

TEACHERS' TOPICS

A Participation Requirement to Engage Students in a Pharmacokinetics Course Synchronously Taught at a Local and Distant Campus

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Objective. To design, implement, and evaluate a strategy to actively engage doctor of pharmacy (PharmD) students at local and distant sites in a pharmacokinetics course.

Design. A Web-based system was designed that allowed second-year pharmacy students to choose whether to participate in a instructor-led class discussion session by registering prior to or during the first 10 minutes of each class. The instructor then used the program to randomly select students to respond to questions based on the assigned reading. Five percent of the overall course grade was based on class participation.

Assessment. For each class session, an average of 85% of students at both the local and distant campuses registered for participation in class discussion and approximately 5% were called on to respond to questions. Student responses to course survey questions regarding the participation strategy were overwhelmingly positive, with 75%-90% agreeing that the strategy more actively engaged them in classroom activities, resulting in improved learning. Student performance in all assessment categories was almost identical at the local and distant sites.

Conclusions. Implementation of a participation strategy in a large course synchronously taught on 2 campuses is feasible and results in successful engagement of most students at both sites.

Keywords: class participation, class discussion, active learning, synchronous teaching, distance learning

INTRODUCTION

Active participation of college students in class discussions is expected to facilitate critical thinking, resulting in increased retention of information and learning.¹ Depending on the instructor's preference, students may participate in class discussions voluntarily or be called on by the instructor. Although achieving voluntary participation of students in small groups or small classroom settings is relatively easy, implementation of the voluntary participation strategy in a large classroom setting is extremely challenging. This is because reticent students can avoid participation easier in larger classrooms, making it more difficult to achieve balance in discussion across students.² Only approximately 25% of students voluntarily participate in class discussions, with an even smaller group (12%) dominating the discussion. Because of these limitations, many instructors understandably resort to lecture-based teaching formats in large classes, further limiting, unwittingly, student participation.

As challenging as student participation is to achieve in large traditional classrooms, participation of students at a remote site during a synchronous teaching format is even more difficult to accomplish. Distant education decreases the interaction between the teacher and students at the distant site.³ Approximately 30% of the students at remote education sites talk, sleep, or otherwise do not pay attention during synchronous delivery of classes.⁴ Therefore, methods must be devised to engage students, in particular those at the remote learning site, during synchronous delivery of course content.

As an instructor at the Texas Tech School of Pharmacy, the author had used voluntary participation in traditional classroom settings to teach basic and applied (clinical) pharmacokinetics using a quasi-problem-based-learning approach for more than a decade.⁵ However, as the class sizes increased, it became increasingly difficult to implement voluntary participation successfully. Additionally, Texas Tech School of Pharmacy in Amarillo opened a new campus in Abilene in 2007, with most of the courses, including Clinical Pharmacokinetics, offered in a synchronous mode during the first 2 years of curriculum. In this system, classes are originated from either Amarillo or Abilene, depending on the location of the instructor. Recognizing the shortcomings of voluntary

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participation in traditional large classrooms and the additional difficulties expected with the addition of a remote campus, the author decided to design an instructional strategy to engage students at both local and remote classrooms during the synchronous learning sessions. The goal was to create a transparent strategy that while only a small fraction of students actually would be called on to answer questions in each session, there would be an equal probability for every student to be called on to participate in class discussions. The hypothesis was that requiring participation in class discussions, in addition to completion of other active-learning activities such as online quizzes and assignments, would result in equal learning among students at the local and distant campuses.

DESIGN

The Clinical Pharmacokinetics course was designed to actively involve students in the learning process. The principles of the course, described in detail in previous articles,⁶⁻⁸ are as follow:

- (1) Provide reading handouts to students at least 2 weeks before each class.
- (2) Formulate learning outcomes as cases/practice problems/scenarios.
- (3) Require students to work on the cases before attending class.
- (4) Center the class session on discussion of the cases rather than on the reading handouts.
- (5) Reward (with grades) students for their work.

Before the addition of the Abilene campus, the above principles were achieved by student participation in class discussions, completion of a quiz on the current topic

at the end of each class session, and completion of take-home assignments on that day's topic. Although class participation was voluntary without any credit assigned, quizzes and take-home assignments comprised 10% and 30% of the students' overall course grade, respectively, with the remaining 60% of the grade determined by their scores on regular examinations. In 2008-2009, a strategy to encourage class participation was implemented and counted 5% of the total course grade, reducing the weight of take-home assignment grades from 30% to 25%, while keeping the weight of the quiz and examination grades at 10% and 60%, respectively.

The participation strategy used a Web-based database for setting up the instructor's preferences and student registration. In the first step, the instructor set up the date and time for registration for each session. Next, students who wished to participate in that session's discussion registered online during the allotted window of time, which was 10 minutes before and after the start of each class (Figure 1). Students had the option of choosing not to register for a session because of lack of preparation or for any other reason. After they registered, the program assigned them a unique number applicable only to that session. During the discussion of the cases, the instructor used the online program to randomly select students from the registration database (Figure 2). The student's number and campus location appeared on the screen at both campuses, and the selected student then was asked to answer 1 or more questions using 1 of the microphones available at both sites.

All students who registered for participation in the session received full credit for that session regardless of whether or not they were called on to participate. This

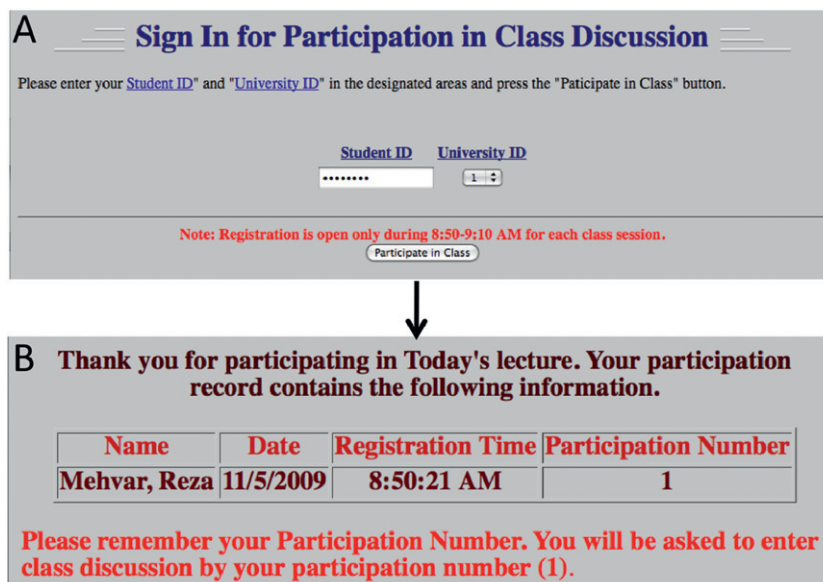


Figure 1. Screen snapshots of Web windows used by students for registration (A) and receiving participation number (B).

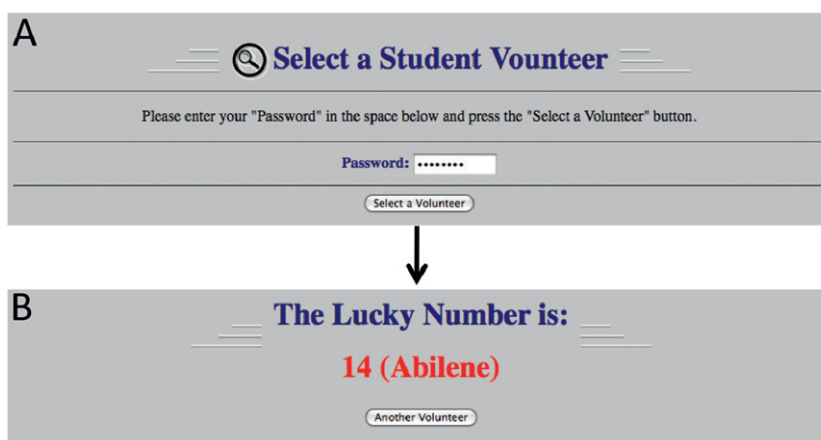


Figure 2. Screen snapshots of Web windows used by the instructor to broadcast to students during the class session for selecting students (A) and projecting their participation numbers (B).

meant there was no penalty for incorrect or partial answers. The intent was to make students come to class prepared for discussion, not to actually grade their answers. Students who chose not to register received a grade of zero for that session. The strategy was first implemented during the 2008-2009 academic year, when the founding class in Abilene began its second year of the program. There were 87 and 37 students in Amarillo and Abilene, respectively, with all instruction originating from Amarillo. The demographics and academic characteristics of the students already have been published.⁹ Students at the 2 sites were equivalent in terms of prepharmacy grade point average (GPA) and Pharmacy College Admission Test (PCAT) scores. In terms of the course schedule, Clinical Pharmacokinetics is a 3-semester credit hour course offered as 2 weekly sessions of 75 minutes each. There were a total of 32 sessions in the semester with 1 used for introduction and 4 devoted to administering progress examinations; hence, the participation strategy could be used in 27 sessions. Because there was no make-up opportunity for class participation, students were allowed to miss or decline to participate in up to 3 sessions without any penalty.

EVALUATION AND ASSESSMENT

To evaluate the effectiveness of the participation strategy, the number of students that registered and the number that were called on to participate were recorded for each session for each campus. Unpaired, two-tailed *t* tests were used to identify any differences between the 2 campuses in students' degree of participation. Additionally, a Web-based, anonymous survey regarding the student perceptions of the usefulness of the strategy was administered at the end of semester. The survey consisted of 10 Likert-scale questions plus 1 open-ended question for comments. The differences between the responses of the local and distant campuses to the survey questions

were tested using Chi square analysis. Finally, all grades for the course (participation, quizzes, assignments, and examinations) were separated based on campus, and unpaired, two-tailed *t* test analysis was used to determine any differences in the students' performance between the local and distant campuses.

An average of 85% of students on each campus registered for participation in each class (84.6% ± 9.0% at the Amarillo campus; 85.1% ± 8.4% at the Abilene campus). Of those who registered, approximately 5% of students at each campus were called on during a class to participate (4.6% ± 1.7% at the Amarillo campus; 4.9% ± 2.6% at the Amarillo campus). There were no significant differences between the 2 campuses in their level of registration ($P = 0.821$) or actual participation ($P = 0.733$) during the entire semester.

The percentage of students who registered for class participation was higher (>90%) at both campuses earlier in the semester (first 7 classes). There were periodic sudden drops in registration at different times, starting with class session 8 (week 4 of instruction). The lowest registration level was approximately 70%, which occurred 3 times during the semester. Except for a few minor differences, the patterns of registration at both campuses were similar. As for actual participation, the designed strategy resulted in participation of students from both campuses in every session, except for 1 session, when the random system did not call on any student from Abilene.

The rate of registration for class participation throughout the semester ranged from 29.6% to 100% among students on the Amarillo campus and 7.4% to 100% for the Abilene campus. Although some students registered for class participation only a few times during the entire semester, there were no students who did not register at all. Examination of the class records confirmed that the low frequency of registration observed for some students

was not due to a lack of class attendance because the same students completed quizzes that were administered in the same class sessions for which they declined to register for participation.

Student response rates to the anonymous participation survey administered at the end of the semester were high at both the Amarillo (96.6%) and Abilene (97.2%) campuses (Table 1). The first 3 questions dealt with the process of registration/participation. An overwhelming percentage of students at both campuses (>97%) agreed or strongly agreed that the process of registration was easy (question 1). Additionally, more than 80% of the students at both campuses agreed or strongly agreed that the allotted time for registration was appropriate (question 2). Similar percentages of students agreed or strongly agreed that they preferred the use of a participation number instead of their name to call on them in class (question 3). A large proportion of students at both campuses (75%-90%) agreed or strongly agreed that the designed strategy for participation made them attend the class more frequently (question 4), come to class more prepared (question 5),

and pay more attention during the class (question 6). Most importantly, 80% of Abilene students and 79% of Amarillo students agreed or strongly agreed that the participation requirement led to improved learning (question 8). Approximately 90% of the students at each campus agreed or strongly agreed that the class participation strategy should be used in this course in the future (question 10). The majority of students at both campuses were neutral regarding an increase in the credit assigned for class participation (question 9). There were no statistical differences between the 2 campuses regarding the responses to all questions except for question 7, which dealt with the effectiveness of the strategy in increasing engagement of students at the distant (Abilene) site. Although the majority of students at both campuses agreed or strongly agreed with this statement, students at the distant site (Abilene) were more positive ($P = 0.017$) about the effectiveness of the strategy than those at the local site (89% versus 64%; Table 1).

Student grades in all areas of the course are presented in Table 2. The participation grades reflect the instructor dropping up to 3 grades of zero for missed

Table 1. Response of Students at the Distant (Abilene) and Local (Amarillo) Campuses to Survey Questions About a Class Participation Strategy

Question	Campus	Response (%)					Mean ^a
		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	
1. Registration process for participation was easy.	Abilene ^b	83.3	13.9	0	0	2.8	4.8
	Amarillo ^c	86.9	11.9	1.2	0	0	4.9
2. The window of time for registration (± 10 min) was appropriate.	Abilene	58.3	25.0	8.3	5.6	2.8	4.3
	Amarillo	64.3	22.6	6.0	4.8	2.4	4.4
3. I liked being asked to participate by my assigned number instead of my name.	Abilene	66.7	16.7	11.1	0	5.6	4.4
	Amarillo	51.2	29.8	13.1	3.6	2.4	4.2
4. Assigning points to participation made me attend the class more frequently.	Abilene	58.3	25.0	8.3	2.8	5.6	4.3
	Amarillo	61.9	26.2	6.0	3.6	2.4	4.4
5. Assigning points to participation made me come to class more prepared.	Abilene	58.3	27.8	2.8	2.8	8.3	4.3
	Amarillo	64.3	25.0	4.8	3.6	2.4	4.5
6. Assigning points to participation made me pay more attention during the class.	Abilene	30.6	44.4	11.1	5.6	8.3	3.8
	Amarillo	34.5	48.8	10.7	3.6	2.4	4.1
7. Relative to other courses, participation requirement in this course effectively increased the engagement of students at the distant site (Abilene).	Abilene ^d	52.8	36.1	2.8	2.8	5.6	4.3
	Amarillo ^d	41.5	22.0	30.5	3.7	2.4	4.0
8. Participation requirement made me learn more.	Abilene	44.4	36.1	8.3	2.8	8.3	4.0
	Amarillo	40.5	38.1	17.9	1.2	2.4	4.1
9. A higher percentage of the course grade should be assigned to participation.	Abilene	11.4	22.9	40.0	14.3	11.4	3.0
	Amarillo	10.8	25.3	38.6	10.8	14.5	3.0
10. Participation requirement should continue in this course in the future.	Abilene	63.9	25.0	0	0	11.1	4.3
	Amarillo	66.7	22.6	6.0	2.4	2.4	4.5

^a Means are calculated based on the following scale: strongly agree = 5; agree = 4; neutral = 3; disagree = 2; strongly disagree = 1

^b n = 84 (84 out of 87 students in Amarillo responded to the survey).

^c n = 36 (36 out of 37 students in Abilene responded to the survey).

^d Significant difference between the 2 campuses, based on chi square analysis ($p = 0.017$).

Table 2. Grades of Pharmacy Students at the Local (Amarillo) and Distant (Abilene) Sites for Various Assessments, Mean (SD)

Campus	Participation	Quizzes	Assignments	Examinations	Overall Grade
Amarillo ^a	94.0 (11.4)	85.9 (8.0)	93.9 (5.0)	85.7 (7.1)	88.2 (5.7)
Abilene ^b	91.8 (22.6)	86.4 (8.2)	93.9 (5.3)	84.4 (7.2)	87.4 (6.4)

^a n = 87 students in Amarillo.

^b n = 37 students in Abilene.

class participations for each student. The average grades of students at the distant site in all categories were equivalent to those for students at the local site, with no significant differences. The overall course grades were 87.4 ± 6.4 (range: 70-97) for the Abilene students and 88.2 ± 5.7 (range: 73-99) for the Amarillo students.

DISCUSSION

The Accreditation Council for Pharmacy Education (ACPE) expects that all PharmD students have high-quality, face-to-face experiences with patients, practitioners, faculty members, and each other, regardless of the method used for curriculum delivery.¹⁰ Additionally, ACPE does not have separate standards for onsite and distance programs and requires that similar outcomes and competency-based standards be achieved by both types of programs.

The goal of implementing a new participation strategy to the Clinical Pharmacokinetics course at the Texas Tech School of Pharmacy was to prevent an expected lack of participation and active engagement of most students, particularly those at a new distant site. The data presented in the Evaluation and Assessment section clearly show the successful achievement of this goal using the designed approach.

Several aspects of the program had to be considered carefully before implementation, including whether to allow students to opt out and how much course credit to assign to student participation. While the instructor desired that all students participate in class discussions, he wanted them to choose to participate rather than be forced to participate. Thus, a registration process was designed, whereby students “voluntarily” registered for class participation. Previous research has shown that credit incentive increases students’ participation, especially among low-responding students.² However, because the participation process in large classrooms does not lend itself to accurate assessment, the author assigned a relatively small credit (5% of the total course grade) to this activity. Despite the small incentive, approximately 85% of students at both campuses chose to participate in the class discussions, suggesting successful achievement of the instructor’s goal. However, the level of registration was not uniform across the semester. There were sessions when registration dropped to approximately 70%. These

sessions occurred beyond 4 weeks after the start of the semester, and most, if not all, happened when students had examinations in other courses on the same day. Additionally, there was lower registration for class participation during the last week of the semester because some students who had not used their 3 allowances for missing class participation, chose to opt out of participating in the last few class discussions. The combination of 5% credit incentive and the “voluntary” registration process resulted in successful implementation of a strategy for increasing class participation.

Another decision was whether to call students by their name or a participation number when asking them questions. The instructor was concerned that flashing students’ names on the screen might be intimidating for some students, so the system was designed to generate a participation number for each student. The survey results at the end of the semester were in agreement with the instructor’s assumption as more than 80% of students agreed or strongly agreed that being identified by a number was preferable to announcing their name (Table 1). Although the name of the student called on was not shown on the screen, it was available to the instructor by scrolling down the window on his computer screen. This was done so that if a student did not respond when his/her participation number was called or forgot or misplaced his/her participation number, he/she could be identified by name (this occurred only once during the semester). Overall, assigning a participation number system seemed to be an efficient, less intimidating approach to calling on students to participate in class.

In addition to the participation number, the responses of the students to the other questions in the participation survey were also overwhelmingly positive (Table 1). Students’ surprisingly positive survey responses (Table 1) to a strategy to encourage them to participate in class (an ongoing challenge for all instructors) also may be attributed to the provision of a registration process for participation. This put students in control of whether or not they might be called on in class. Additionally, the instructor did his best to create a nonthreatening atmosphere during class discussions by clarifying that students did not have to know the correct answer to receive participation credit, but had to explain how they arrived at their answers.

Fifty-three students (43%) provided written comments in their survey responses about the participation strategy. All but 1 of the written comments were either positive or offered suggestions for improvement. The most repeated positive comments related to the use of participation numbers instead of names and the success of the strategy in increasing students' preparedness for class, which resulted in more learning. The 1 negative comment received stated that the instructor should use only examinations to determine the course grade and not any other assessments, such as class participation, quizzes, or assignments. Five students suggested that the participation strategy should be modified so that no student was called on to participate for a second time before everybody had a chance to participate once. However, doing this would defeat the main purpose of the design, which is to make students come to every class prepared because they could be asked to participate.

An issue of interest to educators, administrators, and accreditation agencies in the distant education programs is the performance of students in distant site programs relative to students in on-site programs. The Amarillo, Lubbock, and Dallas campuses of Texas Tech School of Pharmacy, which use a synchronous teaching format to deliver the pharmacotherapeutic courses to all sites, found that the performance of students at local and distant sites were similar.^{11,12} The studies were carried out during the third year of the pharmacy program, when students were distributed among the 3 campuses after spending the first 2 years in Amarillo. Additionally, equivalent performance of first-year students in Anatomy and Pharmaceutical Calculations was found at the distant campus in Abilene and the local site in Amarillo during the 2007-2008 academic year.⁹ In agreement with these studies,^{9,11,12} the performances of the students at the local and distant sites were almost identical in all areas of assessment in our study (Table 2).

In terms of limitations, the current strategy uses an all or none credit for each session, which may present as a limitation for those students who have worked on some, but not all, parts of the cases. Additionally, because there is no penalty associated with not knowing the correct answer, the system is subject to abuse in case students register without actually having worked on the cases. To minimize these limitations, the instructor is in the process of modifying the registration system so that students select those questions in the case that they would like to answer for each session. This will allow for partial credit (instead of all or none) to be awarded for each session and also will remove the possibility of abuse of the system. In the presence of such a system, one may include a penalty if a student claims that (s)he does not know the answer to that question when they are called.

Because of the success of the class participation strategy described here, a number of colleagues at Texas Tech School of Pharmacy have expressed interest in using the system. In fact, a colleague already has used the strategy in another course (Principles of Drug Action) offered to first-year pharmacy students. The instructor is modifying the registration system to allow multiple instructors with individualized accounts and settings to use the system.

SUMMARY

A class participation strategy to engage PharmD students in a large class taught synchronously at local and distant sites was developed using an online, Web-based registration process. The strategy successfully engaged students at both sites during the class sessions. Students overwhelmingly agreed that the strategy increased their preparedness and their attention during the class, resulting in improved learning. The instruction format used in this course, including the participation strategy, resulted in equivalent performances of students at the local and distant sites.

REFERENCES

1. Weaver RR, Qi J. Classroom organization and participation: college students' perceptions. *J Higher Educ.* 2009;76(5):570-601.
2. Foster LN, Krohn KR, McCleary DF, et al. Increasing low-responding students' participation in class discussion. *J Behav Educ.* 2009;18(2):173-188.
3. Ware SK, Olesinski RL, Cole CM, Pray ML. Teaching at a distance using interactive video. *J Allied Health.* 1998;27(3):137-141.
4. Chiou SF, Ching UL. Development and testing of an instrument to measure interactions in synchronous distance education. *J Nurs Res.* 2003;11(3):188-196.
5. Mehvar R. Development and evaluation of a quasi problem-based, objective-driven learning strategy in introductory and clinical pharmacokinetics courses. *J Pharm Teaching.* 1999;7(1):17-29.
6. Mehvar R. Creation of a dynamic question database for pharmacokinetics. *Am J Pharm Educ.* 2000;64(4):441-445.
7. Mehvar R. The relationship among pharmacokinetic parameters: effects of altered kinetics on the drugplasma concentration-time profiles. *Am J Pharm Educ.* 2004;68(2):Article 36.
8. Mehvar R. Principles of nonlinear pharmacokinetics. *Am J Pharm Educ.* 2001;65(2):178-114.
9. Fike DS, McCall KL, Raehl CL, Smith QR, Lockman PR. Achieving equivalent academic performance between campuses using a distributed education model. *Am J Pharm Educ.* 2009;73(5):Article 88.
10. How Can We Ensure Quality in Distance Learning?, Accreditation Council for Pharmacy Education. <http://www.acpe-accredit.org/deans/faqs.asp#6>. Accessed July 22, 2010.
11. MacLaughlin EJ, Supernaw RB, Howard KA. Impact of distance learning using videoconferencing technology on student performance. *Am J Pharm Educ.* 2004;68(3):Article 58.
12. Moridani M. Asynchronous video streaming vs. synchronous videoconferencing for teaching a pharmacogenetic pharmacotherapy course. *Am J Pharm Educ.* 2007;71(1):Article 16.