

RESEARCH ARTICLE

# Comparison of student pharmacists' academic performance with and without required attendance in a pharmacotherapy course

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## Abstract

**Background:** Studies evaluating the association between absenteeism and academic performance have had mixed results; some demonstrate a positive correlation between course attendance and academic performance. **Objective:** To compare student pharmacists' performance in a cohort with graded attendance and those without a graded attendance in a pharmacotherapy course and to evaluate student performance within the required attendance cohort on course learning objectives. **Methods:** All students enrolled during Fall 2021 and Fall 2022 were included in this study. Attendance data for the graded attendance cohort and the Assessment performance data for both cohorts were exported. With the student's *t*-test, the average examination performance on college-level learning outcomes (CLLOs) between groups was compared. **Results:** The comparison between the graded and ungraded attendance cohorts demonstrated a significant difference in academic performance for all three levels of Bloom's taxonomy, and one CLLO on Examination One and in all categories on Examination Two. Within the graded attendance cohort, comparing students who met unit attendance competency with those who did not resulted in a significant difference. **Conclusion:** The results of this study support graded attendance in a pharmacotherapy course. Student pharmacists demonstrated better academic performance when attendance was graded than a cohort without a graded attendance requirement.

## Introduction

Previous research has led to a debate on mandating course attendance for student pharmacists. The association between absenteeism and academic performance has been examined previously (Moore *et al.*, 2008; Stoner & Fincham, 2012; Irwin *et al.*, 2018; Ta *et al.*, 2020; Mitra *et al.*, 2022). While some studies have demonstrated a positive correlation between course attendance and academic performance (Irwin *et al.*, 2018; Ta *et al.*, 2020; Mitra *et al.*, 2022), others have not (Moore *et al.*, 2008; Stoner & Fincham, 2012).

The Accreditation Council for Pharmacy Education (ACPE) sets the standards for pharmacy education and is responsible for the accreditation of professional pharmacy programmes in the United States, where the

Doctor of Pharmacy (Pharm.D.) is the entry-level professional pharmacy degree. Upon graduation from an ACPE-accredited Pharm.D. programme, graduates should be able to provide direct patient care in a variety of healthcare settings, in other words, be "practice ready" (ACPE, 2015). After graduation, pharmacists may complete optional postgraduate training such as residency or fellowship or directly enter the workforce. The scope of pharmacists can vary between states. Currently, there is no national recognition of provider status of pharmacists in the United States and individual states determine the scope of pharmacy practice by their Board of Pharmacy (American Pharmacist Association, 2021).

To standardise pharmacy education and accredit programmes, ACPE created accreditation standards in

2016, which are currently set to be updated for 2025 (ACPE, 2015). The 2016 Accreditation Standards and Key Elements for the Professional Programme in Pharmacy Leading to the Doctor of Pharmacy Degree (2016 Standards) describe the expectation that colleges or schools of pharmacy develop and implement formative and summative assessments to ensure that graduates attain educational outcomes and are “*practice ready*” (ACPE, 2015). Assessments can use knowledge and performance-based methods to evaluate student achievement of learning objectives. Learning objectives are statements that describe what the learners are expected to receive following instructions (Melton, 1997). Learning objectives assist instructors with course alignment by allowing instructors to design balanced assessments, course content, and activities that can all be mapped back to learning objectives (Wiggins & McTighe, 2005). Another way to ensure course alignment is to create parity between learning objectives and assessment questions based on cognitive requirements. Bloom’s taxonomy is a framework that describes the level of cognitive activity with increasing levels of complexity (Bloom, 1956). Optimally, learning objectives should be written at the same Bloom’s taxonomy level as the assessment question (Wiggins & McTighe, 2005).

Anecdotally, the faculty for the pharmacotherapy course series at Washington State University College of Pharmacy and Pharmaceutical Sciences (WSU CPPS) observed decreased attendance and decreased academic performance over the past few years. Historically, attendance has been encouraged but not required as a graded element for the pharmacotherapy course series. In 2022, instructors of one pharmacotherapy course made attendance a mandatory, graded course requirement. No changes were made to content delivery or teaching methods between cohorts.

The primary objective of this analysis was to evaluate student pharmacist examination performance on course-level learning objectives in a cohort with graded attendance compared to a cohort without graded attendance in a pharmacotherapy course. The secondary objective was to evaluate student performance within the required attendance cohort on course learning objectives by comparing the academic performance of students who met competency for required attendance with students who did not.

## Methods

### *Description of course*

The course of studies at WSU CPPS includes four years: three years of didactic coursework and one year of experiential learning. WSU CPPS utilises a flipped-classroom, active-learning model that has been described previously (Remsburg et al., 2014; Bray et al., 2017; McKeirnan et al., 2020). Briefly, students are expected to engage with pre-class materials, attend a live active learning class session twice weekly for two hours, and then re-engage with materials independently after class.

Pharmacotherapy IV is a four-credit required course in the Doctor of Pharmacy Programme at WSU CPPS during the fall semester of the third professional year. It is comprised of two units, and each unit is assessed using a comprehensive examination. The first unit includes infectious diseases, and the second unit includes hepatic diseases and oncology. Competency is required for each unit to receive a satisfactory grade. Unit competency is achieved by at least one of the following: 1) achieving a score of 80% or greater on the weighted average for the unit or 2) achieving a score of 80% or greater on the unit’s comprehensive examination and a minimum score of 75% on the weighted average for the unit.

### *Course attendance and grading policies*

During Fall 2021, the Pharmacotherapy IV course syllabus stated that student attendance in all class sessions was expected. Attendance was not explicitly required or graded. Attendance became a graded element for the Fall 2022 semester, up 5% of the overall course grade. Class attendance was taken manually by the instructor for each session starting in Fall 2022. A single attendance sheet was handed to an individual student that required a name, signature, and written response to a prompt. At the end of class, each student needed to physically hand in their attendance sheet to receive credit. The prompts for attendance changed for each class session. Students were required to be present for the entire class session for attendance credit. After the session, the attendance sheets were scanned and attendance was manually entered into the learning management system. Any discrepancies were verified against the scanned attendance sheet and students had 1 week to correct any discrepancies.

When the graded attendance model was implemented in 2022, students were allowed to miss a specific number of sessions in each unit and still receive full credit for attendance. The number of missed sessions varied from Unit 1 to Unit 2 due to the difference in the number of sessions included in each unit. For Unit 1, the students must have attended 12 out of 14 sessions, and for Unit

2, students must have attended 10 out of 11 sessions to receive full credit. By not requiring every session, it afforded students the flexibility to attend personal or outside commitments or miss class due to illness. Students who attended the required minimum number of sessions will be referred to as meeting “unit attendance competency”. If students attended less than the minimum required number of sessions, then they received points based on the percentage of sessions attended.

### Learning outcomes

At WSU CPPS, college-level learning outcomes (CLLOs) were developed based on the ACPE Standard-one key elements related to foundational knowledge (ACPE, 2015). Standard-one key elements involve the

development, integration, and application of foundational sciences, such as pharmaceutical and clinical sciences, to the delivery of patient care (ACPE, 2015). Examples of this element include the evaluation of scientific literature to solve therapeutic problems and advance patient-centred care (ACPE, 2015). The CLLOs were mapped throughout the curriculum to ensure instructors covered all the learning outcomes as required by ACPE. Courses are assigned CLLOs that fit best with the course content. Bloom’s taxonomy and specific CLLOs that are included in Pharmacotherapy IV are shown in Table I. Pharmacotherapy IV assessments are designed to include questions categorised by their Bloom’s taxonomy level and CLLO within assessment software (version ExamSoft Legacy, ExamSoft Worldwide LLC, Dallas, TX).

**Table I: WSU CPPS course-level learning objectives for Pharmacotherapy IV with codes and descriptions**

CLLO domain	CLLO code	CLLO description
Bloom’s taxonomy (Bloom, 1956)	BT1	Knowledge Level of Bloom’s Taxonomy
	BT2	Application Level of Bloom’s Taxonomy
	BT3	Synthesis Level of Bloom’s Taxonomy
ACPE Standard One: Foundational knowledge (ACPE, 2015)	PT04	Identify and evaluate relevant clinical lab data or diagnostics essential to screen, diagnose, or evaluate treatment
	PT06	Monitor and adjust therapy based on efficacy, cost, tolerability, or risk for adverse events
	PT07	Identify or apply the key facts, including the pharmacologic activity, mechanism of action, therapeutic use, tolerability of prescription drugs and their application to patient care
	PT08	Utilise clinical skills to select optimal therapy and create patient-centred care plans.
	PT09	Discuss the properties of microorganisms (bacteria, viruses, parasites, and fungi) as they relate to human disease and treatment
	PC02	Describe the anatomy, physiology, and pathophysiology of the human body

ACPE= Accreditation Council for Pharmacy Education; CLLO= course level learning objective.

### Data collection and analysis

Student pharmacists enrolled in Pharmacotherapy IV during Fall 2021 and Fall 2022 were included in this study. Attendance data for the graded attendance cohort were exported from the learning management system after the completion of the Fall 2022 semester. Student pharmacist assessment performance data for the 2021 and 2022 cohorts were collected from the assessment platform at the end of the Fall 2022 semester. The University Institutional Review Board (IRB) determined that this project did not meet the criteria for board review (IRB#19644). The student’s *t*-test was used to compare means between groups. *P* values of 0.05 or less were considered significant, and all tests were two-tailed. All statistical analyses were performed using Excel (version 16.61.1, Microsoft Inc).

### Results

#### **Academic performance comparison between the graded attendance cohort and the ungraded cohort**

One hundred and five student pharmacists were enrolled in Pharmacotherapy IV in the Fall 2022 cohort. Examination One was completed by 102 students as scheduled and Examination Two was completed by 104 students. Students who were absent on examination day completed a make-up assessment using a different version of the assessment and were excluded from the analysis. For the 2021 cohort, 134 student pharmacists completed Examination One and 129 completed Examination Two on the scheduled examination day. Results showed a statistically significant difference between cohorts in performance for all three levels of Bloom’s taxonomy (BT1, *p* = 0.024, BT2, *p* = 0.003, BT3 *p* < 0.001) and one CLLO

(PT7,  $p = 0.001$ ) on Examination One and in all categories on Examination Two (BT1,  $p < 0.001$ , BT2  $p$

$= 0.013$ , PT04  $p < 0.001$ , PT07  $p = 0.015$ , PT08  $p = 0.019$ ) (Table II).

**Table II: Student performance on examination questions in the graded attendance cohort compared with the Ungraded cohort organised by category**

CLLO category (number of questions)	Average performance by students in graded attendance cohort (n=102)	Average performance by students in the ungraded cohort (n=134)	<i>p</i> -value
<b>Examination one</b>			
BT1			
Graded attendance (18)	81.9%	78.1%	0.024*
Attendance not graded (14)			
BT2			
Graded attendance (36)	84.7%	80.3%	0.003*
Attendance not graded (42)			
BT3			
Graded attendance (7)	82.8%	92.8%	< 0.001*
Attendance not graded (5)			
PT04			
Graded attendance (10)	84.4%	91.0%	< 0.001*
Attendance not graded (8)			
PT06			
Graded attendance (5)	77.5%	74.4%	0.123*
Attendance not graded (6)			
PT07			
Graded attendance (11)	82.4%	75.7%	0.001*
Attendance not graded (15)			
PT08			
Graded attendance (25)	83.7%	82.3%	0.200
Attendance not graded (26)			
PT09			
Graded attendance (9)	88.2%	87.6%	0.364
Attendance not graded (9)			
<b>Examination two</b>			
BT1			
Graded attendance (29)	90.4%	86.0%	< 0.001*
Attendance not graded (30)			
BT2			
Graded attendance (26)	87.2%	84.3%	0.013*
Attendance not graded (19)			
PT04			
Graded attendance (12)	85.7%	77.7%	< 0.001*
Attendance not graded (15)			
PT07			
Graded attendance (25)	89.6%	86.6%	0.015*
Attendance not graded (22)			
PT08			
Graded attendance (18)	87.0%	83.7%	0.019*
Attendance not graded (10)			

\*Student *t*-test was used to determine the significance, defined at a  $p < 0.05$ .

BT1=Bloom's Taxonomy Level One, Knowledge; BT2= Bloom's Taxonomy Level Two, Application; BT3= Bloom's Taxonomy Level Three, Synthesis; PT04=Pharmacotherapy Objective 04; PT06= Pharmacotherapy Objective 06; PT07= Pharmacotherapy Objective 07; PT08= Pharmacotherapy Objective 08; PT09= Pharmacotherapy Objective 09

### Academic performance within the graded attendance cohort

In the 2022 cohort, 92 out of 102 students (91%) met competency for Unit One attendance and ten students (9%) did not. For Unit Two, 82 out of 104 students (79%) met competency for attendance, and 22 students (21%) did not. A comparison between students who met

attendance competency with those who did not demonstrate a significant difference, but only on questions coded to the knowledge level of Bloom's taxonomy (BT1,  $p = 0.035$ ) (Table III). For the other Bloom's taxonomy levels and CLLOs, no significant difference was observed between students who met attendance competency and those who did not ( $p > 0.05$ ).

**Table III: A comparison of student performance on examination questions between students who met attendance competency with students who did not meet attendance competency in the required attendance cohort**

CLLO category (N = number of questions)	Performance by students who met unit attendance competency	Performance by students who did not meet unit attendance competency	<i>p-value</i>
<b>Examination one</b>	<b>N= 92 (%)</b>	<b>N=10 (%)</b>	
BT1 (18)	82.6	75.0	0.035*
BT2 (36)	84.7	85.0	0.449
BT3 (7)	82.5	85.7	0.302
PT04 (10)	83.9	89.0	0.136
PT06 (5)	78.7	66.0	0.099
PT07 (11)	82.1	84.5	0.328
PT08 (25)	84.0	80.8	0.200
PT09 (9)	88.3	87.8	0.435
<b>Examination two</b>	<b>N= 82 (%)</b>	<b>N=22 (%)</b>	
BT1 (29)	90.7	89.2	0.185
BT2 (26)	87.4	86.2	0.234
BT3 (5)	94.4	90.9	0.113
PC02 (3)	97.2	90.9	0.015
PT04 (12)	85.7	86.0	0.442
PT07 (25)	90.0	88.2	0.146
PT08 (18)	87.7	84.3	0.062
PT09 (3)	95.9	95.5	0.432

\*Student t-test was used to determine significance, defined at a  $p < 0.05$ .

CLLO= Course-level learning outcomes; CLLO abbreviation definitions are shown in Table I.

### Discussion

This research sought to compare student academic performance in the same course between a cohort with graded attendance and a cohort without graded attendance, as well as comparing the performance of students who met and did not meet the attendance competency bar within the graded attendance cohort. When comparing the two cohorts, the cohort without graded attendance performed better than the graded attendance cohort for Bloom's synthesis-level questions and PT04 objectives. Since attendance was optional in 2021 and not tracked, it is unknown whether the students who performed better on these assessment questions were present in class or not. Students who attend class when it is optional may tend to be more engaged, but this was not assessed in the current study.

Student performance on the remaining Bloom's knowledge- and application-level questions and one CLLO (PT07) was significantly higher for students in the required attendance cohort for Examination One and all objectives in Examination Two. These findings suggest that there may be a performance benefit for a cohort when attendance is required. Previous studies have demonstrated that when students are absent from class it can be disruptive to students who regularly attend class (Longhurst, 1999; Fjortoft, 2005).

The results of this study support that students will attend classes if required for a grade. With required attendance, most students were present, as demonstrated by meeting the unit attendance competency. This phenomenon has been demonstrated in another study in a similar-sized course (Westrick *et al.*, 2009). However, attendance rates were not collected for the cohort that did not have

graded attendance, so it is impossible to identify whether classroom attendance was also correlated with academic performance in this case. Anecdotally, the faculty estimate of attendance for the 2021 cohort was approximately 60% (data not shown).

This study did not find any difference in academic performance between students who attended nearly all class sessions and those who did not within the graded attendance cohort from 2022. The only area that appeared to be different between students who met unit attendance competency and those who did not was Bloom's taxonomy knowledge questions. This contrasts with a 2017 study by White and colleagues, showing no difference in knowledge or comprehension level questions, but there was a difference in analysis level questions (White *et al.*, 2017). In addition to class attendance, White and Colleagues also looked at preparation for class, which may explain the difference in results from the present study (White *et al.*, 2017). When students are prepared for class, synthesis-level questions may perform better. In the present study, pre-class preparation was not formally examined. Perhaps knowledge-level concepts were reiterated in class or described as an anecdote, so students who attended were more likely to remember. Narrative or storytelling has been linked with increased retention (Rodrigo *et al.*, 2019).

One strength of the present study is that attendance was taken manually. Other studies of attendance have relied upon student self-reporting when attendance was required by the student handbook but was not graded (Hidayat *et al.*, 2012). Another strength of this study is that specific course-level objectives were assessed. To the authors' knowledge, this is the first study that compares specific course-level objectives with and without required attendance for pharmacy learners.

### **Limitations**

Limitations of this study relate to comparing the performance of different cohorts of students. It can be difficult to determine whether required attendance was the only difference between the comparison groups or whether other factors were involved. Another limitation is the potential difference in examination questions between cohorts. Although the questions were similarly classified based on Bloom's taxonomy and CLLO within the assessment platform, there were minor differences in the number of questions on each examination due to differences in semester schedules between the 2021 and 2022 cohorts. However, the examinations were comprehensive, so the content was the same for both examinations for each cohort.

Future research on the topics of attendance and absenteeism is still needed. This project evaluated student pharmacist academic performance in a course with and without required attendance, but student attendance is not equivalent to student engagement. The researchers are currently working on a separate study evaluating students' level of engagement when they are present in class.

### **Conclusion**

The results of this study support graded attendance in a pharmacotherapy course. Student pharmacists demonstrated better academic performance when attendance was graded than a cohort without a graded attendance requirement. However, there was no significant difference in performance between students who received full credit for attendance and those who did not within the same cohort. While incentivising professional behaviours such as attendance might demotivate other students, the authors believe that this is the first step in creating a "culture of attendance". This study provides additional support that required attendance might influence performance for a cohort of learners. While more data are needed to examine other benefits of required attendance, this may be a step in the right direction.

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### **Conflict of interest**

The authors declare no conflict of interest.

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