

Brief Report

Required Contact Hours and Academic Performance in an Evolving Medical School Curriculum: A Single-Institution Cohort Study

Sarah Kazemeini * , Nicholas Staffa, Gemma Lagasca , Axel Rivas  and Edward Simanton

Kirk Kerkorian School of Medicine at UNLV, 625 Shadow Lane, Las Vegas, NV 89106, USA; staffa@unlv.nevada.edu (N.S.); lagasg1@unlv.nevada.edu (G.L.); rivasa9@unlv.nevada.edu (A.R.)

* Correspondence: kazems1@unlv.nevada.edu

Abstract

Medical schools are increasingly reducing required contact hours and incorporating self-directed learning strategies, yet the impact of these curricular changes on academic performance remains uncertain. This retrospective cohort study compared performance on NBME-based organ system examinations across three consecutive pre-clerkship cohorts at a U.S. allopathic medical school that experienced different levels of required instructional time. Cohorts included 178 students and differed in total required contact hours from 306 to 412 h. Mean MCAT scores did not differ significantly among cohorts (510.4 ± 5.4 , 509.6 ± 6.3 , and 510.0 ± 4.9 ; $p = 0.74$). Significant differences in the proportion of students scoring above the national reference value were observed in the Pulmonology ($p = 0.003$), Gastroenterology ($p = 0.020$), and Endocrinology ($p = 0.003$) blocks; however, these differences did not demonstrate a consistent relationship with contact hour totals. Across cohorts experiencing different contact-hour requirements and concurrent curricular changes, examination performance did not demonstrate a consistent pattern corresponding to the amount of required instructional time. These findings demonstrate that lower contact-hour requirements were not accompanied by consistently poorer short-term standardized outcomes in these cohorts; however, the independent contribution of contact hours cannot be separated from concurrent curricular changes.

Keywords: education; curriculum; students; academic; self-directed learning; medicine



Academic Editor: Branko Aleksic

Received: 21 June 2026

Revised: 2 August 2026

Accepted: 3 August 2026

Published: 5 August 2026

Copyright: © 2026 by the authors.

Published by MDPI on behalf of the

Academic Society for International

Medical Education. Licensee MDPI,

Basel, Switzerland. This article is an

open access article distributed under

the terms and conditions of the

[Creative Commons Attribution](#)

(CC BY) license.

1. Introduction

Medical education has undergone substantial reform over the past two decades as schools seek to balance evolving accreditation standards, competency-based training, and the needs of modern healthcare. Traditional pre-clerkship models were built on extensive didactic teaching, often exceeding 30–40 h per week, based on the assumption that greater time in structured learning would yield stronger knowledge acquisition and examination performance [1–3]. However, theories of adult learning, particularly Knowles' framework, suggest that self-directed learning, flexibility, and autonomy are critical to student motivation and mastery [4,5]. As a result, medical schools have increasingly reduced required in-person contact hours while integrating small-group, flipped-classroom, and technology-enhanced strategies [6–9]. These changes have been justified as aligning with best practices in adult education, yet empirical evidence on their impact remains mixed [10–12].

Prior studies in professional and undergraduate education have explored the relationship between instructional time and academic performance. In undergraduate biology courses, reduced lecture hours supplemented with active learning were associated with improved exam scores [13]. In nursing programs, lower required contact time correlated with higher student satisfaction, though effects on standardized assessments were inconsistent [14]. Within medical education, most existing literature has focused on lecture attendance rather than required contact hours [15–17]. For example, several studies found that voluntary lecture attendance was not strongly associated with exam performance, as many students preferred asynchronous resources [18–20]. Most prior studies have examined lecture attendance, instructional format, or active-learning interventions rather than the total amount of institutionally required instructional time. Although these studies provide relevant context, attendance reflects individual student behavior, whereas required contact hours represent a curriculum-level decision. Consequently, findings from attendance and active-learning studies may not be directly generalizable to the relationship between required instructional time and academic performance. The distinction is important because contact hour requirements influence not only learning opportunities but also student workload, faculty allocation, and curricular philosophy [21].

Despite ongoing debate, few studies have directly examined whether reductions in required contact hours influence academic performance among medical students. Most available data come from undergraduate or professional school settings, or from older medical education models that predate current emphases on integration, technology, and self-directed learning [22–24]. Moreover, the impact of reduced contact hours on student attitudes and perceptions of educational quality remains unclear. This represents a critical gap, as curricular reform has accelerated following the transition of USMLE Step 1 to pass/fail scoring [25,26]. Many institutions have reduced mandatory attendance requirements and increased flexibility to promote self-directed learning, wellness, and individualized study strategies. Despite widespread adoption of these reforms, evidence regarding their effects on academic performance remains limited.

Therefore, the purpose of this study was to compare academic performance on National Board of Medical Examiners (NBME) subject examinations across successive medical student cohorts that experienced different levels of required pre-clerkship contact hours within an evolving curriculum at a single U.S. allopathic medical school. Based on adult learning theory and the increased opportunity for self-directed study created by reductions in required instructional time, we hypothesized that cohorts with fewer required contact hours would not demonstrate consistently lower NBME examination performance than cohorts with more required contact hours. By examining this relationship in the context of an evolving curriculum, this study seeks to contribute empirical evidence to the ongoing discussion of how curricular time structures affect medical student outcomes.

2. Materials and Methods

2.1. Study Design and Setting

This single institution, retrospective, observational cohort study was conducted during the spring semester of the first phase of medical school at the Kirk Kerkorian School of Medicine at the University of Nevada, Las Vegas. Data used in this study were drawn from institutional databases which had been de-identified in accordance with the existing Institutional Review Board (IRB) guidelines titled Medical Education Research Using Program Evaluation Data. The IRB protocol (UNLV-2022-293) approved the use of de-identified program evaluation data for medical education research. The first fall semester is centered around the foundational sciences, followed by organ system blocks in the spring and remaining Phase 1 time. Students also participate in Problem-Based Learning sessions

tailored to lecture content and Foundations of Clinical Practice, where students practice physical exam techniques, interact with standardized patients, and learn clinical skills. Additional required courses cover topics such as ethics, public health in Southern Nevada, and integrative medicine. Required contact hours represented the aggregate scheduled time devoted to in-person instructional activities, including content-focused sessions, problem-based learning, clinical-skills instruction, and standardized patient encounters. Thus, contact hours reflected the quantity of required instructional time but did not distinguish among instructional modalities or capture attendance, participation, instructional quality, or the degree of student engagement during individual sessions.

2.2. Data Collection

Three consecutive cohorts (Classes of 2024, 2025, and 2026) were included in the analysis. Cohort sizes were 58, 58, and 62 students for the Classes of 2024, 2025, and 2026, respectively. MCAT scores were compared across cohorts using analysis of variance (ANOVA) to assess baseline academic comparability. Course schedules from each cohort's spring semester were reviewed to determine required contact hours by organ system block and for the semester overall. Contact hours were defined as instructional activities requiring in-person attendance. Based on total required hours, cohorts were categorized as high-, moderate-, or low-contact-hour curricula.

2.3. Student Exam Performance

Course data at the Kirk Kerkorian School of Medicine were individually collected at the completion of each course in accordance with the guidelines set by the active IRB. Exam performance during the spring semester of the first year of medical school was obtained and evaluated regarding its association with required contact hours. Organ block examinations consisted of retired NBME questions selected by course faculty. Student performance was compared with the national reference performance provided through the NBME item bank. Because only benchmark performance relative to the national reference value was available through institutional reporting systems, outcomes were analyzed as binary variables. Students scoring above the national reference value were coded as 1, whereas students scoring below the reference value were coded as 0.

2.4. Data Analysis

Descriptive statistics were used to summarize contact hours across cohorts and organ system blocks. Analysis of variance (ANOVA) was used to compare mean MCAT scores across cohorts. Chi-square tests were used to compare the proportion of students scoring above the national reference value across cohorts for each organ system block. Statistical significance was defined as $p < 0.05$. The block-level analyses were exploratory, and p -values were not adjusted for multiple comparisons. Therefore, statistically significant block-level findings were interpreted cautiously as nominal associations. Given that outcomes were available only as above- or below-reference performance, analyses were limited to comparisons of proportions rather than continuous score distributions.

3. Results

3.1. MCAT Scores and Cohort Characteristics

Mean MCAT scores were 510.4 ± 5.4 for the Class of 2024 HCH cohort ($n = 58$), 509.6 ± 6.3 for the Class of 2025 LCH cohort ($n = 58$), and 510.0 ± 4.9 for the Class of 2026 MCH cohort ($n = 62$). No significant difference in mean MCAT scores was observed among the cohorts (one-way ANOVA, $F(2,175) = 0.30$, $p = 0.74$), suggesting similar measured

baseline academic preparedness across the three cohorts. These results are shown in Figure 1.

MCAT Means per Cohort

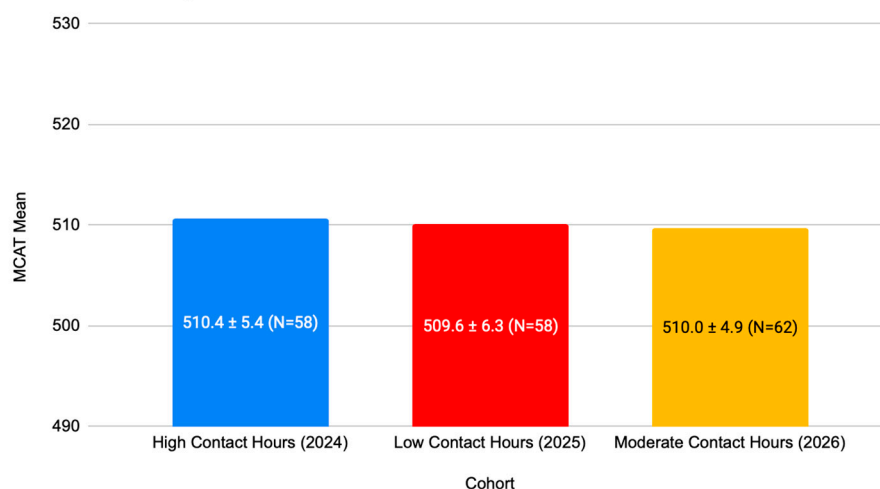


Figure 1. Mean MCAT scores and standard deviations across the three cohorts: Class of 2024 HCH cohort ($n = 58$; 510.4 ± 5.4), Class of 2025 LCH cohort ($n = 58$; 509.6 ± 6.3), and Class of 2026 MCH cohort ($n = 62$; 510.0 ± 4.9).

3.2. Contact Hours per Cohort

Because total required instructional hours differed across cohorts, the Class of 2024 (412 h), Class of 2026 (352.5 h), and Class of 2025 (306 h) were designated as the high-contact-hour (HCH), moderate-contact-hour (MCH), and low-contact-hour (LCH) cohorts, respectively. Cohort labels were used descriptively to facilitate interpretation of differences in total instructional time. These differences are outlined in Table 1.

Table 1. Total required contact hours per organ system block for each cohort (2024, 2025, 2026), illustrating differences in instructional time across the cohorts.

Organ System Block	Class of 2024 (HCH)	Class of 2025 (LCH)	Class of 2026 (MCH)
Pulmonology	68	64	72
Cardiology	76	58	68
Renal	64	42	49
Gastroenterology	72	52	58
Endocrinology	68	48	52
Reproductive	64	42	54
Total Contact Hours	412	306	352

3.3. Exam Performance Across Cohorts

Nominally significant differences among cohorts were observed in the Pulmonology ($p = 0.003$), Gastroenterology ($p = 0.020$), and Endocrinology ($p = 0.003$) blocks. Because these p -values were not adjusted for multiple comparisons, the block-level findings should be interpreted cautiously. The HCH cohort had the lowest proportion of students scoring above the national reference value in Pulmonology, whereas the LCH cohort had the highest proportion in Gastroenterology. In Endocrinology, the MCH cohort had the lowest proportion. Overall, these findings did not demonstrate a consistent pattern in which cohorts with greater required contact hours achieved superior examination performance. Complete cohort-level percentages are presented in Table 2.

Table 2. Percentage of students scoring above the NBME national reference value by organ system block and cohort. Values represent the proportion of students in each cohort who scored above the national reference benchmark on NBME-based organ system examinations.

Organ System Block	Class of 2024 (HCH)	Class of 2025 (LCH)	Class of 2026 (MCH)	<i>p</i> -Value
Pulmonology	39.66%	68.97%	61.29%	0.003
Cardiology	29.31%	48.28%	45.16%	0.083
Renal	55.17%	63.79%	41.94%	0.053
Gastroenterology	58.62%	79.31%	56.45%	0.020
Endocrinology	86.21%	82.76%	61.29%	0.003
Reproductive	62.07%	75.86%	72.58%	0.236

Although significant differences were observed in selected organ system blocks, examination performance did not demonstrate a consistent pattern corresponding to cohort contact-hour totals. Because contact-hour differences occurred alongside other curricular changes, these comparisons should not be interpreted as estimating the independent effect of required instructional time.

4. Discussion

This study compared NBME-based organ system examination performance across successive pre-clerkship cohorts with different required contact-hour totals within an evolving curriculum. Although significant cohort-level differences were identified in selected organ system blocks, these differences did not consistently correspond to the amount of required instructional time. Importantly, contact-hour requirements changed alongside other aspects of curricular design. Therefore, the findings describe performance across different curricular configurations and do not establish an independent effect of contact hours on examination outcomes.

Direct comparison with prior research remains difficult because relatively few studies have evaluated total required instructional time as a distinct curricular exposure [27]. Existing studies vary in how instructional time is defined and often evaluate changes in teaching format simultaneously with changes in scheduled hours [27–30]. Similar to the present study, this makes it difficult to separate the influence of instructional time from the effects of instructional design and other concurrent curricular changes.

Our findings are consistent with prior studies suggesting that the amount of scheduled instructional time alone may not determine academic performance. Previous research has demonstrated that reductions in traditional lecture time, particularly when accompanied by active-learning or blended-learning approaches, may result in similar or improved examination outcomes [29–32]. Studies of medical and health profession students have also found that lecture attendance is not consistently associated with examination performance, as students increasingly use asynchronous and external learning resources [32,33]. However, these studies have generally examined attendance or specific instructional methods rather than institutionally required contact hours [32,34]. The present study extends this literature by comparing standardized examination performance across successive medical student cohorts exposed to different overall levels of required instructional time.

Although contact hours varied across cohorts, their relationship with performance was not consistent across disciplines. For example, the Class of 2024 performed significantly worse in the Pulmonology block despite having the highest contact hours, while the Class of 2025 achieved higher scores in the Gastroenterology block with the fewest required hours. Conversely, the Class of 2026 underperformed in the Endocrine block despite an intermediate number of hours. These mixed findings suggest that the effect of contact hours

may be subject-specific and influenced by additional factors such as curricular content, instructional quality, and student engagement. The absence of significant differences in other blocks, including Cardiology and Renal, further highlights the complexity of isolating instructional time as a predictor of performance.

Several factors may have contributed to the observed results. Each cohort experienced changes in both required contact hours and broader curricular design, so the observed differences may reflect a combination of instructional time, curricular content, teaching methods, and other unmeasured factors. One possible explanation is that students adapted to reduced required instructional time by changing their independent study practices or use of external learning resources. However, the present study did not measure attendance, study behavior, resource use, self-directed learning, or student perceptions. Therefore, the role of learner adaptation and self-directed study remains hypothetical and cannot be established from these data.

This study has several limitations. It was conducted at a single institution with relatively small cohorts, which may limit generalizability. In addition, required contact hours changed alongside other curricular features, including potential differences in instructional content and pedagogical strategies. Therefore, the effects of contact hours cannot be isolated from the broader curricular changes experienced by each cohort. The study examined only one measure of performance, which was performance on NBME-based organ system examinations. Additional outcomes such as clerkship performance, licensing examination scores, and long-term knowledge retention were not assessed. Furthermore, although contact hours were systematically tracked, the study did not evaluate attendance, study habits, use of external learning resources, or engagement in self-directed learning, all of which may have influenced performance. Finally, institutional reporting provided examination performance only as whether each student scored above or below the NBME national reference value. Continuous scaled scores were unavailable, which required the outcome to be dichotomized. This resulted in a loss of information and may have obscured meaningful differences in the underlying score distributions across cohorts. The analyses therefore could not assess differences in mean scores, the magnitude of cohort-level differences, or variation among students within each cohort. Accordingly, the findings should be interpreted as comparisons of the proportions of students exceeding the national reference value rather than as comprehensive comparisons of academic performance.

Strengths of this study include the evaluation of three consecutive medical student cohorts, the use of standardized NBME-based assessments, and the examination of naturally occurring curricular changes rather than an artificial educational intervention. Additionally, baseline academic preparedness was similar across cohorts, reducing the likelihood that observed differences were attributable to incoming student characteristics.

Taken together, these findings suggest that required instructional time may not be the sole determinant of short-term examination performance. Outcomes may also reflect differences in curricular content, instructional methods, learner behaviors, and other unmeasured factors. These findings may be particularly relevant as medical schools reconsider required instructional time following the transition of USMLE Step 1 to pass/fail scoring. In these cohorts, lower required contact-hour totals were not accompanied by consistently poorer short-term benchmark performance; however, the mechanisms underlying this pattern remain unknown.

5. Conclusions

In this single-institution retrospective cohort study, NBME-based organ system examination performance did not demonstrate a consistent pattern corresponding to required pre-clerkship contact-hour totals across three successive cohorts. Although significant

cohort-level differences were observed in selected organ system blocks, cohorts with more required instructional time did not consistently demonstrate better performance. These findings should be interpreted cautiously because contact-hour requirements changed alongside other curricular features, examination performance was available only as a dichotomized outcome relative to the national reference value, and multiple unadjusted block-level comparisons were performed. Therefore, the findings do not establish an independent effect of required contact hours on academic performance. Rather, they suggest that instructional time is one component of a broader curricular structure that may include differences in content, teaching methods, and student learning behaviors. Future studies should directly measure attendance, study behaviors, use of external resources, self-directed learning, and student perceptions to determine how learners respond to changes in required instructional time.

Author Contributions: Conceptualization, S.K., N.S., and E.S.; methodology, S.K., N.S., and E.S.; formal analysis, S.K. and N.S.; investigation, S.K., N.S., G.L., and A.R.; data curation, S.K. and N.S.; writing—original draft preparation, S.K. and N.S.; writing—review and editing, S.K., N.S., G.L., and E.S.; visualization, S.K. and N.S.; supervision, E.S.; project administration, S.K. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Ethical review and approval were obtained through the University of Nevada, Las Vegas Institutional Review Board under the protocol “Medical Education Research Using Program Evaluation Data” (UNLV-2022-293). This study utilized de-identified educational program evaluation data and was conducted in accordance with institutional guidelines governing medical education research.

Informed Consent Statement: Consent was waived because this study utilized previously collected, de-identified educational program evaluation data.

Data Availability Statement: The data presented in this study are available upon reasonable request from the corresponding author. The data are not publicly available because they contain institutional educational records and are subject to privacy and ethical restrictions.

Acknowledgments: During the preparation of this manuscript, the authors used ChatGPT (GPT-5.5, OpenAI) to assist with manuscript organization, outline development, and language editing. The authors reviewed and revised all generated content, verified the accuracy of the information presented, and take full responsibility for the content of this publication.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Gouthro, P.A. Taking Time to Learn: The Importance of Theory for Adult Education. *Adult Educ. Q.* **2019**, *69*, 60–76.
2. Sukrajh, V.; Adefolalu, A.O.; Louw, A.J.N. Promoting active learning in medical education using the peer teaching model: Perceptions of senior medical students. *SN Soc. Sci.* **2021**, *1*, 158. [[CrossRef](#)]
3. Taylor, D.C.M.; Hamdy, H. Adult learning theories: Implications for learning and teaching in medical education: AMEE Guide No. 83. *Med. Teach.* **2013**, *35*, e1561–e1572. [[CrossRef](#)] [[PubMed](#)]
4. Hurtubise, L.; Lester, T.K.; Okada, S. Considerations for flipping the classroom in medical education. *Acad. Med.* **2014**, *89*, 696–697. [[CrossRef](#)] [[PubMed](#)]
5. Prober, C.G.; Heath, C. Lecture halls without lectures—A proposal for medical education. *N. Engl. J. Med.* **2012**, *366*, 1657–1659. [[CrossRef](#)] [[PubMed](#)]
6. Prober, C.G.; Khan, S. Medical education reimaged: A call to action. *Acad. Med.* **2013**, *88*, 1407–1410. [[CrossRef](#)] [[PubMed](#)]
7. Credé, M.; Roch, S.G.; Kieszczyńska, U.M. Class attendance in college: A meta-analytic review of the relationship of class attendance with grades and student characteristics. *Rev. Educ. Res.* **2010**, *80*, 272–295. [[CrossRef](#)]
8. Purcell, P. Engineering Student Attendance at Lectures: Effect on Examination Performance. In Proceedings of the International Conference on Engineering Education (ICEE 2007), Coimbra, Portugal, 3–7 September 2007.

9. Andrietti, V.; Velasco, C. Lecture attendance, study time, and academic performance: A panel data study. *J. Econ. Educ.* **2015**, *46*, 239–259. [[CrossRef](#)]
10. Miller, C.J.; Metz, M.J. A comparison of professional-level faculty and student perceptions of active learning: Its current use, effectiveness, and barriers. *Adv. Physiol. Educ.* **2014**, *38*, 246–252. [[CrossRef](#)] [[PubMed](#)]
11. Doggrell, S.A. Differences between students in various programs in a biochemistry course in lecture attendance, engagement, and academic outcomes. *Biochem. Mol. Biol. Educ.* **2023**, *51*, 377–388. [[CrossRef](#)] [[PubMed](#)]
12. Anas, S.; Kyrou, I.; Rand-Weaver, M.; Karteris, E. The effect of online and in-person team-based learning on undergraduate endocrinology teaching during the COVID-19 pandemic. *BMC Med. Educ.* **2022**, *22*, 120. [[CrossRef](#)] [[PubMed](#)]
13. Kortemeyer, G.; Dittmann-Domenichini, N.; Schlienger, C.; Spilling, E.; Yaroshchuk, A.; Dissertori, G. Attending lectures in person, hybrid or online—How do students choose, and what about the outcome? *Int. J. Educ. Technol. High. Educ.* **2023**, *20*, 19. [[CrossRef](#)] [[PubMed](#)]
14. Schnee, D.; Ward, T.; Philips, E.; Torkos, S.; Mullakary, J.; Tataronis, G.; Felix-Getzik, E. Effect of live attendance and video capture viewing on student examination performance. *Am. J. Pharm. Educ.* **2019**, *83*, 6897. [[CrossRef](#)] [[PubMed](#)]
15. Miller, C.J.; McNear, J.; Metz, M.J. A comparison of traditional and engaging lecture methods in a large, professional-level course. *Adv. Physiol. Educ.* **2013**, *37*, 347–355. [[PubMed](#)]
16. Barranquero-Herbosa, M.; Abajas-Bustillo, R.; Ortego-Maté, C. Effectiveness of flipped classroom in nursing education: A systematic review of systematic and integrative reviews. *Int. J. Nurs. Stud.* **2022**, *135*, 104327. [[PubMed](#)]
17. Singh, K.; Mahajan, R.; Gupta, P.; Singh, T. Flipped classroom: A concept for engaging medical students in learning. *Indian Pediatr.* **2018**, *55*, 507–512. [[CrossRef](#)]
18. Qutob, H. Effect of flipped classroom approach in the teaching of a hematology course. *PLoS ONE* **2022**, *17*, e0267096. [[CrossRef](#)] [[PubMed](#)]
19. Du, L.; Zhao, L.; Xu, T.; Wang, Y.; Zu, W.; Huang, X.; Nie, W.; Wang, L. Blended learning vs. traditional teaching: The potential of a novel teaching strategy in nursing education—A systematic review and meta-analysis. *Nurse Educ. Pract.* **2022**, *63*, 103354. [[CrossRef](#)] [[PubMed](#)]
20. Belfi, L.M.; Bartolotta, R.J.; Giambrone, A.E.; Davi, C.; Min, R.J. “Flipping” the introductory clerkship in radiology: Impact on medical student performance and perceptions. *Acad. Radiol.* **2015**, *22*, 794–801. [[PubMed](#)]
21. Cipriano, S.D.; Dybbro, E.; Boscardin, C.K.; Shinkai, K.; Berger, T.G. Online learning in a dermatology clerkship: Piloting the new American Academy of Dermatology Medical Student Core Curriculum. *J. Am. Acad. Dermatol.* **2013**, *69*, 267–272. [[CrossRef](#)] [[PubMed](#)]
22. Ryan, C.L.; Cant, R.; McAllister, M.M.; Vanderburg, R.; Batty, C. Transformative learning theory applications in health professional and nursing education: An umbrella review. *Nurse Educ. Today* **2022**, *119*, 105604. [[CrossRef](#)] [[PubMed](#)]
23. Ait-Aissa, K.; Olotu, B.; Munkhsaikhan, U. The impact of absenteeism on academic performance among first-year dental students. *J. Dent. Educ.* **2025**, *89*, 1448–1453. [[CrossRef](#)] [[PubMed](#)]
24. Bockus, C.; Truong, G.; Bartholomew, K.S.; Sarandos, S.L.; Binney, K.; Catalanotti, J.S. Declining medical student attendance: A single institution thematic analysis of reasons students do not attend a preclinical public health course. *Med. Educ. Online* **2025**, *30*, 2587387. [[CrossRef](#)] [[PubMed](#)]
25. Staples, N.; Collett, J.; Gild, M.; Hong, J.; Huq, F.; Shone, J.; Scott, K.M. Variation in students’ experiences and approaches to learning during early clinical immersion. *Clin. Teach.* **2025**, *22*, e70156. [[CrossRef](#)] [[PubMed](#)]
26. Romer, P.A.; Ko, R.B.; Dasarathy, D.; Negris, O.R.; Win, A.K.; Leveille, L.A.; Duah, B.A.; Geraghty, J.R. Navigating expectations in the transition to the pass/fail Step 1 exam: Tensions and recommendations from student leaders of the NEXT Step 1 Project. *Acad. Med.* **2025**, *100*, 1247–1253. [[CrossRef](#)] [[PubMed](#)]
27. Abdul Rahman, N.F.; Davies, N.; Suhaimi, J.; Idris, F.; Syed Mohamad, S.N.; Park, S. Transformative learning in clinical reasoning: A meta-synthesis in undergraduate primary care medical education. *Educ. Prim. Care* **2023**, *34*, 211–219. [[CrossRef](#)] [[PubMed](#)]
28. Taylor, T.A.H.; Kemp, K.; Mi, M.; Lerchenfeldt, S. Self-directed learning assessment practices in undergraduate health professions education: A systematic review. *Med. Educ. Online* **2023**, *28*, 2189553. [[CrossRef](#)] [[PubMed](#)]
29. Al Shenawi, H.; Yaghan, R.; Almarabheh, A.; Al Shenawi, N. The relationship between attendance and academic performance of undergraduate medical students during surgical clerkship. *BMC Med. Educ.* **2021**, *21*, 396. [[CrossRef](#)] [[PubMed](#)]
30. Thongsricome, T.; Longsomboon, R.; Srithawatpong, N.; Atchariyakorn, S.; Kaikaew, K.; Wangsaturaka, D. Sustained improvement in medical students’ academic performance in renal physiology through the application of flipped classroom. *Clin. Teach.* **2025**, *22*, e70021. [[CrossRef](#)] [[PubMed](#)]
31. Graham, K.L.; Cohen, A.; Reynolds, E.E.; Huang, G.C. Effect of a flipped classroom on knowledge acquisition and retention in an internal medicine residency program. *J. Grad. Med. Educ.* **2019**, *11*, 92–97. [[CrossRef](#)] [[PubMed](#)]
32. Khanova, J.; Roth, M.T.; Rodgers, J.E.; McLaughlin, J.E. Student experiences across multiple flipped courses in a single curriculum. *Med. Educ.* **2015**, *49*, 1038–1048. [[CrossRef](#)] [[PubMed](#)]

33. Franchi, T.; Magudia, A.; Rasheed, A. Appropriate use of self-directed learning at medical school prepares students for future clinical practice. *Med. Educ. Online* **2020**, *25*, 1752450. [[CrossRef](#)] [[PubMed](#)]
34. Hill, M.; Peters, M.; Salvaggio, M.; Vinnedge, J.; Darden, A. Implementation and evaluation of a self-directed learning activity for first-year medical students. *Med. Educ. Online* **2020**, *25*, 1717780. [[CrossRef](#)] [[PubMed](#)]

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.