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Using the Flipped Classroom With Simulation-Based Medical Education to Engage Millennial Osteopathic Medical Students

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With advances in technology and the advent of social media and social networking sites, the way medical education is taught to millennials must evolve. The “flipped classroom,” which occurs when students are exposed to learning materials before their assigned face-to-face class or didactic session, can help engage all learning styles. A flipped classroom paired with simulation-based medical education (SBME) engages millennial learners to acquire the large amount of information required in osteopathic medical school. Using this paired approach in osteopathic medical education can help students meet the requirements outlined by the Accreditation Council for Graduate Medical Education (ACGME). With the single accreditation system for graduate medical education, finalizing in 2020, this article proposes mandating a flipped classroom with SBME to better prepare osteopathic medical students for their training in ACGME-accredited programs.

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The millennial generation of osteopathic medical students has different learning styles than prior generations. The millennial learner tends to incorporate technology and thrive in a “learning-centered environment” rather than in traditional undergraduate didactic sessions.¹ Indeed, the traditional lecture with Microsoft PowerPoint slides is now being questioned as to its relevance and importance in undergraduate medical education.² Instead, a “flipped classroom” with simulation-based medical education (SBME) allows millennial learners to engage their self-directed learning style and address their need for up-to-date information.¹ Such student engagement is paramount for millennial learners and their retention of information.²

In July 2020, all graduate medical education (GME) programs will be accredited by the Accreditation Council for Graduate Medical Education (ACGME) under a single accreditation system. Some ACGME-accredited programs, such as surgery,³ require the use of simulation during undergraduate training, which is not the case for current programs accredited by the American Osteopathic Association. Simulation-based medical education

is a method of learning that incorporates high-fidelity simulators and/or standardized patients to simulate a medical case or patient, allowing medical students to practice their clinical skills before encountering a real patient. These sessions are engaging and interactive and incorporate “active learning with emotional connection,”¹ which allows learners to apply the knowledge gained in simulation training to real cases.

With the rapidly expanding information regarding millennial learning capabilities and preferences, and with ACGME’s expectations for simulation training experience, osteopathic medical schools must evolve to engage and meet the needs of younger learners. As discussed in this article, a flipped classroom with SBME allows for all of these requirements to be fulfilled and thus should be mandated in osteopathic medical education. By effectively using technology through a flipped classroom and SBME model, osteopathic medical students can thrive.

Millennials and the Flipped Classroom

The accountability factor is one of the reasons why the flipped classroom is an appropriate way to educate osteopathic medical students from the millennial generation. Although the birth years vary depending on the source, generally, millennials were born between 1982 and 2002. Because they grew up in the early years of digital technology, including online communication and social media, they are considered “digital natives.”⁴ Millennials also tend to be distracted more easily, which can impede learning through traditional lecture models.⁴ As a result, millennials crave active learning methods that challenge them and offer the ability to control the pace of their learning.⁴ A flipped classroom can provide all of these aspects of learning.

For example, a video module, videotaped lecture, or active learning session before a face-to-face encounter helps millennial learners stay active to the tasks at hand. A flipped classroom also allows students to

replay a part of a lecture or modules they would like to learn again if needed.⁴ Because the flipped classroom is “student centered,” millennial learners can fully engage and be in charge of their own learning.⁵ People who tend to succeed in the flipped classroom have high levels of self-motivation.⁶ Although intrinsic motivation is innate, “the maintenance and enhancement of intrinsic motivation depends on the social and environmental conditions surrounding the individual.”⁷ Allowing the millennial learner freedom to participate in learning before in-person sessions gives them autonomy and allows them to view the subject matter in their own time and space and learn at their own pace.⁸ The face-to-face part of the flipped classroom then encourages deep and meaningful interaction with others, allowing for high order of thinking.⁹ The need for peer-to-faculty interactions is imperative in medical education, and this interaction occurs in the flipped classroom.¹⁰

Responses from students have been positive, with surveys showing that most millennial students have enjoyed their experience with the flipped classroom method of teaching.¹¹ For example, in one survey,¹² millennial students preferred the variety of learning formats that the flipped classroom provided.

How Does the Flipped Classroom With SBME Work?

In SBME, the flipped classroom is incorporated when learners are given videos or pretests before a simulated case to prepare them for the learning objective of the session. During the simulation or face-to-face environment, the learners “engage in experimental learning through simulation of various sorts.”¹³ During the debriefing phase of SBME, the learners can react and reflect on their practice while they absorb and retain information “at their own pace and perhaps have a choice of methods by which to achieve cognitive learning objectives.”¹³ Thus, learners identify how they perceive, process, and learn the information they are provided and experience.¹⁴

Using the Flipped Classroom With SBME to Engage Learning Styles

Millennial students have different learning ideals than other generations, such as Generation X, which is not as technologically advanced. The flipped classroom allows for multiple learning styles for students to obtain knowledge.¹⁴ Millennial students may want or expect the incorporation of technology and visual learning aides to improve their learning.¹⁴ For example, a study of graduate pharmacy students showed they had better recall and did better on a test after exposure to both a “flipped classroom format and a virtual patient case.”¹⁵

Incorporating the Flipped Classroom With SBME in Osteopathic Medical School

Flipped classrooms are useful during clerkship years when osteopathic medical students are geographically spread out and cannot immediately convene at a given location. Flipped classrooms are especially beneficial during hospital rotations, where students are expected to have an extraordinary amount of medical knowledge to apply in clinical settings. Before their rotation, students can be emailed information, videos, and modules that they can review before their rotation. This is especially valuable in subspecialty areas, where specific information needed is often not detailed during preclinical training. One study in China showed that when an ophthalmology module was given to students before their rotation, students in the flipped classroom had higher scores on a posttest compared with students in the traditional group.¹⁶ However, in another study, Carrick et al¹⁷ showed that a group of students who took a neuro-otology curriculum online (representing the flipped classroom) received similar scores on posttests as those who were assigned to the traditional classroom experience.

Williams¹⁸ noted that during the face-to-face interaction of a flipped classroom, one of the only skills not taught was bedside manner. Simulation could help fill this gap. During the simulated session of a flipped classroom, the osteopathic medical student would be

exposed to a case on the subject they were learning. This case would be videotaped and recorded and reviewed with a faculty member who would discuss how it relates to clinical practice. Such a session would allow for a learning-centered paradigm that the millennial learner craves.⁴ As stated in a *Simulating Healthcare* article,¹³ “the face-to-face time that students spend together in conjunction with faculty members is generally the most expensive time,” and therefore, it should be maximized. Furthermore, SBME may help osteopathic medical students pass licensing examinations. Sandella et al¹⁹ found that students who had a prerequisite SP examination at their school were more likely to pass the Comprehensive Osteopathic Medical Licensing Examination-USA Level 2-Performance Evaluation.

Procedure-driven specialties such as surgery can use SBME and the flipped classroom as an avenue for students to practice surgical procedures. Chiu et al²⁰ found that medical students who participated in a simulation-based flipped classroom were able to suture better than their counterparts in traditional classroom settings. In a study by Liebert et al,²¹ medical students on their surgery clerkships who were exposed to a simulation-based flipped classroom felt more prepared for their shelf examinations and agreed that the “environment fostered accountability and self-directed learning.” These results suggest that by incorporating SBME with a flipped classroom, medical students can learn procedure-based skills as well as enhance their medical knowledge.²² Likewise, by using SBME, the ACGME simulation requirement that exists for some specialties can be met.²³

Flipped Classroom and Graduate Education

Considering medical education also involves lifelong learning, it is important to examine how the flipped classroom affects GME. An osteopathic medical student is preparing to enter the GME world from the first day of osteopathic medical school. When that

student enters GME, he or she must be prepared and ready for learning curves and the exponential knowledge growth seen in residency programs. Emergency medicine residency programs have studied the flipped classroom and have used the idea of filmed lectures, modules, and simulations with positive results.²⁴ Young et al²⁵ tested the idea of a flipped classroom on Loma Linda ACGME-accredited emergency medicine residents and found that most residents preferred this learning environment. Anesthesiology interns²⁶ and residents²⁷ also have responded favorably to a flipped classroom method. A study of 143 internal medicine residents who were exposed to a flipped classroom at the Mayo Clinic had “improved scores after curriculum exposure and associations with greater engagement in online modules.”²⁸ They also had improved quality improvement knowledge.²⁸

Residency programs are expected to prepare residents for practice by developing competencies in patient care, medical knowledge, practice-based learning and improvement, interpersonal and communication skills, professionalism, and systems-based practice.^{29,30} Journal clubs are common tools to enhance practice-based learning and improve overall competency of residents. Journal clubs can be seen as flipped classrooms, where the learner is given an article before an intense face-to-face dissection of the article at a later date. Rucker et al,³¹ however, described how a family medicine residency expanded their journal club by embracing a flipped classroom model and posting online discussion modules with more interactive case vignettes. Instead of the face-to-face meeting being a long account of the article, discussions were able to begin immediately, bringing clinical patient demographics to the forefront.³¹

Cooper et al³² highlight the differences in the flipped classroom in the undergraduate and graduate levels of medical education. During undergraduate training, medical students’ main responsibility is to study and engage in testing; during GME training, learners have a larger clinical responsibility and must take time to develop their practical skills as well as continue

learning. Although the outcome of the journey is the same (to be a competent physician), getting there while facing day-to-day challenges can be an issue. Cooper et al³² suggest giving residents incentives to help motivate them for learning in a flipped classroom model. This incentive can not only help motivate the learner, but can also hold the learner accountable for participating in the flipped classroom. Patanwala et al³³ found that pharmacy students did better in a flipped classroom setting when they knew a posttest was involved than if there was no test.³³

The flipped classroom has also been used in other sectors of graduate education. Nursing education programs have found “neutral or positive outcomes.”³⁴ Masters of public health programs have used the flipped classroom with positive results,^{35,36} as has veterinary science education.³⁷

Dealing With Challenges and Change

Although most osteopathic medical schools have simulation laboratories that could be used with the flipped classroom, the financial costs of increasing technology, developing online modules or videos, and training faculty in the new curricular model may still be a barrier. Technological issues in particular present a challenge to the flipped classroom.³⁸ Making sure osteopathic medical students have access to proper technology to be able to participate in the pre-class assignments, regardless of their financial situation, is important to avoid introducing economic disadvantages. Moffett³⁹ offers 12 tips for “flipping” the classroom. For example, she recommends using technology already available as a money-saving strategy.³⁹ Another suggestion is to “remember that a flip does not have to be ‘all or nothing.’”³⁹ These changes can occur gradually, which is especially important to remember in the early stages of a flip when faculty and learners may be hesitant.

Over time and with effort, the curriculum will come together and provide a variety of learning options for

students. As noted by Roehl et al,⁴ “The introduction of any new strategy requires a shift in the minds of both educators and students.” The faculty will need training sessions and development sessions to assume the role as facilitator and mentor to the students during the face-to-face time. The faculty in charge of the debriefing portion of simulations will also need training and instruction. An important part of making the flipped classroom successful is to appropriately point out the expectations for the results of the course for both the student and educator.⁴⁰ Millennial learners will likely have a smooth transition to the flipped classroom and SBME, as they have been exposed to online learning and technological tools.

Although there will be an initial increase in financial investment for at least the first year of the flipped classroom with SBME, the costs should eventually decrease. As described by Persky and McLaughlin,⁸ “by blending the strengths of computer-mediated instruction ... and face-to-face class time..., the flipped classroom can improve student outcomes, increase student engagement, and enhance critical thinking development.” Thus, the changes and investments will be invaluable to the success of the program.⁴¹

Conclusion

As the millennial learner has adjusted to “disruptive innovations,” so must osteopathic medical education.⁴² By osteopathic undergraduate medical education using a flipped classroom in the curriculum, students can feel engaged in their learning while also controlling the pace of medical knowledge.⁴² With the single accreditation system finalizing in 2020, the time is now to adapt to a flipped classroom with SBME as a standard for teaching osteopathic medical students to meet the ACGME requirements and to succeed in ACGME-accredited residencies.

References

1. Toohey SL, Wray A, Wiechmann W, Lin M, Boysen-Osborn M. Ten tips for engaging the millennial learner and moving an emergency medicine residency curriculum into the 21st century. *West J Emerg Med*. 2016;17(3):337-343. doi:10.5811/westjem.2016.3.29863
2. Schwartzstein RM, Roberts DH. Saying goodbye to lectures in medical school—paradigm shift or passing fad? *N Engl J Med*. 2017;377(7):605-607. doi:10.1056/NEJMp1706474
3. ACGME Program Requirements for Graduate Medical Education in General Surgery. Chicago, IL: Accreditation Council for Graduate Medical Education; 2018. <https://www.acgme.org/Portals/0/PFAssets/ProgramRequirements/440GeneralSurgery2018.pdf?ver=2017-10-03-110315-270>. Accessed August 29, 2018.
4. Roehl A, Reddy SL, Shannon GJ. The flipped classroom: an opportunity to engage millennial students through active learning strategies [strategies]. *J Fam Consumer Sci*. 2013;105(2):44-49.
5. Gillispie V. Using the flipped classroom to bridge the gap to generation Y. *Ochsner J*. 2016;16(1):32-36.
6. Lucardie AT, Berkenbosch L, van den Berg J, Busari JO. Flipping the classroom to teach millennial residents medical leadership: a proof of concept. *Adv Med Educ Pract*. 2017;8:57-61. doi:10.2147/AMEP.S123215
7. Riley G. The role of self-determination theory and cognitive evaluation theory in home education. *Cogent Educ*. 2016;3(1):1163651. doi:10.1080/2331186X.2016.1163651
8. Persky AM, McLaughlin JE. The flipped classroom—from theory to practice in health professional education. *Am J Pharm Educ*. 2017;81(6):118. doi:10.5688/ajpe816118
9. DeRuisseau L. The flipped classroom allows for more class time devoted to critical thinking. *Adv Physiol Educ*. 2016;40(4):522-528. doi:10.1152/advan.00033.2016
10. McLean S, Attardi SM, Faden L, Goldszmidt M. Flipped classrooms and student learning: not just surface gains. *Adv Physiol Educ*. 2016;40(1):47-55. doi:10.1152/advan.00098.2015
11. Ramnanan CJ, Pound LD. Advances in medical education and practice: student perceptions of the flipped classroom. *Adv Med Educ Pract*. 2017;8:63-73. doi:10.2147/AMEP.S109037
12. Pettit R, McCoy L, Kinney M. What millennial medical students say about flipped learning. *Adv Med Educ Pract*. 2017;8:487-497. doi:10.2147/AMEP.S139569
13. Simulation can be the model flipped classroom. Simulating Healthcare. April 9, 2014. <https://simulatinghealthcare.net/2014/04/09/simulation-can-be-the-model-flipped-classroom/>. Accessed December 6, 2017.
14. Romanelli F, Bird E, Ryan M. Learning styles: a review of theory, application, and best practices. *Am J Pharm Educ*. 2009;73(1):9.
15. Lichvar AB, Hedges A, Benedict NJ, Donihi AC. Combination of a flipped classroom format and a virtual patient case to enhance active learning in a required therapeutics course. *Am J Pharm Educ*. 2016;80(10):175. doi:10.5688/ajpe8010175
16. Tang F, Chen C, Zhu Y, et al. Comparison between flipped classroom and lecture-based classroom in ophthalmology clerkship. *Med Educ Online*. 2017;22(1):1395679.
17. Carrick FR, Abdulrahman M, Hankir A, et al. Randomized controlled study of a remote flipped classroom neuro-otology curriculum. *Front Neurol*. 2017;8:349. doi:10.3389/fneur.2017.00349
18. Williams DE. The future of medical education: flipping the classroom and education technology. *Ochsner J*. 2016;16(1):14-15.

19. Sandella JM, Peters A, Smith LL, Gimipel JR. Preparation strategies of osteopathic medical students for the COMLEX-USA Level 2-PE. *J Am Osteopath Assoc*. 2016;116(4):234-242. doi:10.7556/jaoa.2016.048
20. Chiu HY, Kang YN, Wang WL, et al. The effectiveness of a simulation-based flipped classroom in the acquisition of laparoscopic suturing skills in medical students—a pilot study. *J Surg Educ*. 2018;75(2):326-332. doi:10.1016/j.jsurg.2017.07.007
21. Liebert CA, Mazer L, Bereksy Merrell S, Lin DT, Lau JN. Student perceptions of a simulation-based flipped classroom for the surgery clerkship: a mixed-methods study. *Surgery*. 2016;160(3):591-598. doi:10.1016/j.surg.2016.03.034
22. Okuda Y, Bryson EO, DeMaria S Jr, et al. The utility of simulation in medical education: what is the evidence? *Mt Sinai J Med*. 2009;76(4):330-343. doi:10.1002/msj.20127
23. Riley B. Using simulation-based medical education to meet the competency requirements for the single accreditation system. *J Am Osteopath Assoc*. 2015;115(8):504-508. doi:10.7556/jaoa.2015.104
24. Rose E, Claudius I, Tabatabai R, Kearn L, Behar S, Jhun P. The flipped classroom in emergency medicine using online videos with interpolated questions. *J Emerg Med*. 2016;51(3):284-291. doi:10.1016/j.jemermed.2016.05.033
25. Young TP, Bailey CJ, Guptill M, Thorp AW, Thomas TL. The flipped classroom: a modality for mixed asynchronous and synchronous learning in a residency program. *West J Emerg Med*. 2014;15(7):938-944. doi:10.5811/westjem.2014.10.23515
26. Marchalot A, Dureuil B, Veber B, et al. Effectiveness of a blended learning course and flipped classroom in first year anesthesia training [published online November 22, 2017]. *Anaesth Crit Care Pain Med*. doi:10.1016/j.accpm.2017.10.008
27. Martinelli SM, Chen F, DiLorenzo AN, et al. Results of a flipped classroom teaching approach in anesthesiology residents. *J Grad Med Educ*. 2017;9(4):485-490. doi:10.4300/JGME-D-17-00128.1
28. Bonnes S, Ratelle J, Halvorsen A, et al. Flipping the quality improvement classroom in residency education. *Acad Med*. 2017;92(1):101-107. doi:10.1097/ACM.0000000000001412
29. ACGME Outcome Project: general competencies. University of Colorado Denver website. <http://www.ucdenver.edu/academics/colleges/medicalschool/departments/pediatrics/meded/fellowships/Documents/ACGME%20Outcome%20Project.pdf>. Assessed December 6, 2017.
30. Malik MU, Diaz Voss Varela DA, Stewart CM, et al. Barriers to implementing the ACGME Outcome Project: a systematic review of program director surveys. *J Grad Med Educ*. 2012;4(4):425-433.
31. Rucker SY, Ozdogan Z, Al Achkar M. Flipped classroom model for learning evidence-based medicine. *Adv Med Educ Pract*. 2017;8:619-625. doi:10.2147/AMEP.S142233
32. Cooper AZ, Hsieh G, Kiss JE, Huang GC. Flipping out: does the flipped classroom learning model work for GME? [editorial]. *J Grad Med Educ*. 2017;392-393. doi:10.4300/JGME-D-16-00827.1
33. Patanwala AE, Erstad BL, Murphy JE. Student use of flipped classroom videos in a therapeutics course. *Curr Pharm Teach Learn*. 2017;9(1):50-54. doi:10.1016/j.cptl.2016.08.043
34. Bethavas V, Bridgman H, Kornhaber R, Cross M. The evidence for 'flipping out': a systematic review of the flipped classroom in nursing education. *Nurse Educ Today*. 2016;38:15-21. doi:10.1016/j.nedt.2015.12.010
35. Galway LP, Corbett KK, Takaro TK, Tairyan K, Frank E. A novel integration of online and flipped classroom instructional models in public health higher education. *BMC Med Educ*. 2014;14:181. doi:10.1186/1472-6920-14-181
36. Howard SW, Scharff DP, Loux TM. Flipping classrooms in a school of public health. *Front Public Health*. 2017;5:73. doi:10.3389/fpubh.2017.00073
37. Mortensen CJ, Nicholson AM. The flipped classroom stimulates greater learning and is a modern 21st century approach to teaching today's undergraduates. *J Anim Sci*. 2015;93(7):3722-3731. doi:10.2527/jas.2015-9087
38. Torre D, Manca A, Durning S, Janczukowicz J, Taylor D, Cleland J. Learning at large conferences: from the 'sage on the stage' to contemporary models of learning. *Perspect Med Educ*. 2017;6(3):205-208. doi:10.1007/s40037-017-0351-3
39. Moffett J. Twelve tips for "flipping" the classroom. *Med Teach*. 2015;37(4):331-336. doi:10.3109/0142159X.2014.943710
40. Jesurasa A, Mackenzie K, Jordan H, Goyder EC. What factors facilitate the engagement with flipped classrooms used in the preparation for postgraduate medical membership examinations? *Adv Med Educ Pract*. 2017;8:419-426. doi:10.2147/AMEP.S132266
41. Caligaris M, Rodriguez G, Laugero L. A first experience of flipped classroom in numerical analysis. *Pocedia Social Behav Sci*. 2016;217:838-845.
42. Hurtubise L, Hall E, Sheridan L, Han H. The flipped classroom in medical education: engaging students to build competency. *J Med Educ Curricular Dev*. 2015;2:35-43. doi:10.4137/JMECD.S23895

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