEREST				
3. How interested were you in surgery when you started medical school?	Not at all Interested 1	Somewhat Interested 2	Very Interested 3	Extremely Interested 4
4. How interested are you in surgery now that you are done with your surgical rotation?	Not at all Interested 1	Somewhat Interested 2	Very Interested 3	Extremely Interested 4
5. How interested are you in the surgery courses included in your medical school's curriculum?				
5a. Principles of Surgery	Not at all Interested 1	Somewhat Interested 2	Very Interested 3	Extremely Interested 4
5b. Practical Minor/Skills	Not at all Interested 1	Somewhat Interested 2	Very Interested 3	Extremely Interested 4
5c. Clinical Surgery	Not at all Interested 1	Somewhat Interested 2	Very Interested 3	Extremely Interested 4
6. How interested are you in pursuing a career in surgery after your experiences in the OR?	Not at all Interested 1	Somewhat Interested 2	Very Interested 3	Extremely Interested 4
PART 2: SURGICAL PREPAREDNESS				
7. To what extent do you agree that practicing is essential for learning surgery?	Not Essential 1	Somewhat Essential 2	Very Essential 3	Extremely Essential 4
8. How useful was the surgical rotation you have completed in your learning experience?	Not at all Useful 1	Somewhat Useful 2	Very Useful 3	Extremely Useful 4
9. To what extent do you feel that your surgical courses have provided sufficient hours of practice to prepare you effectively?	Not at all Useful 1	Somewhat Useful 2	Very Useful 3	Extremely Useful 4
10. How useful was your participation in University-organized Operating Room (OR) activities in enhancing your surgical preparedness?	Not at all Useful 1	Somewhat Useful 2	Very Useful 3	Extremely Useful 4
PART 3: SURGICAL PREFERENCE				
For Questions 11-17: How agreeable are you to the following statements?				
11. The lectures included in the curriculum should be more interactive.	Strongly Disagree 1	Disagree 2	Agree 3	Strongly Agree 4
12. The surgery courses in the university should increase the number of credits dedicated to surgical courses.	Strongly Disagree 1	Disagree 2	Agree 3	Strongly Agree 4
13. The curriculum should increase the frequency of attendance to surgical wards.	Strongly Disagree 1	Disagree 2	Agree 3	Strongly Agree 4

**APPENDIX A
REVISED VERSION OF THE QUESTIONNAIRE**

REVISED QUESTIONNAIRE

QUESTIONS	CHOICES			
14. The number of opportunities to observe live surgeries should be more frequent.	Strongly Disagree 1	Disagree 2	Agree 3	Strongly Agree 4
15. The curriculum should include suture courses.	Strongly Disagree 1	Disagree 2	Agree 3	Strongly Agree 4
16. The curriculum should include scrubbing and OR good practice training	Strongly Disagree 1	Disagree 2	Agree 3	Strongly Agree 4
17. There should be more surgery related electives and/or extracurricular activities.	Strongly Disagree 1	Disagree 2	Agree 3	Strongly Agree 4
PART 4: SURGICAL SATISFACTION				
18. How satisfied are you with the amount of time you spent in the OR?	Very Unsatisfied 1	Unsatisfied 2	Satisfied 3	Very Satisfied 4
19. How satisfied are you with the topics taught to practice surgical skills in the curriculum?	Very Unsatisfied 1	Unsatisfied 2	Satisfied 3	Very Satisfied 4
20. How satisfied are you with the number of hours of practice included in your surgical courses done so far?	Very Unsatisfied 1	Unsatisfied 2	Satisfied 3	Very Satisfied 4
21. How satisfied are you with the quality of teaching of surgical topics during the COVID-19 pandemic?	Very Unsatisfied 1	Unsatisfied 2	Satisfied 3	Very Satisfied 4

APPENDIX B

ORIGINAL QUESTIONNAIRE FROM SANSONI, G., et al. (2022)

Engagement and satisfaction of medical students in Italy: how are surgical topics taught? (English version)

This is an anonymous survey about student engagement and satisfaction with how surgical topics are taught in Italian Medical Schools.

We are not collecting any identifiable personal data, and the platform used for the survey complies with EU GDPR.

By filling the survey you agree that we can use your answers for academic purposes. The time required to fill in the questionnaire is about 3 minutes.

*** Required**

1. What year of University are you enrolled in (if you are fuori corso, choose the last year of enrollment)? *
- 1st or 2nd.
- 3rd year.
- 4th year.
- 5th year.
- 6th year.

Sezione senza titolo

2. What is your age?*
- Mark only one answer.*

- 19 years old or younger.
- 20 to 23 years old.
- 24 to 27 years old.
- 28 years old or older.

3. What gender do you identify as?*
- Mark only one answer.*

- Female.
- Male.
- Agender/non binary.
- Other.
- Prefer not to say.

4. Are you an Italian citizen?*
- Mark only one answer.*

- Yes.
- No.

5. What is your current employment status?*
- Mark only one answer.*

- Employed full time.
- Employed part time.
- Occasional worker.
- Full time student not currently working.
- Prefer not to say.

6. At what region is your University located?*
- Mark only one answer.*

- | | | | | | | |
|-------------------------------|-------------------------------|---|--------------------------------|---|--------------------------------------|--------------------------------|
| <input type="radio"/> Abruzzo | <input type="radio"/> Apulia | <input type="radio"/> Basilicata | <input type="radio"/> Calabria | <input type="radio"/> Campania | <input type="radio"/> Emilia-Romagna | <input type="radio"/> Sardinia |
| <input type="radio"/> Lazio | <input type="radio"/> Liguria | <input type="radio"/> Lombardy | <input type="radio"/> Marche | <input type="radio"/> Molise | <input type="radio"/> Piemonte | <input type="radio"/> Veneto |
| <input type="radio"/> Sicily | <input type="radio"/> Umbria | <input type="radio"/> Trentino-Alto Adige | <input type="radio"/> Tuscany | <input type="radio"/> Friuli-Venezia Giulia | | |

Short Communication

Azevedo Sansoni G, et al.

Satisfaction of Medical Students with Surgical Training: A Survey of Northern Italy

7. How interested in surgery were you when you entered University?*

Mark only one answer.

1 2 3 4 5

Not interested at all. Really interested.

8. How interested in surgery are you now?*

Mark only one answer

1 2 3 4 5

Not interested at all. Really interested.

9. What do you think about the frontal (theoretical) surgery courses included in the curriculum?*

Mark only one answer

1 2 3 4 5

Not interested at all. Really interested.

10. What is your opinion about the teaching of the surgical topics?*

Mark only one answer

1 2 3 4 5

I'm not satisfied at all. I'm really satisfied.

11. Do you think that in order to learn surgery, practice is necessary?*

Mark only one answer.

- Yes.
 No.
 I'm not sure..

12. What is your opinion o surgery clerkships you have had so far?*

Mark only one answer.

- Very useful for my learning experience.
 Somewhat. useful for my learning experience.
 Not usefull at all for my learning experience.
 I did not have surgery clerkships so far.

13. Do you think enough hours of practice were included in your surgical courses done so far?

Mark only one answer.

- Yes.
 No.
 I'm not sure.

14. How many times have you been to an OR (Operating Room) as an activity promoted by the University?*

Mark only one answer.

- Never.
 1 to 5 times
 6 to10 times
 Over 10 times.

15. If you have been to the OR, has this experience changed you interest in surgery?

Mark only one answer.

- No, my interest in surgery did not change.
- Yes, my interest in surgery increased.
- Yes, my interest in surgery decreased.
- I've never been to the OR.

16. How often would you like to go to the OR?*

Mark only one answer.

- Never.
- Once every academic year.
- Once every month.
- Once every week.
- Other _____

17. Would you like to have more surgery related electives and/or extracurricular courses?*

Mark only one answer.

- Yes.
- No.
- I'm nt sure.

18. What could be improved in the way surgery is taught in your University?*

Check all that apply.

- Make the lectures more interactive.
- Increase the number of credits dedicated to surgical courses
- Increase the frequency of attendance to surgical wards.
- Increase the frequency of attendance to live surgeries
- Include suture courses.
- Include scrubbing and OR good practice training.
- None of the above would be helpful.
- Other: _____

19. Do you think that the COVID-19 pandemic affected the quality of teaching of surgical topics? *

Mark only one answer.

- Yes, the COVID-19 pandemic affected the quality of teaching of surgical topics in a NEGATIVE way.
- Yes, the COVID-19 pandemic affected the quality of teaching of surgical topics in a POSITIVE way.
- No, the COVID-19 pandemic DID NOT affect the quality of teaching of surgical topics.

APPENDIX C: AUTHOR'S CONTRIBUTIONS**Project Roles**

1. Research Project:
 - A. Conception: Developing the initial idea and research question.
 - B. Organization: Planning the study design, methodology and logistics.
 - C. Execution: Conducting experiments, collecting data and managing the research process.
2. Statistical Analysis:
 - A. Design: Determining appropriate statistical methods and analysis plans.
 - B. Execution: Performing data analysis and generating results.
 - C. Review and Critique: Interpreting statistical findings and ensuring accuracy.
3. Manuscript Preparation:
 - A. Writing the First Draft: Composing sections of the manuscript (eg, Introduction, Methods, Results, Discussion).
 - B. Review and Critique: Providing feedback, editing and revising the manuscript.
 - C. Final Approval: Approving the final version of the manuscript for submission.
4. Literature Review:
 - A. Identification: Searching for relevant published literature.
 - B. Evaluation: Critically appraising and synthesizing existing research.
 - C. Integration: Incorporating findings into the manuscript.
5. Funding Acquisition:
 - A. Budgeting: Developing and managing the research budget.
6. Ethical Considerations:
 - A. IRB/Ethics Committee Submission: Preparing and submitting protocols for ethical review.
 - B. Participant Protection: Ensuring adherence to ethical guidelines and informed consent processes.
7. Data Management:
 - A. Data Collection Tool Design: Creating surveys, questionnaires, or other data collection instruments.
 - B. Data Entry and Cleaning: Inputting and preparing raw data for analysis.
 - C. Data Security: Ensuring the safe storage and handling of research data.
8. Mentorship/Supervision:
 - A. Guidance: Providing direction and support to junior researchers or students.
 - B. Training: Educating team members on research methodologies or specific techniques.

Individual Author Contributions

Hernandez, Kayne Irish P.: 1A, 1B, 1C, 2C, 3A, 3B, 4A, 6B, 7A, 7C

Hernandez, Lianne Gabrielle R.: 1A, 1B, 1C, 2A, 2B, 2C, 3A 3B, 3C, 4A, 5A, 6A, 6B, 7A, 7C

Hernandez, Timothy Matthew S.: 1A, 1B, 1C, 2C, 3A, 3B, 3C, 4A, 4B, 4C, 6A, 6B, 7A, 7C

Holganza, Ma. Veronica M.: 1A, 1B, 1C, 2A, 2B, 2C, 3A, 3B, 4A, 4B, 4C, 6A, 6B, 7B, 7C

Ignacio, Joaquin R.: 1C, 2B, 3A, 3B, 3C, 5A, 6A, 7A, 7B, 7C

Ida Marie M. Tabangay-Lim M.D.: 8A, 8B

Jan Michael Lleva M.D.: 8A, 8B

Angelica Guzman-Hernandez M.D.: 8A, 8B

Warren Bacorro M.D.: 8A, 8B

Charles Abraham Villamin M.D.: 8A, 8B