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ORIGINAL RESEARCH

Determinants and Outcomes of In-person Lecture Attendance in Medical School

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Abstract

Introduction Attendance at in-person lectures in medical schools is declining with nearly 28.8% of all active, second-year medical students who reported "almost never" attending in-person lectures during their preclinical years. The objective of this study was to explore the relationship between medical student attendance and performance and investigate students' goal orientation as factors influencing their decision to attend.

Methods Participants completed a survey at the end of their second year that asked to self-report attendance during each of the three preclinical semesters, factors that influenced attendance, and measured their goal orientation (GO). Student performance outcomes included all courses in the preclinical curriculum and USMLE Step 1 scores.

Results There was a statistically significant reduction in frequency of attendance after each subsequent semester ($p < .001$). Third semester attendance, but not learning GO, was positively related to M2 course performance. Prove performance GO was positively related and third semester attendance was negatively related to Step 1 score after controlling for M2 course performance.

Conclusions The pattern of declining lecture attendance in medical school with the rapid adoption of virtual learning triggered by the Covid-19 pandemic indicates students have taken more control over where and when they learn. Our results showed that students perceived in-person attendance at lectures was more valuable for balancing keeping up with coursework and maintaining social relationships and less valuable for efficient Step 1 preparation. Students' goal orientation may help identify individuals who are less likely to attend in-person. The full impact of the COVID-19 on student learning is yet to be determined.

Keywords Attendance · Medical students · Lectures · Goal orientation

Introduction

Preclinical medical education is changing due to both technology and medical student expectations. COVID-19, in addition to technologies such as lecture recordings and online learning modules, are giving students the opportunity to learn remotely. For many students, this is their preferred learning approach. The Association of American Medical Colleges Medical School Year Two Questionnaire (Y2Q) administered annually to second-year medical students detected a steady increase in the number of medical students reporting "almost never" attending in-person lectures during the preclinical years of their medical education. Most recently, this cohort has grown to include 28.8% of students [1]. The reason for this decline in attendance is multifactorial; however, reserving time for independent preparation for the United States Medical Licensing Examination (USMLE) Step 1 is likely playing a role. Performance on the USMLE Step 1 exam has become increasingly important to students due to its use as a screening tool for many residency programs [2]. Quantifying the relationships between lecture attendance, course performance, and Step 1 score provides context for curriculum design, advisor recommendations, and attendance policies in medical education. As schools

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return to in-person lectures and Step 1 transitions to pass/fail, determining the factors that influence medical students' decision to attend in-person lectures may identify key contributors to declining attendance.

Faculty and students have significant differences in their perception of the relationship between attendance and academic performance, with faculty perceiving that attending lectures is associated with better performance as compared with students' perceptions [3]. Historically, studies at both undergraduate and graduate levels of education have shown a positive correlation between attendance and academic performance [4, 5]. However, as lecture recordings and other curriculum content become accessible to medical students online, this correlation is not consistently reproduced [6–9]. Kauffman et al. [8] used curriculum engagement, a measurement of both in-person attendance and lecture video viewing, and found no significant correlation with final exam performance or Step 1 score. Eisen et al. [6] noted social expectation as a motivating factor for lecture attendance, whereas reasons commonly cited for not attending included availability of lectures online, preference for individual study outside the classroom, and the inconvenience of traveling to class. Qualitative evidence is consistent with this finding; those students with high in-person attendance report enjoying the "social aspects of learning," and those with low in-person attendance report preferring to focus their studies on resources that efficiently present the content likely to be tested on the USMLE Step 1 exam [8].

Another aspect that could influence student perceptions about course attendance is their goal orientation (GO). GO is conceptualized as a learner's reaction to achievement situations [10]. Within these orientations, learners tend to align with one of three dimensions, "learning GO," "prove performance GO," and "avoid performance GO." Learners with a "learning GO" approach opportunities focused on personal skill growth, "performance prove" individuals approach opportunities where they can demonstrate their competence and proficiency in a given area or areas relative to others, and "performance avoid" orientated individuals seek to avoid situations where deficiencies in their level of competence might be highlighted. GO is identified as a major component of lifelong learning or the learning activities undertaken to increase knowledge, skills, and competence within a specific area of interest [11]. Previous research in secondary education supports GO is associated not only with classroom interactions but also with learner attendance [11]. While GO has been studied extensively in various domains of academic motivation, there is little empirical evidence supporting the connection between medical student GO and specific academic behaviors such as course attendance. In considering attendance as a factor in performance, lifelong learning, and thus GO, may aid in understanding key motivators for learner attendance in courses.

The aims of our study are to measure relationships between attendance at non-mandatory lectures and academic performance at our institution and investigate students' GO and commitment to lifelong learning as factors influencing medical students' decision to attend non-mandatory lectures.

Materials and Methods

Students in the VCU School of Medicine (SOM) "C3" curriculum progress through 3 semesters leading up to a Step 1 study period in 30 months. The majority of courses are non-mandatory attendance. Students are provided over 1 month of dedicated Step 1 study at the conclusion of the preclinical curriculum. However, most students choose to begin incorporating Step 1 preparation into their schedules during the preclinical curriculum, before their dedicated study period, similar to other schools [12].

Evaluation Surveys

Evaluation surveys were administered electronically to all students from a single class at the end of their second year (i.e., M2). Surveys asked students to self-report the frequency they attended non-mandatory in-person lectures during their first, second, and third semesters (1 = almost never, 2 = occasionally, 3 = somewhat often, 4 = often, 5 = most of the time) (Appendix). Evaluation surveys also asked students the degree to which 12 factors encouraged or discouraged attendance (1 = strongly discouraged, 5 = strongly encouraged). Survey questions were developed by two rising M3 students (GG, PM) and refined in collaboration with the Curriculum Office and Office of Assessment, Evaluation, and Scholarship.

GO was measured using 13 items rated on a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree) representing learning GO (5 items), prove performance GO (4 items), and avoid performance GO (4 items) subscales [13]. An example item representing the learning GO subscale was "I often look for opportunities to develop new skills and knowledge." An example item from the prove performance subscale was "I'm concerned with showing that I can perform better than my coworkers." An example item from the avoid performance subscale was "I prefer to avoid situations at work where I might perform poorly."

This study qualified for exempt status by the VCU IRB #HM20014899.

Student Performance Outcomes

Assessments in each course consisted of one or more examinations, quizzes, assignments, team-based learning assessments and in some cases simulations. The students had to

achieve an overall grade of 70 to pass the course. All courses in the preclinical curriculum are graded as pass or fail. M2 performance was calculated using the average performance score across all 7 M2 courses. Step 1 performance for the first attempt taking the test was used for analysis.

Analysis

A repeated measures ANOVA with Bonferroni correction was used to test for changes in mean frequency of attendance for each semester. The Mann–Whitney *U* tests were performed to compare factors that encourage or discourage attendance between high and low attendees. Pearson correlations were computed to determine relationships between student GO, frequency of attendance during the third semester, student course performance, and Step 1 performance. Separate linear regression analyses were performed to test unique variability explained by GO and non-mandatory attendance in the third semester on M2 course performance and Step 1 scores.

Results

Sample

One hundred ninety-five students completed evaluation surveys for a survey response rate of 92%. Nineteen (10%) respondents had not received their Step 1 score at the time of survey administration.

Frequency of Attendance at Non-mandatory Lectures

Respondents attended non-mandatory lectures most frequently during the first semester where 72% of respondents attended somewhat often, often, or most of the time (Fig. 1). Almost half (43%) of respondents reported almost never attending non-mandatory lectures during the third semester. A repeated measures ANOVA and post hoc tests showed a statistically significant main effect of semester on frequency of attendance with reduction in frequency of attendance after each subsequent semester ($F = 85.56$, $df = 2$, $p < .001$).

Factors Related to Non-mandatory Attendance

Self-reported factors that encouraged and discouraged attendance were compared for low- and high-frequency attenders of non-mandatory lectures during the third semester. Low attenders were defined by respondents who indicated they attended non-mandatory lectures almost never or occasionally during the third semester ($n = 118$) while high attenders attended somewhat often, often, or most of the time during the third semester ($n = 77$). Student attendance during the third semester was used because sessions were closer in time and expected to be most relevant to the performance and wellness outcomes.

Keeping up with coursework and social interaction with classmates were rated most encouraging for attendance by both low and high attenders (Fig. 2). Factors most commonly reported to discourage attendance included low quality of lectures, availability of other resources for studying, ability to have lecture recordings, and ability to have a flexible schedule. The Mann–Whitney *U* tests performed to compare high and low attenders showed that high attenders more commonly responded that they found that attendance encouraged them to keep up with coursework ($z = 2.73$, $p = .006$) compared with low attendance students. All other factors were similar across both groups.

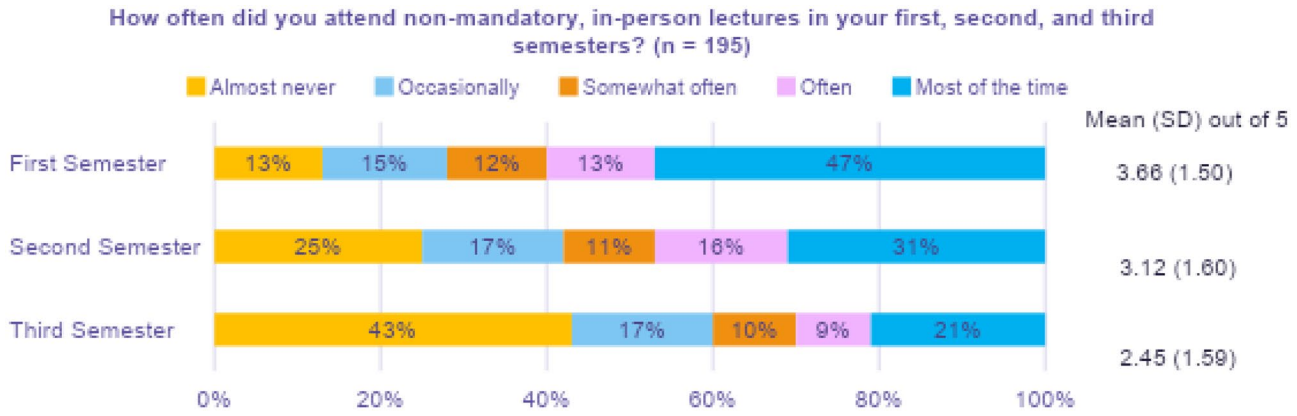

Fig. 1 Frequency of respondents reporting their attendance at non-mandatory lectures during medical school

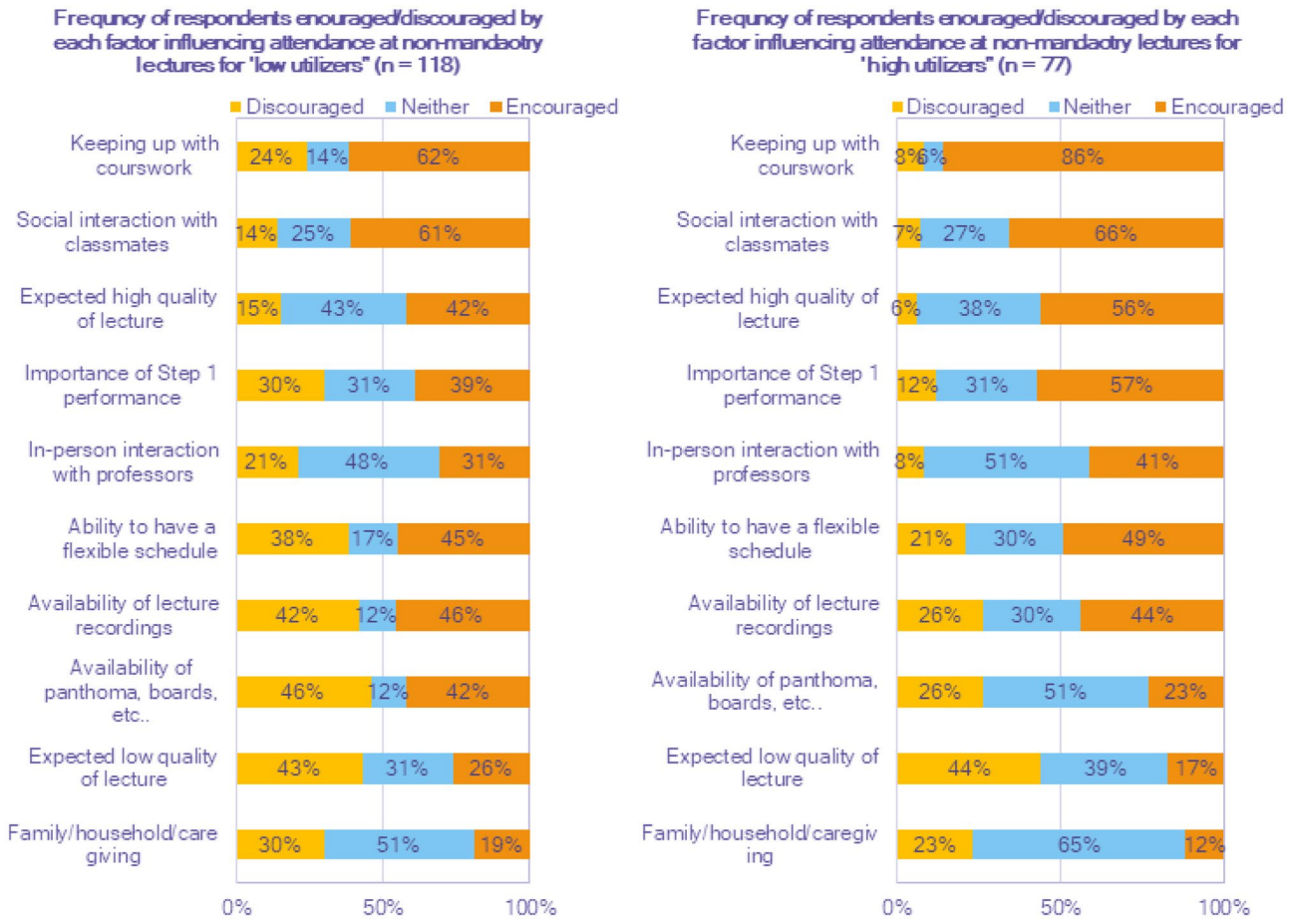

Fig. 2 Examining the degree to which various factors or perceptions encourage or discourage both high and low attending student at non-mandatory lectures ($n = 196$)

Student Goal Orientation, Non-mandatory Attendance, and Student Outcomes

Pearson correlations among study variables were computed to determine relationships between student GO, frequency of attendance during the third semester, student performance, and wellness. Student learning GO showed moderate positive relationships to frequency of attendance during the third semester ($r = .30$, $p < .01$) with a small positive correlation with M2 course performance (Table 1). Prove performance GO was not related to frequency of attendance or M2 course performance, but did show a small statistically significant relationship with Step 1 scores ($r = .17$, $p < .05$). Avoid performance GO was not related to attendance, course performance, or Step 1 scores.

Table 1 Pearson correlations among study variables

	1	2	3	4	5	6	7
1. GO—Learning	(.88)						
2. GO—Prove	.14	(.72)					
3. GO—Avoid	−.38**	.21 **	(.90)				
4. Semester 3 attendance	.30 **	.01	−.02	---			
5. M1 course mean	.13	.08	−.05	.19**	---		
6. M2 course mean	.15*	.05	−.12	.29**	.74 **	---	
7. Step 1 score	.11	.17*	−.08	.07	.67 **	.66 **	---

Coefficient alpha for GO subscales reported in parentheses along the diagonal

GO goal orientation

*$p < .05$; **$p < .01$

Table 2 Linear regression predicting M2 course performance (adjusted $R^2 = 0.67$) ($n = 189$)

	Beta	Standard error	*Standardized beta*	*t*-score	*p*-value
(Constant)	16.50	3.85		4.28	< .01
M1 course performance	.79	.04	.78	18.31	< .01
Learning GO	.06	.15	.02	.42	.68
Third semester attendance	.26	.09	.13	2.93	< .01

Linear regression analyses were performed to test the effects of GO and non-mandatory attendance in the third semester on M2 course performance and Step 1 scores. Model 1 regressed M2 course performance on learning GO, and third semester attendance frequency after controlling for M1 course performance as a covariate. Results showed that third semester attendance ($B = .13$, $t = 2.93$, $p = .004$), but not learning GO was positively related to M2 course performance (Table 2).

Model 2 regressed Step 1 score on prove performance GO and third semester attendance with M2 course performance entered as a covariate. Results showed that prove performance GO was positively related ($B = .14$, $t = 2.50$, $p = 0.013$) and third semester attendance was negatively related ($B = -.13$, $t = -2.31$, $p = .022$) to Step 1 score after controlling for M2 course performance (Table 3).

Discussion

Attendance Steadily Declines over the Preclinical Curriculum

At our institution, medical student attendance dropped in a stepwise fashion from one semester to the next with the percentage of students reporting "almost never" attending in-person lectures rising from 13% in the first semester to 43% in the third semester (Fig. 1). This stepwise fall in attendance has been observed anecdotally by students and faculty across institutions, but to our knowledge has not been previously measured. One explanation for this fall in attendance over time is a gradual encroachment of independent study in preparation for Step 1. This theory is supported by the findings of a previous study that 63.1% of students begin Step 1 study in the second year of their medical education [12]. An alternative explanation is that students change their learning behavior throughout their preclinical years by incorporating supplemental materials and preferring to view lecture recordings that may be pace adjusted, paused, and replayed rather than viewing lectures in person.

Social Interaction, Lecture Quality, and Supplemental Resources as Main Attendance Influencers

High attenders reported their ability to keep up with coursework as a factor encouraging their attendance. Additionally, social interaction with classmates and keeping up with coursework were factors most encouraging attendance in both high and low attenders. These findings are consistent with those of previous studies that found social expectation and "the social aspects of learning" as factors encouraging medical student attendance [6, 8]. Although not measured in our study, future research should investigate whether non-mandatory non-lecture learning activities may be more attended than lecture only due to the additional social interaction.

Factors most commonly cited as discouraging attendance were expected low quality of lectures, availability of other resources, ability to have lecture recordings, and ability to have a flexible schedule. This finding may serve as a point of potential influence for faculty disheartened by falling attendance. If lecture quality matches or exceeds that of available supplemental resources, students may be more likely to attend.

Relationships between Attendance, Performance, and Goal Orientation

Considering the three types of GO, the relationship between attendance and performance was not consistent across

Table 3 Linear regression predicting Step 1 score (adjusted $R^2 = 0.43$) ($n = 189$)

	Beta	Standard error	*Standardized beta*	*t*-score	*p*-value
(Constant)	−113.20	28.84		−3.93	< .01
M2 course performance	3.81	.33	.66	11.53	< .01
Prove performance GO	2.46	.99	.14	2.50	.01
Third semester attendance	−1.51	.65	−.13	−2.31	.02

measurements of performance in our study. We found a positive relationship between third semester attendance and M2 course performance; however, high attenders did not score significantly higher on Step 1. The positive relationship between learning GO and frequency of attendance showed that influencing students learning motivation may be one way to increase attendance. Together our results show that there may be products of the curriculum other than enhanced medical knowledge that are more accessible during in-person lectures. These products could include improved communication teamwork skills, clinical reasoning, and empathy, which we did not measure. Future studies are needed to determine if students with a learning GO have improved performance during their clinical years when the skills they may obtain from in-person attendance are put to the test.

We found a significant positive correlation between prove performance GO and Step 1 score. Given the weight attributed to Step 1 score in selection of the residency applicants, many students with prove performance GO are externally motivated by the ability to demonstrate their performance with a score rather than to attend in-person lectures in the context of a pass-fail curriculum. With Step 1 moving to pass-fail scoring a, motivation may wane for those high on prove goal orientation. Previous research has shown that pass/fail grading systems may hinder or help performance [14–16]. Further studies will be necessary to determine whether GO continues to be a predictor of high performance on standardized tests like Step 1 and Step 2 CK. We hypothesize that students will spend less time and effort studying for Step 1 in the pass-fail format, and this may be reflected in lower Step 2 CK scores.

We did not observe any correlation between avoid performance GO or prove performance GO and attendance. We would have expected those with avoid performance GO or prove performance GO to attend less due to the possibility of being asked to demonstrate their competence in class or in order to focus on independent Step 1 study, respectively. The lack of correlation between avoid performance GO and attendance may be explained by students not feeling as though they are expected to demonstrate their competence during lectures often enough to discourage attendance, or it may be that other factors such as social interaction outweigh the influence of their GO. The lack of correlation between prove performance GO and attendance may be due to a division of this group into one that perceives attendance as an important contributor to their ability to perform and another group that does not. Further studies are necessary to characterize the influence of a student's GO on their decision to attend non-mandatory lectures.

Options for virtual learning in medical education continued to increase in response to the COVID-19 pandemic. At our institution, students were given the option to view lectures live via Zoom or to watch recordings in place of in-person lecture attendance. Virtual options may offer more flexibility; however, the limitations to social interaction in this format may have negative effects on the learning environment and medical student well-being. In spite of this, rapid creation of new online resources, if implemented effectively, may enhance learning. Those learners with avoid performance GO may be more likely to interact with faculty members through the anonymity that the Zoom platform provides. This is a critical moment in medical education research, and we must proceed purposefully in order to develop a better understanding of the most effective methods for passing on medical knowledge.

Limitations

This was a single-institution study limiting its generalizability especially to institutions with differing curriculum models. The cross-sectional nature of the study did not allow for longitudinal measurement of trends in variables like well-being or GO. Our attendance data is self-reported and is subject to recall bias due to its retrospective collection.

Conclusions

The relationship between attendance and performance is complex and is influenced by many factors including students' GO. We found that non-mandatory, in-person attendance dropped in a stepwise fashion throughout the preclinical phase of students' education. Within our institution, students with learning GO were more likely to attend non-mandatory, in-person lectures, while those with prove performance GO scored higher on the USMLE Step 1 exam. Understanding how medical students' GO influences their interaction with the curriculum as well as their academic and clinical performance will give valuable context to the consequences of the rapid adoption of virtual learning modalities during the COVID-19 pandemic and a transition to pass-fail scoring of Step 1.

Appendix. Survey administered to students

Student-designed Attendance Questions **Instructions:** Please describe *how often* you attended…	**Almost Never**	**Occasionally**	**Somewhat Often**	**Often**	**Most of the Time**
1. non-mandatory, in-person lectures during your **FIRST** semester	1	2	3	4	5
2. non-mandatory, in-person lectures during your **SECOND** semester	1	2	3	4	5
3. non-mandatory, in-person lectures during your **THIRD** semester	1	2	3	4	5

Section 13 **To what extent did the following factors encourage or discourage your decision to attend non-mandatory, in-person lectures during your pre-clinical years?**	**Strongly Discouraged**	**Somewhat Discouraged**	**Neither Encouraged nor Discouraged**	**Somewhat Encouraged**	**Strongly Encouraged**
1. Ability to have a flexible schedule	1	2	3	4	5
2. Importance of Step 1 performance	1	2	3	4	5
3. Keeping up with coursework	1	2	3	4	5
4. Social interaction with classmates	1	2	3	4	5
5. In-person interaction with professors (ask questions, network)	1	2	3	4	5
6. Availability of lecture recordings (pause, rewind, speed up videos)	1	2	3	4	5
7. Availability of other resources (Pathoma, Boards and Beyond, etc.)	1	2	3	4	5
8. Expected high quality of lecture	1	2	3	4	5
9. Expected low quality of lecture	1	2	3	4	5
10. Family/household/ caregiving obligations	1	2	3	4	5

Declarations

Ethics Approval Approval was sought granted by the Virginia Commonwealth University Institutional Review Board (IRB: HM20014899).

Informed Consent Signed consent was waived for this study and an informed consent process was used where participants were provided a description of the study and data disclosure.

Conflict of Interest The authors declare no competing interests.

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