

UC San Diego

UC San Diego Previously Published Works

Title

The Plastic Surgery Learning Module: Improving Plastic Surgery Education for Medical Students

Permalink

<https://escholarship.org/uc/item/4x70c5th>

Journal

Plastic & Reconstructive Surgery Global Open, 9(12)

ISSN

2169-7574

Authors

Reghunathan, Meera
Segal, Rachel M
Reid, Chris M
[et al.](#)

Publication Date

2021

DOI

10.1097/gox.0000000000003980

Peer reviewed

The Plastic Surgery Learning Module: Improving Plastic Surgery Education for Medical Students

Meera Reghunathan, MD*
Rachel M. Segal, BS†
Chris M. Reid, MD*
Amanda A. Gosman, MD*

Background: Medical students receive limited exposure to the field of plastic surgery because most students will not rotate in plastic surgery, especially those at schools without dedicated plastic surgery residency programs. This study aimed to create and validate a plastic surgery learning module for medical students to dispel media-propagated myths and misrepresentation of the breadth of plastic surgery and equip students with referral-making capabilities.

Methods: The plastic surgery learning module was created using Articulate Storyline 360 (New York, N.Y.). Student participants were recruited from a single medical school across all four classes. Pre- and postmodule surveys were administered via Qualtrics (Provo, Utah). Scores were computed for the general surgical knowledge section and for each specialty referral question.

Results: Twelve students completed usability testing and edits were subsequently made to optimize the module. The module took on average 66 minutes to complete. Sixty-five students (19 MS1, 16 MS2, 15 MS3, 15 MS4) completed efficacy testing. In the premodule survey, students were nearly 100% accurate in identifying breast-related referrals, unlike pediatric/craniofacial (avg: 68%), reconstruction/microsurgery (avg: 64%), and hand/upper extremity (avg: 30%) referrals. Students of all classes exhibited significant improvement in all testing categories except for the breast category, with the most improvement in the hand referrals category. Prior exposure to plastic surgery (57%) correlated with higher premodule hand ($P = 0.003$) and breast/cosmetic ($P = 0.01$) referral scores.

Conclusion: The plastic surgery learning module shows promise to be a comprehensive yet affordable and time-efficient tool for medical students to learn about basic surgical principles and the scope of plastic surgery. (*Plast Reconstr Surg Glob Open* 2021;9:e3980; doi: 10.1097/GOX.0000000000003980; Published online 10 December 2021.)

INTRODUCTION

Plastic surgery is a diverse surgical field. Public perception of plastic surgery is influenced by the media, which misrepresents the field as a whole.¹ The terms “cosmetic,” “plastic,” and “reconstructive” continue to be poorly understood by the public and medical students, causing an identity crisis in the field of plastic surgery.^{2,3} Even healthcare professionals, including most medical students and primary care physicians, fail to recognize that hand

surgery, reconstructive surgery, and nonbreast-cancer surgeries are routinely performed by plastic surgeons, and are thereby unable to identify appropriate referrals in clinical scenarios.⁴⁻⁶ Plastic surgeons are all too frequently not identified as the primary surgeon for procedures fundamental to the specialty.⁷ There are significant strides yet to be made in dissemination of knowledge of plastic surgery both within the public and amongst healthcare professionals.

Medical students’ exposure to the field of plastic surgery continues to be limited and inadequate because most medical students will not rotate in plastic surgery and many students do not have plastic surgery residency programs at their medical schools.⁸ Evidence shows that improved medical student education about plastic surgery

From the *Department of Surgery, Division of Plastic Surgery, University of California San Diego, San Diego, Calif.; and †School of Medicine, University of California San Diego, La Jolla, Calif.

Received for publication August 11, 2021; accepted October 8, 2021.

Presented at Plastic Surgery the Meeting 2021 [online].

Copyright © 2021 The Authors. Published by Wolters Kluwer Health, Inc. on behalf of The American Society of Plastic Surgeons. This is an open-access article distributed under the terms of the [Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 \(CCBY-NC-ND\)](https://creativecommons.org/licenses/by-nc-nd/4.0/), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

DOI: 10.1097/GOX.0000000000003980

Disclosure: The authors have no financial disclosures or conflicts of interest. This study received funding from the American Council of Academic Plastic Surgeons/Plastic Surgery Foundation.

Related Digital Media are available in the full-text version of the article on www.PRSGlobalOpen.com.

leads to better referral patterns, especially in the areas of hand/peripheral nerve surgery and general reconstructive surgery.⁹ Although medical students interested in plastic surgery can purchase textbooks or subscribe to online learning, there is no standardized available online resource for medical students to gain a basic introduction to plastic surgery in a concise and time-efficient manner. This project aims to create and validate a plastic surgery learning module (PSLM) for all medical students, with the goal of improving medical student knowledge about the breadth and depth of plastic surgery and referral-making capability.

METHODS

Creating the Learning Module

An investigator (MR) was responsible for creation of the PSLM content using Articulate Storyline 360 (New York, N.Y.). Learning module topics were chosen to address the components of plastic surgery that medical students should be familiar with. Some topics highlighted general surgical knowledge—designated “surgical core topics”—and were allocated more module content than other topics that primarily focused on introducing students to the breadth of plastic surgery, designated “specialty topics”. (See Video [online], which shows an example of the learning module. This provides a sample of the learning module (including the narration included in the module) by reviewing the table of contents and a select subtopic. The content was curated based on information from the American Society of Plastic Surgeons Education Network, an online educational resource for resident education in plastic surgery.¹⁰ *Essentials of Plastic Surgery*, second edition by Jeffrey Janis and *Plastic Surgery* by Grabb and Smith were also referenced.^{11,12} Graphics, animations, and voice narration were created by one of the investigators (MR), and photographic content was taken from open access research articles on respective topics and surgeries. Content was curated and presented to be at a reading and education level appropriate for medical students at a first- to third-year level—specifically, content was not curated to be detailed enough for a plastic surgery sub-intern. The learning module content was reviewed and edited by two investigators (AG, CR), both of whom are attending surgeons in plastic surgery.

Study Recruitment and Usability Testing

Institutional review board approval was obtained at the authors’ institution. Students were recruited from University of California San Diego School of Medicine for the study between October 2020 and March 2021. Students were recruited via medical school email addresses and medical-student-specific Facebook groups. Participants signed a consent form embedded into the premodule survey to participate in the study and answered premodule survey questions without the use of other resources. Students were considered under-represented in medicine (UIM) if they identified as Black/African American, American Indian, Pacific Islander, multiracial, or Hispanic.

Takeaways

Question: How do we educate all medical students about the scope and fundamentals of plastic surgery in order to improve their referral-making abilities?

Findings: This study included the design and implementation of a plastic surgery learning module amongst medical students at a single institution. The module takes 66 minutes on average to complete and improves students’ general surgical knowledge as well as referral-making capabilities in craniofacial surgery, hand surgery, and reconstructive/microsurgery.

Meaning: This plastic surgery learning module is a promising, affordable, and time-efficient tool for medical students to learn about plastic surgery.

Usability has been defined as having four components: easy to learn, useful, easy to use, and pleasant to use.¹³ One of the most prominent models used in usability evaluation is the FRAME model, developed by Marguerite Koole in 2009.¹⁴ The usability questionnaire was conducted using a questionnaire adapted from the FRAME model, focusing mainly on the device and learner aspects given the limited social aspects inherent in the online learning module. From the cohort of students that expressed interest in participating in the study, three students were randomly chosen from each medical school class to participate in the usability portion of the study from December 2020 to January 2021. The usability portion of the module prompted students to critique the usability and readability aspects of the module in addition to its efficacy. (See appendix, Supplemental Digital Content 1, which displays the usability survey. <http://links.lww.com/PRSGO/B857>.)

Students in the usability group were incentivized with a \$15 dollar Amazon gift card that was received upon completion of usability testing and an additional \$10 dollar Amazon gift card sent upon completion of the 1-month postsurvey. Once usability testing was completed, feedback was incorporated into the module to create a final draft used for further efficacy testing. The study cohort and testing design is illustrated in Figure 1.

Efficacy Testing and Data Analysis

Efficacy of the PSLM was quantified by asking didactic knowledge questions and calculating scores from this survey at three time points: before the module, immediately postmodule, and 1-month postmodule to assess retention. Efficacy testing was incorporated into the pre- and postsurveys administered to the usability testing group, and additionally administered to students who completed only efficacy testing. The efficacy data from both cohorts were combined, as the changes made following usability testing were minor. Students in the efficacy testing only group were incentivized with a \$10 dollar Amazon gift card that was received upon completion of efficacy testing and an additional \$10 dollar Amazon gift card sent upon completion of the 1-month postsurvey.

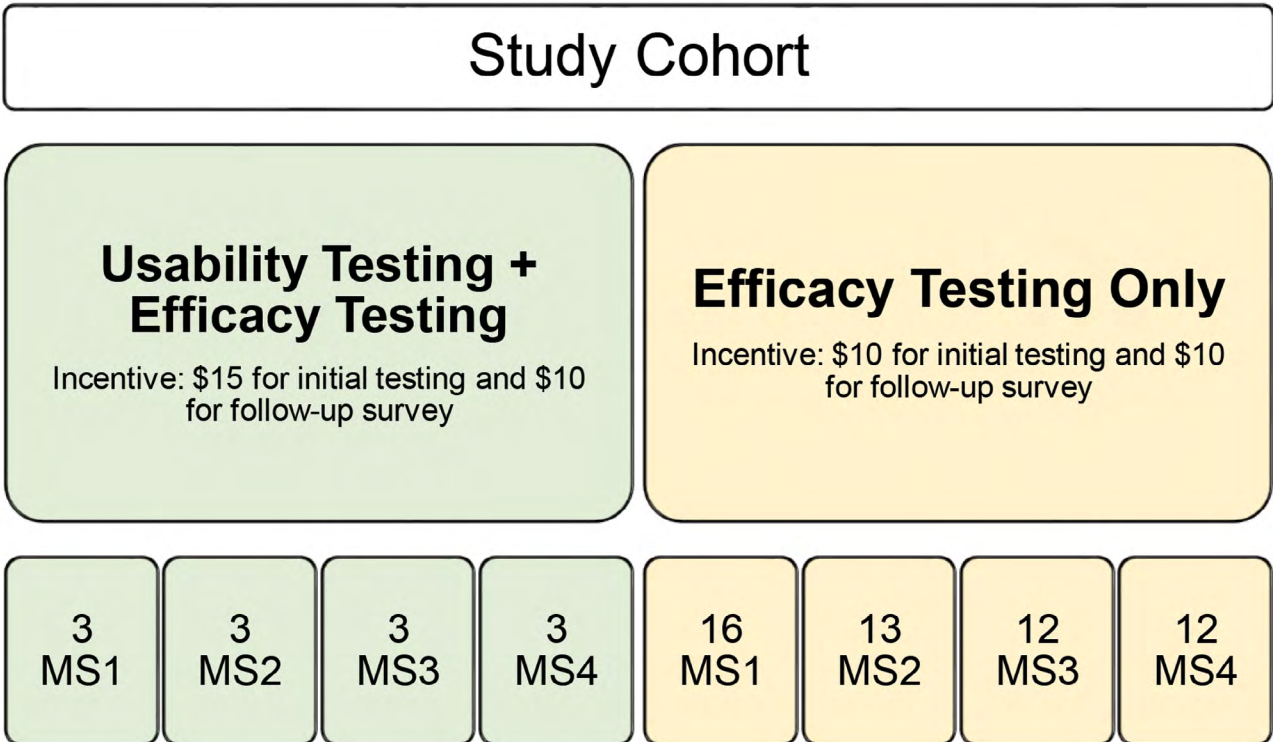


Fig. 1. Study design. This graphic describes the study design and participants in each study group.

Scores were computed for the didactic knowledge section (score out of 16) and for each specialty referral question (hand/upper extremity-6, craniofacial/pediatric-6, reconstruction/microsurgery-5, and breast/cosmetic-6). Pre- and postmodule scores were compared via paired *t*-tests. ANOVA analysis with subgroup analysis was used to compare module scores amongst a variety of demographic factors, prior participant exposure to plastic surgery, and whether the participant had any interest in pursuing a surgical career.

RESULTS

Usability Testing

Participant demographics are described in [Table 1](#). Twelve participants, three from each year in medical school, completed usability testing. The module took on average 66 minutes to complete. The table of contents is displayed in [Figure 2](#). On a Likert scale of 1 (not usable) to 5 (very easy to use), all usability criteria and the usability of every module page were rated easy to use (all averages greater than 4.6/5). All participants agreed that the learning module is easy to navigate and that there were no broken links in the learning module (5/5 average Likert score). Most agreed that icons in the learning module were easily identified (4.8/5 average Likert score). All pages were rated highly for usability ([Table 2](#)). Minor edits were made to the module based on written feedback in the usability survey's free text answer space.

Efficacy Testing

Surgical Knowledge

The pre- and postmodule surveys contained 16 surgical knowledge questions, which included multiple choice questions about wound healing, skin grafts, sutures and knot tying, local anesthetics, pressure sores, and skin lumps/bumps. (See [appendix 2, Supplemental Digital Content 2](#), which displays the premodule survey. <http://links.lww.com/PRSGO/B858>.) Before the module, third- and fourth-year medical students scored significantly higher than first- and second-year medical students in general surgical knowledge ($P = 0.04$). Student gender did not affect scoring. UIM students scored significantly lower in both pre- and postmodule didactic knowledge ($P < 0.05$). Students overall significantly improved on average approximately five points out of 16 ([Fig. 3](#)), with the most improvement seen in the first- and second-year classes ($P = 0.02$). Students with an interest in surgery (59%) achieved higher postmodule surgical knowledge scores than their counterparts ($P = 0.01$).

Plastic Surgery Referrals

There was no significant difference between classes in identifying plastic surgery referrals before the module ($P = 0.13$). Students who identify as under-represented in medicine scored significantly lower identifying breast/cosmetic referrals and craniofacial/pediatric referrals ($P < 0.05$) before the module. Prior exposure to plastic surgery (57%) correlated with higher premodule hand ($P = 0.003$) and breast/cosmetic ($P = 0.01$) scores. Students

Table 1. Participant Demographics

Variable	N (%)
Total	65 (100)
Age (average ± SD)	25 ± 2
Gender	
Men	20 (31)
Women	45 (69)
Nonbinary	0 (0)
Other	0 (0)
Race	
White	26 (40)
Black/African American	4 (6)
Asian	25 (38)
American Indian/Alaska Native	1 (2)
Native Hawaiian/Pacific Islander	9 (14)
Multiracial	0 (0)
Ethnicity	
Hispanic or Latinx	5 (8)
Not Hispanic or Latinx	60 (92)
Medical school (MS) class	
MS1	19 (29)
MS2	16 (25)
MS3	15 (23)
MS4	15 (23)
Highest level of education	
Bachelor's degree	59 (91)
Master's degree	6 (9)
PhD	
Other	
Prior experience in plastic surgery	
Any experience	37 (57)
Clerkship in plastic surgery	10 (15.4)
<2 weeks	6 (9.2)
3–4 weeks	2 (3.1)
>4 weeks	2 (3.1)
Shadowing in plastic surgery	6 (9.2)
Attended a PSIG event	23 (35.4)
Research in plastic surgery	6 (9.2)
None	20 (30.8)
Interest in surgical career	38 (59)

PSIG, plastic surgery interest group.

were nearly 100% accurate in identifying breast-related referrals in the premodule survey, unlike pediatric/craniofacial (avg: 68%), reconstruction/microsurgery (avg: 64%), and hand/upper extremity (avg: 30%) referrals. Students of all classes exhibited a significant improvement in all testing categories except for the breast category, with the most improvement noted in the hand referral category (Fig. 4). The largest absolute improvement in identifying craniofacial/pediatric, reconstruction/microsurgery, and hand/upper extremity referrals was achieved by first-, second-, and third-year medical students; however, fourth-year medical students did significantly improve their ability to identify referrals in the aforementioned categories. Neither gender was associated with a higher postmodule score.

Retention

Retention surveys were sent to students who completed all three portions of the module 1 month after completion of the postmodule survey. Forty-seven students (72.3%) from the original cohort completed the retention survey: 13 first-year students, 12 second-year students, 10 third-year students, and 12 fourth-year students. First- and second-year students had significantly lower surgical knowledge question scores and hand referral scores in their retention surveys when compared with their postmodule surveys ($P < 0.001$). There were no significant

differences in postmodule scores and retention survey scores for reconstruction/microsurgery, pediatrics/craniofacial, or breast/cosmetic referral questions for first-year or second-year students. There were no significant differences in postmodule scores and retention survey scores for third-year or fourth-year students.

DISCUSSION

The Importance of Medical Student Education about Plastic Surgery

The creative and innovative nature of plastic surgery expands its scope to the limits of the imagination. Every day people discover new materials, instruments, and techniques to innovate new and more efficient methods to accomplish old solutions. Unfortunately, the broadness and versatility of the field can cause confusion for both the public and medical providers.^{1,4} The media's portrayal of plastic surgeons as only cosmetic surgeons propagates some misconceptions about the field of plastic surgery; although cosmetic surgery is a significant and important portion of plastic surgery, especially in the private practice sector, media often does not represent the complex reconstructive, craniofacial, or hand/upper extremity careers in plastic surgery.^{1,2} The lack of medical student exposure to plastic surgery is important as studies have shown that medical schools that provide greater exposure to plastic surgery have a higher percentage of graduates who apply to plastic surgery.¹⁵ This problem is doubly crucial as it directly influences referral patterns to plastic surgery, for the majority of students who do not pursue plastic surgery but will be the future referring providers. Tackling this problem starts with improved medical student education. Agarwal et al demonstrated that more than 70% of students fail to identify plastic surgery's involvement in managing many areas of hand and peripheral nerve surgery, complex chest wall and abdominal reconstructions, and congenital skull deformities.⁴ The premodule testing of students presented in this study is in concordance with the results of that study: students in our cohort had difficulty in identifying hand, reconstruction, and pediatric referrals, while being able to identify breast and cosmetic referrals before the module. Tanna et al show that these misunderstandings are not remedied in the process of residency as primary care physicians were unable to identify plastic surgeons as experts in the management in hand surgery, facial skin cancer, or facial fractures.⁶ The way that plastic surgeons are perceived by their colleagues affects both parties; plastic surgeons largely depend on collaboration and referrals from other specialties for a significant part of their practice. More importantly, it is vital for primary care physicians along with other referring providers to match the needs of their patients to appropriate specialists, and in doing so provide the highest level of care possible. The results of this study show that medical students and referring providers have a long way to go before starting to understand the full scope of plastic surgery.

Back to title page
Conclusion


Table of Contents

Study the following topics:

- Sutures and Knot Tying
- Wound Healing
- Grafts and Flaps
- Skin and Subcutaneous Disease
- Breast Surgery
- Pressure Sores
- Local Anesthetics
- Careers in Plastic Surgery

Be familiar with the following topics:

- Congenital Anomalies/ Pediatric Plastic Surgery
- Facial Trauma
- Facial Aesthetics
- Aesthetic Surgery and Body Contouring
- Hand Surgery
- Chest/ Trunk
- Lower Extremity
- Burn Reconstruction
- Gender Affirming Surgery
- Microsurgery



The subjects to the left are common topics that every graduating medical student should have mastery of. The topics to the right describe the breadth of plastic surgery. I suggest going in order. *Click on each topic to learn more.*

Fig. 2. Table of contents for learning module. Each of the icons in the table of contents links students to a subsection of the learning module with topic-specific content. The column on the left includes “General Surgical Knowledge” topics, while the topics in the right column represent “Plastic Surgery Referral” topics that describe the breadth and scope of plastic surgery. These correlate respectively with the general surgical knowledge questions and the referral questions in the pre and postmodule surveys.

Current Resources for Medical Students

Medical students’ exposure to plastic surgery varies significantly amongst institutions and has not yet been

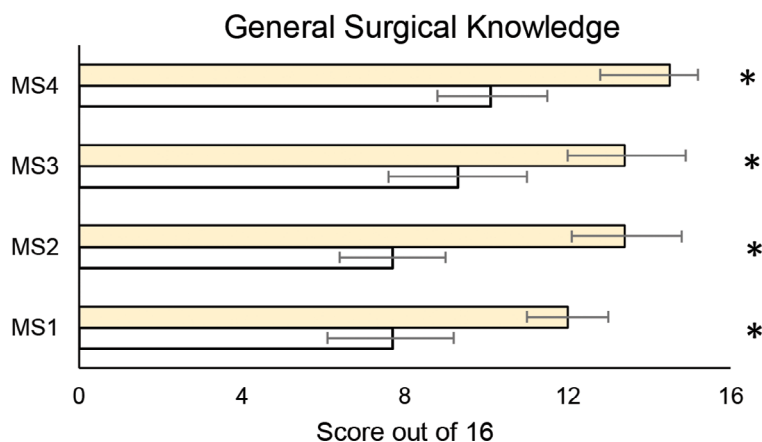
Table 2. Usability and Readability Testing

	Average Likert Score (1 = not usable, 5 = very usable)
N	12
“The learning module is easy to navigate”	5.00
“Icons in the learning module are easily identified”	4.83
Icons in the learning module easily connect to the intended pages immediately	4.67
There are no broken links in the learning module	5
Introduction	4.92
Table of contents	4.92
Sutures and knot tying	4.83
Wound healing	4.83
Grafts and flaps	4.75
Skin and subcutaneous disease	4.83
Breast surgery	4.92
Pressure sores	4.83
Local anesthetics	4.92
Careers in plastic surgery	4.83
Congenital anomalies/pediatric plastic surgery	4.83
Facial trauma	4.92
Facial aesthetics	4.92
Aesthetic surgery/body contouring	4.92
Hand surgery	4.75
Chest/abdominal reconstruction	4.92
Lower extremity reconstruction	4.92
Burn reconstruction	4.92
Gender-affirming surgery	4.92
Microsurgery	4.92

This table displays the results of usability testing for overall usability metrics and individual module pages.

characterized on a national level. As of 2020, there were 84 residency programs in the United States associated with medical schools and/or major hospital systems, yet there are currently 155 accredited MD-granting institutions and 36 accredited DO granting institutions.^{16,17} This leaves nearly half of all medical schools without a plastic surgery residency program, which limits medical school rotation opportunities, research opportunities, and overall exposure to the field. Even at schools that have plastic surgery programs, plastic surgery is usually not a required course or clerkship. At the authors’ institution, there is no formal plastic surgery instruction in the surgical didactic curriculum and clinical clerkships are offered on a lottery basis, such that less than a third of medical students will rotate in plastic surgery. The data of this study suggest that students considered UIM are less aware of the scope of plastic surgery; the authors postulate that these students may have less early exposure to plastic surgery and may have both social and economic limitations that prevent many UIM students from fostering an interest in surgical careers. More investigation is warranted to further elucidate this trend amongst UIM students.

Some have attempted to address the lack of exposure medical students receive for plastic surgery. An organized Plastic and Reconstructive Surgery Interest Group can meet the goals of providing an overview of plastic surgery to interested students and providing these students with mentorship.⁸ In this same piece, Dr. Agarwal suggests that the lack of exposure could be mitigated by the creation of an electronically-based module, although at that time



Medical School Class	Pre-Module Raw Score (95% CI)	Post-Module Raw Score (95% CI)	Pre v Post p-value
MS1 (n = 19)	7.7 (6.1, 9.2)	12.0 (11.0, 13.0)	< 0.001
MS2 (n = 16)	7.7 (6.4, 9.0)	13.4 (12.1, 14.8)	< 0.001
MS3 (n = 15)	9.3 (7.6, 11.0)	13.4 (12.0, 14.9)	< 0.001
MS4 (n = 15)	10.1 (8.8, 11.5)	14.5 (12.8, 15.2)	< 0.001
Total (n = 65)	8.6 (7.9, 9.4)	13.3 (12.7, 13.8)	0.002
ANOVA p-value	0.04	0.02	

Fig. 3. Surgical knowledge questions. This includes score out of 16 total questions relevant to each of the following topics: sutures/knot tying, wound healing, reconstructive elevator, flaps and grafts, skin and soft tissue masses, breast reduction and reconstruction, pressure sores, and local anesthetics. Asterisks (*) indicate a P value less than 0.5. Pre-module scores are shown in white, and post-module scores are shown in yellow.

none had been created. In the UK, a group investigated the use of a single day plastic surgery workshop consisting of lectures, suturing workshops, tendon repair, and local flap design. This group found that this approach significantly increased positive perceptions and dispelled pre-conceived false stereotypes regarding the field of plastic surgery.¹⁸ Despite these investigations, no intervention has been adopted on a national level.

The Value of the PSLM

This study demonstrates that the PSLM presented by the authors successfully improves understanding of basic surgical principles as well as the scope of plastic surgery for all levels of medical students. The highest gains in knowledge are amongst the first- and second-year students, suggesting that perhaps the module has the highest yield for the time spent amongst this group—although these groups also exhibited a lower retention of knowledge in some categories. It is not intended solely for those students interested in plastic surgery—in fact, it will likely have the highest impact on future referrals if used by students who will not pursue plastic surgery as a specialty but instead pursue primary care or other fields. Many plastic surgery principles, including the handling of skin and soft tissue and the basics of the

reconstructive elevator, are valuable to many physicians, from primary care physicians removing lumps and bumps in the clinic to other surgical specialties closing their respective operative sites. The module is time efficient (taking approximately 1 hour to complete on average), interactive, free, and accessible with internet or a cellular device, tablet, laptop, or computer. It is unique in that it is meant for all medical students—not just those interested in plastic surgery. Limitations for the module’s use exist in low resource settings due to requirement of internet access, and the module is currently only available in the English language.

Next Steps and Future Directions

The authors’ institution is planning to integrate the PSLM into the first-year medical student curriculum. The hope for the PSLM is that it will become an adjunct in medical school curricula, especially at institutions that do not have affiliated plastic surgery residency programs. This module would best be integrated into medical education as a requirement during anatomy courses, or during the surgical clinical clerkship. This content can be easily adapted for primary care residents and other front line specialty residencies, such as emergency medicine or family medicine. It may be suitable

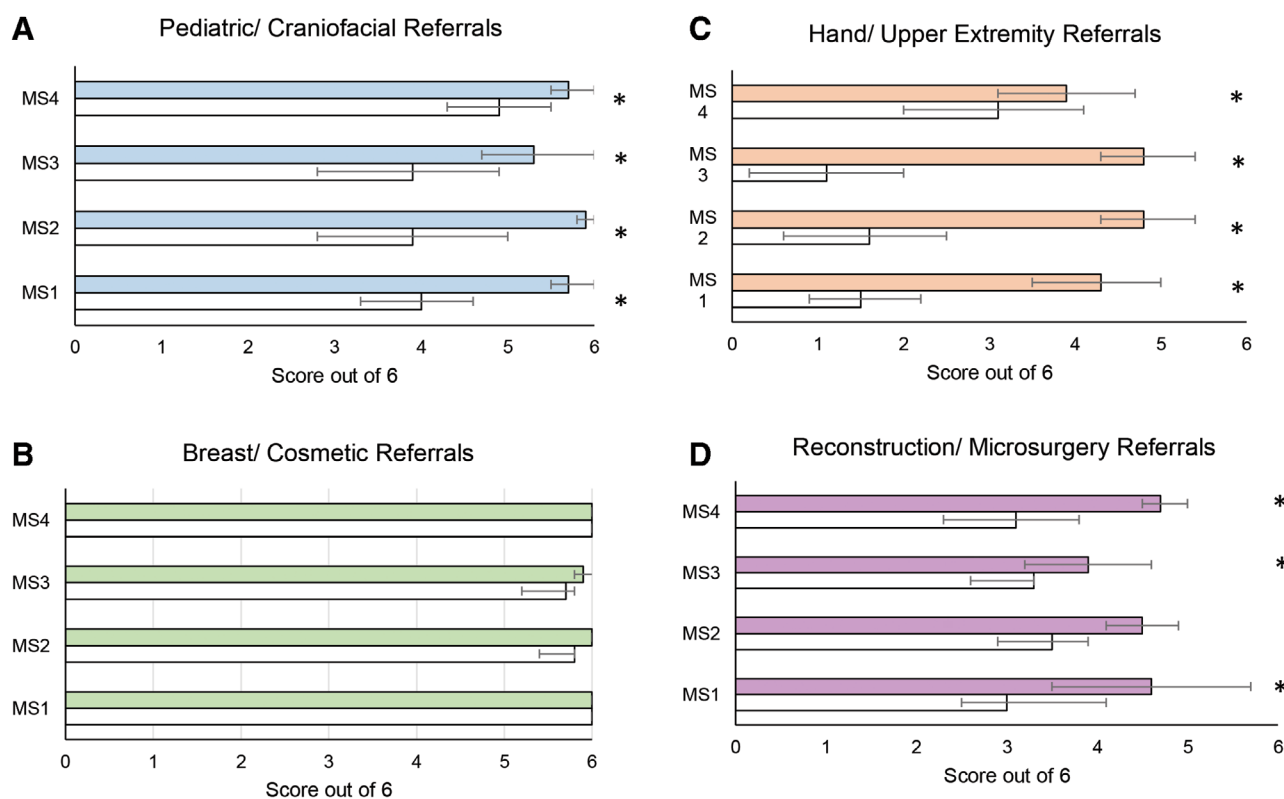


Fig. 4. Pre and postmodule referral scores. This includes scores out of six in Craniofacial/Pediatric (A), Breast/Cosmetic (B), and Hand (C), and a score out of five in Reconstruction/Microsurgery (D). Pre vs postmodule scores in each category and class were computed via paired samples correlation t test. ANOVA P values were computed via ANOVA analysis comparing performance in each test component by medical school class. Asterisks (*) indicate a P value less than 0.5. Premodule scores are shown in white, and postmodule scores are shown in color.

for international settings as well for English-speaking students interested to learn more about plastic surgery. Going forward, the PSLM will be available to any student or institution—any interested party should contact the authors. The PSLM content will be reviewed and updated on an annual basis to ensure that the content remains relevant and accurate.

CONCLUSIONS

Disparities exist in medical students' understanding of the scope of plastic surgery. The PSLM is effective in improving plastic surgery knowledge and referral-making ability amongst all medical students, with the highest impact amongst first- and second-year medical students in the topics of hand, reconstruction, and pediatric plastic surgery. The PSLM shows promise to be a comprehensive yet affordable and time-efficient tool for medical students to learn about the scope of plastic surgery.

Meera Reghunathan, MD

200 West Arbor Drive MC 8890

San Diego, CA 92103

E-mail: mreghuna@health.ucsd.edu

REFERENCES

- de Blacam C, Kilmartin D, Mc Dermott C, et al. Public perception of plastic surgery. *J Plast Reconstr Aesthet Surg.* 2015;68:197–204.
- Hamilton GS III, Carrithers JS, Karnell LH. Public perception of the terms “cosmetic,” “plastic,” and “reconstructive” surgery. *Arch Facial Plast Surg.* 2004;6:315–320.
- Nahai F. Plastic surgery's identity crisis. *Aesthet Surg J.* 2013;33:609–611.
- Agarwal JP, Mendenhall SD, Moran LA, et al. Medical student perceptions of the scope of plastic and reconstructive surgery. *Ann Plast Surg.* 2013;70:343–349.
- Kling RE, Nayar HS, Harhay MO, et al. The scope of plastic surgery according to 2434 allopathic medical students in the United States. *Plast Reconstr Surg.* 2014;133:947–956.
- Tanna N, Patel NJ, Azhar H, et al. Professional perceptions of plastic and reconstructive surgery: what primary care physicians think. *Plast Reconstr Surg.* 2010;126:643–650.
- Kim DC, Kim S, Mitra A. Perceptions and misconceptions of the plastic and reconstructive surgeon. *Ann Plast Surg.* 1997;38:426–430.
- Mendenhall S, Agarwal J. Improving medical student understanding of the scope of plastic surgery. *Ann Plast Surg.* 2013; 71:130.
- Agarwal JP, Mendenhall SD, Hopkins PN. Medical student perceptions of plastic surgeons as hand surgery specialists. *Ann Plast Surg.* 2014;72:89–93.
- American Society of Plastic Surgeons. ASPS Education Network. 2021. Available at <https://www.plasticsurgery.org/for-medical-professionals/education/asps-education-network>. Accessed April 9, 2021.
- Janis JE. *Essentials of Plastic Surgery*. 2nd ed. Boca Raton, Fla.: CRC Press; 2014.

12. Grabb WC, Smith JW, Chung KC. *Grabb and Smith's Plastic Surgery*. 8th ed. Philadelphia, Pa.: Wolters Kluwer; 2019.
13. Gould JD, Lewis C. Designing for usability: key principles and what designers think. *Communications of the ACM*. 1985;28:300–311.
14. Koole M. *The Framework for the Rational Analysis of Mobile Education (FRAME) Model: An Evaluation of Mobile Devices for Distance Education [master's Thesis]*. University of Saskatchewan, Saskatoon, Canada; 2006.
15. Greene AK, May JW, Jr. Applying to plastic surgery residency: factors associated with medical student career choice. *Plast Reconstr Surg*. 2008;121:1049–1053.
16. National Resident Matching Program. *National Resident Matching Program, Results and Data: 2020 Main Residency Match*. Washington, DC: National Resident Matching Program; 2020.
17. Motivatemd. U.S. Med School List - MD/DO Schools with MCAT and GPA Data. <https://www.motivatemd.com/list-of-medical-schools/>. Published January 6, 2021. Accessed April 9, 2021.
18. Spiers HVM, Zargaran A, Murtaza AN, et al. Enhancing medical curricula: the role of a 1-day plastic surgery course as an educational adjunct for medical students. *J Surg Educ*. 2018;75: 116–121.