

Article

Not peer-reviewed version

Reaching Students Where They Scroll: Facebook as a Learning Platform in Undergraduate Anatomy and Physiology Education

[Homaira M Azim](#)*, [Dimitrios E Bakatsias](#), [Patrick A Vespa](#), [Brittnay K Harrington](#), [Kristyn A Spetz](#)

Posted Date: 12 August 2025

doi: 10.20944/preprints202508.0734.v1

Keywords: anatomy education; health sciences education; learning community; student motivation; student retention; Facebook



Preprints.org is a free multidisciplinary platform providing preprint service that is dedicated to making early versions of research outputs permanently available and citable. Preprints posted at Preprints.org appear in Web of Science, Crossref, Google Scholar, Scilit, Europe PMC.

Copyright: This open access article is published under a Creative Commons CC BY 4.0 license, which permit the free download, distribution, and reuse, provided that the author and preprint are cited in any reuse.

Disclaimer/Publisher's Note: The statements, opinions, and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions, or products referred to in the content.

Article

Reaching Students Where They Scroll: Facebook as a Learning Platform in Undergraduate Anatomy and Physiology Education

Homaira M. Azim *, Dimitrios E. Bakatsias, Patrick A. Vespa, Brittney K. Harrington and Kristyn A. Spetz

Drexel University College of Medicine, Philadelphia, PA, USA

* Correspondence: homaira.azim@drexel.edu

Abstract

ocial networking platforms offer promising educational value, particularly for undergraduate students whose daily lives are deeply embedded in online spaces. Yet in most courses, instructional technologies remain limited to institutional learning management systems (LMS), which often do not foster informal interaction or community. This study examined whether supplementing LMS with a Facebook group could enhance academic outcomes and retention in undergraduate Anatomy and Physiology (A&P) courses. Over two semesters, two student cohorts (N = 39) were taught by the same instructor using identical materials; one cohort also used a closed Facebook group for course-related engagement. Students in the Facebook cohort scored significantly higher on mid-semester unit exams ($p < .001$ to $p = .006$). Though final course grades were not significantly different ($p = .186$), regression analysis revealed a 9.4% higher mean final grade among Facebook users. Importantly, the pass rate in the Facebook cohort was 94.7% compared to 45% in the control group, with dropout rates significantly lower (5.3% vs. 55%, $p = .001$). These findings suggest that incorporating social media into undergraduate science instruction may promote academic success and retention by providing a familiar, collaborative space for active learning and peer support.

Keywords: anatomy education; health sciences education; learning community; student motivation; student retention; Facebook

Introduction

Background

Electronic technologies are deeply embedded in modern life and increasingly regarded as essential in education. U.S. colleges and universities routinely use at least one learning management system (LMS), such as Canvas or Blackboard, in both online and in-person courses. Most instructors, however, restrict their use of educational technologies to LMS tools, institutional email, or a combination of both (Roblyer et al., 2010). Some also incorporate student response systems (SRSs), like clickers, to promote active learning (Hutson, 2022; Mand et al., 2024; Grzeskowiak et al., 2015). Collectively, these tools reflect a shift toward integrating technology into the higher education landscape.

For incoming freshmen, the transition to college marks a period of social and academic adjustment. Many students rely on social media to establish connections and navigate this unfamiliar environment (Arnett, 2007; Touloupis & Tachmatzidis, 2023). Social media is deeply woven into students' daily routines and significantly shapes campus culture (Michikyan et al., 2015). One study involving over 300 college students found that participants checked Facebook nearly every hour on average, underscoring how deeply the platform is embedded in their daily routines (Hainš et al., 2020), yet its use for academic purposes remains limited (Kolhar & Kazi, 2021). While students often prefer using mobile devices for learning, they still value accessible, informal ways to connect with

peers and instructors— primarily through familiar digital platforms (Magda et al., 2020). Research shows that meaningful engagement with faculty correlates with increased academic motivation, stronger performance, and reduced attrition (Al-Hussami et al., 2011; Bengtsson & Ohlsson, 2010). Although social media could be a valuable tool for student-faculty interaction, there is a mismatch between student and instructor usage rates (Kleiner et al., 2007; Machado et al., 2024).

Barriers to Engagement and Belonging

Students primarily use their institution's LMS because it is required for participation (Koh & Kan, 2021; Ross, 2021). However, most LMS platforms typically lack informal, interactive features that encourage meaningful social connection and engagement for students (Gray et al., 2010). The formal structure of the LMS platform often results in passive participation and limits interactions with peers or faculty. This lack of community can diminish student motivation and obstruct deeper engagement with course material (Lenhart, 2001; Costley et al., 2022). External factors, such as discomfort initiating communication or a lack of belonging, may further hinder collaborative learning and academic performance. Collaborative learning environments, by contrast, have been shown to boost student motivation and support the attainment of educational goals (Loes, 2022; Mendo-Lázaro et al., 2022). Nevertheless, traditional LMS tools often lack the social reinforcement necessary to foster a sense of community among students and between students and faculty.

Faculty who do not engage with social media may risk becoming disconnected from students' current digital culture and communication norms (Brubaker et al., 2021). Building a strong classroom community requires more than structured discussion boards; it requires informal, flexible tools that allow students to comfortably interact and share. In the absence of such tools, many students may miss out on the collaborative benefits of peer learning. Existing research supports the idea that informal interactions and a shared sense of classroom culture are central to creating a supportive learning environment (Garg & Dougherty, 2022; Johnson et al., 2014).

Rethinking Connection Through Technology

To address LMS limitations some educators have turned to social media platforms like Facebook as supplementary learning spaces. This approach aligns with pedagogical goals of building accessible, interactive, and supportive environments that extend beyond the classroom. In a systematic review of 14 studies, Cheston et al. (2013) found that social media tools, including faculty-moderated blogs, were as effective as traditional small-group learning in developing students' academic skills. Similarly, Guckian et al. (2021) showed that platforms like Facebook and WhatsApp improved student engagement and were associated with higher test scores. Ortadeveci et al. (2023) examined social media's role in anatomy education and found that it improved access to content, encouraged peer discussion, and facilitated real-time information exchange.

With users spending over two hours per day on social networking platforms globally (Kemp, 2024), these platforms present a powerful yet underutilized opportunity for academic engagement. Their familiarity, accessibility, and widespread popularity among students make them particularly well-suited to fostering informal peer learning and community-building (Chambers et al., 2023; Shaltry et al., 2013). In an era of rapid technological advancement—including the rise of artificial intelligence (AI)—integrating the use of social media for academic purposes may offer a minimally disruptive way of staying connected to the mainstream student culture. Independent of the tools used, traditional models of instruction require serious rethinking. There is a growing shift away from passive, lecture-based formats toward more dynamic, student-centered approaches in anatomy education—such as spaced repetition, flipped classroom models, and near-peer teaching—each aimed at deepening engagement and enhancing long-term retention (Satoh et al., 2023; Azim et al., 2025; Castellano et al., 2024).

However, implementing social media in academic settings comes with several challenges. DiVall et al. (2012) noted that managing a class Facebook group required extra time and energy from instructors, and that student engagement tended to decline as the semester progressed. Security and

privacy concerns were also raised when unauthorized users joined open groups. To mitigate such issues, instructors can create closed groups, set clear conduct expectations, and assign moderators to encourage meaningful and appropriate activity. Additional concerns about e-professionalism—including breaches of confidentiality or inappropriate behavior—must be considered. These concerns may be addressed through formal training or signed agreements outlining acceptable use (Vukušić et al., 2021; DiVall et al., 2012). Instructors should also assess feasibility based on class size; managing a small cohort of 20 may be realistic, compared to managing a group of 100 which could present logistical challenges.

It is well established that the role of academic and social integration—referring to students' engagement with both the intellectual and interpersonal aspects of college life— supports retention and performance. Rienties et al. (2020) emphasized its importance in sustaining student commitment. Analysis of 26,000 responses from the Community College Survey of Student Engagement found that increased engagement correlated with lower attrition (Spitzig & Renner, 2022). Likewise, a longitudinal study of over 8,000 students across 44 U.S. institutions found that students who continued into their second year exhibited higher levels of classroom participation and engagement with faculty (Griffin et al., 2022). These findings reinforce that social and academic engagement are central to reducing dropout rates and supporting success (Truta & Baban, 2018; Rienties et al., 2020).

Social media can also hold promise beyond the classroom. In healthcare education, social networking platforms are increasingly used for rapid communication, professional networking, and sharing evidence-based resources (Chan et al., 2018; Cortegiani et al., 2024; Hasham et al., 2025). These platforms can further support the development of collaborative culture and enhance communication between educators and students (Guckian et al., 2021).

Putting It to the Test

This study is grounded in the first author's experience incorporating a Facebook group into undergraduate Anatomy and Physiology (A&P) courses at a community college in central Indiana. Two sections of A&P 101 were taught by the same instructor using identical course materials. One section had access to a closed Facebook group in addition to the institutional LMS; the other did not. The study aimed to determine whether Facebook use as a supplementary learning tool would correlate with improved academic performance and reduced dropout rates. It was hypothesized that students using Facebook would demonstrate higher levels of engagement, better exam scores, and a significantly higher course completion rate.

Methods

This study analyzed data drawn from the official gradebooks of two Anatomy and Physiology (A&P 101) courses taught by the same instructor over two consecutive semesters at a community college. While the two cohorts consisted of different students, their demographic characteristics were comparable. Both courses followed an identical curriculum and utilized the same instructional materials, including course texts, lecture slides, lab resources, quizzes, and examination forms. The instructor delivered content during the same weekly timeslots in both cohorts. The only distinction between the two groups was the use of a Facebook closed-group page, which was implemented exclusively in Cohort B. Cohort A did not use Facebook as a supplementary learning tool.

As the main intervention in this study, a private Facebook group page was created for Cohort B and used alongside the institution's LMS platform. The page was created and actively moderated by the course instructor. Access was restricted to students enrolled in Cohort B and the instructor, ensuring a secure, closed-group environment. The page was intended to function as a supplementary learning space—not a requirement for course participation—and provided a flexible, informal platform for academic interaction. Posts included reminders about quizzes and lab activities, supplemental learning tips, study resources, and motivational messages. Students were encouraged, though not mandated, to ask questions, share ideas, and engage with each other on course-related topics. The instructor routinely monitored group activity to respond to questions and promote a

respectful and supportive learning atmosphere. No grades or participation points were tied to Facebook group activity.

All enrolled students in both classes were included in the study: Cohort A (n = 20) and Cohort B (n = 19), for a total sample size of 39. No exclusion criteria were applied. The only sources of data were the instructor-maintained gradebooks and demographic information routinely collected at course enrollment.

Course assessments included four unit exams (each composed of a lecture and a lab component) and ten quizzes (five lecture and five lab). For the purposes of analysis, only the first, second, and final unit exams were included. These consisted of lecture exam 1, lab exam 1, lecture exam 2, lab exam 2, final lecture exam, and final lab exam. The third unit exam was excluded because the majority of students who eventually dropped the course had already disengaged by that point and did not complete the exam. Including it would have introduced substantial missing data. It was assumed that the first, second, and final unit exams offered sufficient information to evaluate both individual and group-level academic performance. Each of the lecture and lab exams from units 1 and 2 was graded out of 50 points. Final lecture and lab exams were graded out of 75 points. Final course grades were calculated as percentages on a 100-point scale.

Demographic data and exam scores were entered into SPSS statistical software (version 24) for analysis. The primary outcome variable was students' final course grade (%). The main independent variable was Facebook use (yes/no). Descriptive statistics included means and standard deviations for continuous variables (i.e., age, exam scores, final course grades) and frequencies and percentages for categorical variables (i.e., gender, race, Facebook use, and dropout status). Inferential statistical tests included independent sample t-tests, chi-square tests, linear regression, and correlation analysis. The significance level (α) was set at .05, and p-values below this threshold were considered statistically significant.

Results

A total of 39 students were included in the study: 20 students (51.3%) in Cohort A (no Facebook) and 19 students (48.7%) in Cohort B, which used a closed Facebook group as an additional learning platform. Demographic characteristics, including age, gender, and race, were broadly similar between the cohorts, with no statistically significant differences. Full demographic data is presented in Table 1.

Table 1. Student demographic data.

Variable	Cohort A n = 20	Cohort B n = 19	P-value
Age, mean (SD)	27.15 (6.9)	26.16 (5.2)	0.246
Gender			
Female	18	17	1.000
Male	2	2	
Race			
White	14	16	0.487
Black	3	1	
Asian	1	0	
Latino/Latina	0	1	
Indian	2	1	
Dropped out	11	1	0.001

Academic Performance

The primary outcome variable was final course grade (%). The study examined whether Facebook use had a statistically significant impact on students' final grades or individual unit exam

scores. Final course grades were available for 27 of the 39 students; the remaining 12 students dropped out prior to the final exam.

A correlation matrix of numerical variables confirmed that student age was not significantly correlated with final course grade ($p = .744$, $r = .066$). In contrast, each of the six unit exams—Lecture Exam 1, Lab Exam 1, Lecture Exam 2, Lab Exam 2, Final Lecture Exam, and Final Lab Exam—was strongly and significantly correlated with final course grade, with all p -values $< .001$ and correlation coefficients ranging from $r = .840$ to $r = .937$. These values highlight the predictive strength of students' assessment scores across the semester. The full results are shown in Table 2.

Independent sample t -tests revealed statistically significant differences in performance between the Facebook and non-Facebook cohorts for Lecture Exam 1 ($p < .001$), Lab Exam 1 ($p = .004$), Lecture Exam 2 ($p = .006$), and Lab Exam 2 ($p = .004$). However, no statistically significant differences were found in Final Lecture Exam ($p = .492$), Final Lab Exam ($p = .206$), or Final Course Grade (%) ($p = .186$). These results suggest that while students using Facebook performed significantly better in earlier exams, this benefit did not extend to final exam scores or overall course grades.

Table 2. Mean comparisons of student grades between Cohort A (no Facebook) and Cohort B (Facebook), with correlation to final course grade (%).

Unit Exams & Final Course Grade	Cohort A mean (SD)	Cohort B mean (SD)	P-value	Correlation with Final Course Grade (r)
Lecture Exam 1	31.6 (5.4)	41.4 (8.3)	<0.001	.840
Lab Exam 1	28.7 (10.5)	39.3 (11.1)	0.004	.850
Lecture Exam 2	31.6 (7.3)	39.6 (9.7)	0.006	.875
Lab Exam 2	24.5 (11.7)	35.8 (11.2)	0.004	.931
Final Lecture Exam	50.6 (14.1)	54.3 (12.5)	0.492	.845
Final Lab Exam	49.3 (19.1)	58.3 (15.9)	0.206	.937
Final Grade (%)	64.4 (16.7)	73.9 (17.2)	0.186	—

Note: This table presents mean scores out of 50 points (with standard deviations) for each unit exam and final course grade across both cohorts. P-values reflect independent sample t-tests. Pearson correlation coefficients (r) represent associations between each exam and the final course grade, based on students who completed the course (n = 27). Correlations are not listed for final course grade, as it was the outcome variable.

To further evaluate the relationship between Facebook use and final course grades, a linear regression analysis was conducted. Using Facebook participation as the predictor variable and final course grade as the outcome, the regression equation was:

$$\text{Final Course Grade (\%)} = 64.444 + 9.444 \times \text{Facebook}$$

Students who used Facebook scored an average of 9.44 percentage points higher, though the model's $R^2 = .069$, indicating limited explanatory power. The p -value = .186, which was not statistically significant. A follow-up multiple regression analysis incorporating early exam scores did not improve model significance, and stepwise modeling excluded Facebook from all predictive models, reaffirming that Facebook use was not a significant predictor of final grades.

Student Retention and Dropout Rates

A key difference between the two cohorts was the rate of student retention. Of the 39 students included in the study, 12 (30.8%) dropped the course before completing the final exam. However, retention varied dramatically between cohorts: 11 students dropped from Cohort A (55%), while only 1 student dropped from Cohort B (5.3%). This difference was statistically significant based on a chi-

square test ($p = .001$), strongly suggesting a relationship between Facebook use and reduced dropout rates. Students who participated in the Facebook group were significantly less likely to drop the course, suggesting that the social and academic support provided via the platform may have positively impacted engagement and course completion.

Discussion

This study explored the potential benefits of incorporating Facebook as a supplementary learning tool in undergraduate Anatomy and Physiology (A&P) classrooms. The initial hypothesis proposed that Facebook use could enhance student motivation, engagement, and sense of community—factors that might translate into improved academic performance and reduced dropout rates. Overall, statistical analyses revealed significantly higher scores on early unit exams and substantially lower dropout rates among students who used Facebook. While the difference in final course grades was not statistically significant, the observed trends point to a positive association between Facebook use and student success.

Learning in the Feed: How Facebook Supported Performance

To better understand how Facebook might support student learning, we examined its impact on both academic performance and course retention. Independent sample t-tests revealed significantly higher early unit exam scores in the Facebook group, and correlation analyses demonstrated strong associations between these scores and final course grades. Linear regression indicated that Facebook users scored an average of 9.44 percentage points higher than non-users, though this difference did not reach statistical significance ($p = .186$). This pattern mirrors earlier findings by Klein (2008), who documented similar improvements in science achievement when using Facebook to support classroom instruction.

These findings align with a growing body of research suggesting that social media platforms can promote collaborative learning, improve communication with instructors, and facilitate the exchange of academic resources and peer support (Jaffar et al., 2016; Ali, 2016). Several studies echo this perspective: Cheston et al. (2013), Guckian et al. (2021), and Ashraf et al. (2021) all reported enhanced academic outcomes when social media was purposefully embedded into educational contexts. Ashraf et al. (2021) further highlighted the importance of social constructivist learning principles and the technology acceptance model in maximizing the pedagogical value of these platforms. However, unlike our small sample of 39 students, their findings were based on a much larger population ($n = 233$). The lack of statistical significance in our regression model may therefore reflect limited statistical power rather than the absence of a real effect.

Interestingly, although students in the Facebook group consistently outperformed their peers in early assessments, no statistically significant difference was observed in final lecture or lab exam scores. One possible explanation for this is the substantial imbalance in cohort sizes among students who completed the final exams: 18 were from the Facebook group, but only 9 were from the non-Facebook group. This uneven distribution may have limited our ability to detect significant differences at the end of the semester. Nonetheless, correlation coefficients between all six unit exams and final course grade were robust ($r = .840$ to $r = .937$), emphasizing the predictive value of ongoing assessment.

Belonging and Persistence: The Retention Effect

Perhaps the most striking finding of the study was the sharp contrast in dropout rates. While over half of the students in the non-Facebook group (55%) dropped the course, only one student (5.3%) from the Facebook group did so. This difference was statistically significant ($p = .001$), suggesting that participation in a class Facebook group may contribute to increased retention. These findings align with prior literature on social integration and academic persistence, where belongingness and peer support play critical roles in student success (Tinto, 1993; Rovai, 2003).

Demographics and Data Boundaries

Analyses of student age, gender, and race were not used to draw conclusions about academic outcomes due to the small and uneven distribution of participants across demographic subgroups. For instance, the sample was ~90% female and ~77% White, with limited representation from other racial and gender identities. Additionally, age was not significantly correlated with final course grade ($p = .744$), and including a quadratic age variable failed to improve the relationship. These limitations restricted meaningful subgroup comparisons, and investigating such effects was beyond the scope of the current study.

Limitations and Future Directions

This study was limited by its relatively small sample size ($n = 39$) and lack of randomization. The findings, while promising, cannot be generalized without caution. Future research should involve larger cohorts across multiple sections and campuses. Expanding the study to include other science courses and institutions could further validate whether social media integration benefits extend beyond A&P education. Finally, qualitative studies capturing student perspectives may shed light on the mechanisms by which social media influences motivation, engagement, and persistence in college learning environments.

Conclusions

This study contributes to a growing body of evidence suggesting that incorporating familiar social media platforms—such as Facebook—into undergraduate science instruction can positively influence student engagement and retention. Although improvements in final course grades did not reach statistical significance, students who participated in a course-specific Facebook group demonstrated significantly higher early exam scores and dramatically lower dropout rates. These findings highlight the potential of social media to serve as a supplemental academic space that fosters motivation, peer collaboration, and a sense of community—especially in courses with high cognitive demands like Anatomy and Physiology. In an educational landscape where students are deeply embedded in digital culture, embracing accessible and relatable tools may help instructors connect more effectively with their learners. By meeting students where they already are—online—educators can expand opportunities for engagement that extend beyond the capabilities of traditional learning management systems. While further research involving larger and more diverse samples is needed, the present study highlights the promise of low-barrier, high-familiarity platforms in supporting student success in higher education.

Author Contributions: HA designed the study and collected the data. HA and DB participated in data analysis. DB, PV and BH drafted the initial manuscript. PV and KS finalized the manuscript. HA supervised data analysis and manuscript preparation. All authors interpreted the results, provided feedback on earlier drafts, read and approved the final manuscript, and agreed to submit it to the journal. All authors have read and agreed to the published version of the manuscript.

Funding: The authors did not receive support from any organization for the submitted work.

Institutional Review Board Statement: All procedures performed in this study have been performed following the Declaration of Helsinki. This study was reviewed and granted the “exempt” status by the Institutional Review Board (IRB) at Indiana University (protocol # 1904319982). All participants involved in the study were invited to participate voluntarily. The need for written informed consent to participate was waived by the IRB.

Data Availability Statement: Majority of data generated and analyzed during this study are included in this published article. Complete raw datasets generated in this study are available from the corresponding author on reasonable request.

Conflicts of Interests: The authors declare that they have no competing interests.

References

- Al-Hussami, M., Saleh, M. Y. N., Hayajneh, F., Abdalkader, R. H., & Mahadeen, A. I. (2011). The effects of undergraduate nursing student–faculty interaction outside the classroom on college grade point average. *Nurse Education in Practice*, 11(5), 320–326. <https://doi.org/10.1016/j.nepr.2011.02.004>
- Ali, A. (2016). Medical students' use of Facebook for educational purposes. *Perspectives on Medical Education*, 5(3), 163–169. <https://doi.org/10.1007/s40037-016-0273-5>
- Arnett, J.J. (2007). Emerging Adulthood: What Is It, and What Is It Good For?. *Child Development Perspectives*, 1: 68-73. <https://doi.org/10.1111/j.1750-8606.2007.00016.x>
- Ashraf, M. A., Khan, M. N., Chohan, S. R., Khan, M., Rafique, W., Farid, M. F., & Khan, A. U. (2021). Social Media Improves Students' Academic Performance: Exploring the Role of Social Media Adoption in the Open Learning Environment among International Medical Students in China. *Healthcare*, 9(10), 1272. <https://doi.org/10.3390/healthcare9101272>
- Azim, H. M., Santare, J. A., Sprague, A. V., Murphy, R. J., Miller, L. C., Perrotta, S. E., Maddahi, Y. N., & Record, M. J. (2025). *How about an anatomy elective? Making a case for utilizing spaced repetition and longitudinal integration of anatomy in medical curricula*. *BMC Medical Education*, 25, Article 462. <https://doi.org/10.1186/s12909-025-07021-0>
- Bengtsson, M., & Ohlsson, B. (2010). The nursing and medical students' motivation to attain knowledge. *Nurse Education Today*, 30(2), 150–156. <https://doi.org/10.1016/j.nedt.2009.07.005>
- Brubaker, P., Gibbons, A., & Pettey, G. (2021). An examination of student perceptions of teacher social media use in the classroom. *Journal of Public Relations Education*, 7(1), 62–94. <https://journalofpreeducation.com/an-examination-of-student-perceptions-of-teacher-social-media-use-in-the-classroom/>
- Castellano, M. S., Riquelme, J. C., Vargas, M., & Smith, C. D. (2024). Empowering human anatomy education through gamification and artificial intelligence: An innovative approach to knowledge appropriation. *Clinical Anatomy*, 37(1), 12–24. <https://doi.org/10.1002/ca.24074>
- Chambers, J., Mistry, K., Spink, J., Tsigarides, J., & Bryant, P. (2023). Online medical education using a Facebook peer-to-peer learning platform during the COVID-19 pandemic: A qualitative study exploring learner and tutor acceptability of Facebook as a learning platform. *BMC Medical Education*, 23, 293. <https://doi.org/10.1186/s12909-023-04268-3>
- Chan, W. S., & Leung, A. Y. M. (2018). Use of social network sites for communication among health professionals: Systematic review. *Journal of Medical Internet Research*, 20(3), e117. <https://www.jmir.org/2018/3/e117/>
- Cheston, C. C., Flickinger, T. E., & Chisolm, M. S. (2013). Social media use in medical education: A systematic review. *Academic Medicine*, 88(6), 893–901. <https://doi.org/10.1097/ACM.0b013e31828ffc23>
- Cortegiani, A., Battaglini, D., Amato, G., Behr, A. U., Donadello, K., Einav, S., Frigo, M. G., Fullin, G., Giannini, A., Ippolito, M., Marozzi, F., Monzani, R., Monti, G., Schultz, M. J., Torrano, V., Villa, G., & Giarratano, A. (2024). Dissemination of clinical and scientific practice through social media: a SIAARTI consensus-based document. *Journal of anesthesia, analgesia and critical care*, 4(1), 21. <https://doi.org/10.1186/s44158-024-00157-3>
- Costley, J., Southam, A., Bailey, D., & Haji, S. A. (2022). How use of learning management system mediates the relationships between learner interactions and learner outcomes. *Interactive Technology and Smart Education*, 19(2), 184–201. <https://doi.org/10.1108/ITSE-12-2020-0236>
- DiVall, M. V., & Kirwin, J. L. (2012). Using Facebook to facilitate course-related discussion between students and faculty members. *American Journal of Pharmaceutical Education*, 76(2), Article 32. <https://doi.org/10.5688/ajpe76232>
- Garg, N., & Dougherty, K. D. (2022, May 24). How to build classroom community to increase student learning. *Inside Higher Ed*. <https://www.insidehighered.com/advice/2022/05/25/how-build-classroom-community-increase-student-learning-opinion>
- Gray, K., Annabell, L., & Kennedy, G. (2010). Medical students' use of Facebook to support learning: Insights from four case studies. *Medical Teacher*, 32(12), 971–976. <https://doi.org/10.3109/0142159X.2010.497826>

- Griffin, A., Johnson, K. V., & Jogan, K. (2022). First-year college students' behaviors and characteristics of those who stay and those who go. *Journal of College Student Retention: Research, Theory & Practice*, 23(4), 815–823. <https://doi.org/10.1177/1521025119879414>
- Grzeskowiak, L. E., Thomas, A. E., To, J., Phillips, A. J., & Reeve, E. (2015). Enhancing education activities for health care trainees and professionals using audience response systems: A systematic review. *Journal of Continuing Education in the Health Professions*, 35(4), 261–269. <https://doi.org/10.1097/01.CEH.0000473130.55806.87>
- Guckian, J., Utukuri, M., Asif, A., Burton, O., Adeyoju, J., Oumeziane, A., Chu, T., & Rees, E. L. (2021). Social media in undergraduate medical education: A systematic review. *Medical Education*, 55(11), 1227–1241. <https://doi.org/10.1111/medu.14567>
- Hainš, V. V., Kučar, M., & Kovačić, R. (2020, September). Student social media usage and its relation to free-recall memory tasks. In *2020 43rd International Convention on Information, Communication and Electronic Technology (MIPRO)* (pp. 731–736). IEEE. <https://doi.org/10.23919/MIPRO48935.2020.9245167>
- Hasham, M. A., Parshuram, V., & Bandre, G. R. (2025). Social media in healthcare: Transforming patient engagement, education, and research dissemination. *International Journal of Academic Medicine*, 11(1), 4–9. https://doi.org/10.4103/ijam.ijam_48_24
- Hutson, E. (2022). Student response systems in online nursing education. *The Nursing Clinics of North America*, 57(4), 539–549. <https://doi.org/10.1016/j.cnur.2022.06.004>
- Jaffar, A. A., & Eladl, M. A. (2016). Engagement patterns of high and low academic performers on Facebook anatomy pages. *Journal of Medical Education and Curricular Development*, 3, Article JMECD.S36646. <https://doi.org/10.4137/JMECD.S36646>
- Johnson, D. W., Johnson, R. T., & Smith, K. A. (2014). Cooperative learning: Improving university instruction by basing practice on validated theory. *Journal on Excellence in College Teaching*, 25(3–4), 85–118.
- Kemp, S. (2024). *Digital 2024: Global Overview Report*. Datareportal. <https://datareportal.com/reports/digital-2024-global-overview-report>
- Klein, J. (2008). Social networking for the K–12 set. *Learning & Leading with Technology*, 12(5), 1–5. <https://eric.ed.gov/?id=EJ824505>
- Kleiner, B., Thomas, N., & Lewis, L. (2007). Educational technology in teacher education programs for initial licensure (NCES 2008-040). *National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education*. <https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2008040>
- Koh, J. H. L., & Kan, R. Y. P. (2021). Students' use of learning management systems and desired e-learning experiences: Are they ready for next generation digital learning environments? *Higher Education Research & Development*, 40(5), 995–1010. <https://doi.org/10.1080/07294360.2020.1799949>
- Kolhar, M., Kazi, R. N. A., & Alameen, A. (2021). Effect of social media use on learning, social interactions, and sleep duration among university students. *Saudi Journal of Biological Sciences*, 28(4), 2216–2222. <https://doi.org/10.1016/j.sjbs.2021.01.010>
- Lenhart, A., Rainie, L., Lewis, O., & Pew Internet & American Life Project. (2001). Teenage life online: The rise of the instant-message generation and the Internet's impact on friendships and family relationships. *Pew Internet & American Life Project*.
- Loes, C. N. (2022). The effect of collaborative learning on academic motivation. *Teaching & Learning Inquiry*. Advance online publication. <https://doi.org/10.20343/teachlearninginqu.10.4>
- Machado, C., Hsiao, P. Y., Vaccaro, C., & Baker, C. (2024). Entering the social media stratosphere: Higher education faculty use of social media with students across four disciplines. *Journal of Interactive Media in Education*, 2024(1), 8. <https://doi.org/10.5334/jime.854>
- Magda, A. J., Capranos, D., & Aslanian, C. B. (2020). Online college students 2020: Comprehensive data on demands and preferences. *Wiley Education Services*. <http://hdl.voced.edu.au/10707/654914>
- Mand, S. K., Cico, S. J., Haas, M. R. C., Schnabel, N. E., & Schnapp, B. H. (2024). Let's get active: The use of technology-enhanced audience interaction to promote active learning. *AEM education and training*, 8(Suppl 1), S50–S55. <https://doi.org/10.1002/aet2.10950>

- Mendo-Lázaro, S., Martínez-Martínez, A., León-del-Barco, B., & Polo-del-Río, M. (2022). The impact of cooperative learning on university students' academic goals. *Frontiers in Psychology, 12*, 787210. <https://doi.org/10.3389/fpsyg.2021.787210>
- Michikyan, M., Subrahmanyam, K., & Dennis, J. (2015). Facebook use and academic performance among college students: A mixed-methods study with a multi-ethnic sample. *Computers in Human Behavior, 45*, 265–272. <https://doi.org/10.1016/j.chb.2014.12.033>
- Ortadeveci, A., & Ozden, H. (2023). Social media as a learning tool in anatomy education from the perspective of medical and dental students. *Clinical Anatomy, 36*(5), 809–817. <https://doi.org/10.1002/ca.24046>
- Rienties, B., Tempelaar, D., & Cocquyt, C. (2020). Drop-out and transfer-out intentions: The role of socio-cognitive factors. *Frontiers in Education, 5*, Article 606291. <https://doi.org/10.3389/feduc.2020.606291>
- Roblyer, M., McDaniel, M., Webb, M., Herman, J., & Witty, J. (2010). Findings on Facebook in higher education: A comparison of college faculty and student uses and perceptions of social networking sites. *Internet and Higher Education, 13*(2), 134–140. <https://doi.org/10.1016/j.iheduc.2010.03.002>
- Ross, S. (2021). Slack it to me: Complementing LMS with student-centric communications for the millennial/post-millennial student. *Journal of the Medical Library Association, 109*(3), 488–494. <https://doi.org/10.1177/0273475319833113>
- Rovai, A. P. (2002). Building sense of community at a distance. *The International Review of Research in Open and Distance Learning, 3*(1). <https://doi.org/10.19173/irrodl.v3i1.79>
- Satoh, M., Fujimura, A., & Miyagawa, S. (2023). Difficulties and innovations in teaching anatomy and physiology: Faculty perspectives. *Nurse Education in Practice, 67*, Article 103551. <https://doi.org/10.1016/j.nepr.2023.103551>
- Shaltry, C., Henriksen, D., Wu, M. L., & Dickson, W. P. (2013). Situated learning with online portfolios, classroom websites and Facebook. *TechTrends, 57*(3), 20–25. <https://doi.org/10.1007/s11528-013-0658-9>
- Spitzig, J., & Renner, B. J. (2022). Student engagement and retention of adult learners at community colleges. *Journal of College Student Retention: Research, Theory & Practice*. Advance online publication. <https://doi.org/10.1177/15210251221138065>
- Tinto, V. (1994). *Leaving College: Rethinking the causes and cures of student attrition* (2nd ed.). University of Chicago Press. <https://doi.org/10.7208/chicago/9780226922461.001.0001>
- Touloupis, T., Sofologi, M., & Tachmatzidis, D. (2023). Pattern of Facebook use by university students during the COVID-19 pandemic: Relations with loneliness and resilience. *Social Network Analysis and Mining, 13*(1), 64. <https://doi.org/10.1007/s13278-023-01073-0>
- Truta, M. A., & Baban, C. (2018). Academic engagement and intention to drop out: Levers for sustainability in higher education. *Sustainability, 10*(12), 4637. <https://www.mdpi.com/2071-1050/10/12/4637>
- Vukušić Rukavina, T., Svalina, M., Marasović Šušnjara, M., & van der Vaart, R. (2021). Dangers and benefits of social media on e-professionalism of health care professionals: Scoping review. *Journal of Medical Internet Research, 23*(11), e25770. <https://doi.org/10.2196/25770>
- Wang, Y., Niiya, M., Mark, G., Reich, S. M., & Warschauer, M. (2015). Coming of age (digitally): An ecological view of social media use among college students. In *Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing (CSCW '15)* (pp. 571–582). Association for Computing Machinery. <https://doi.org/10.1145/2675133.2675271>

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.