Medical Students' Attitudes toward Using Simulated Patients to Introduce Basic Science Concepts in a Large Classroom Setting

L Van Winkle, D Sefcik

Citation

L Van Winkle, D Sefcik. *Medical Students' Attitudes toward Using Simulated Patients to Introduce Basic Science Concepts in a Large Classroom Setting*. The Internet Journal of Medical Education. 2009 Volume 1 Number 2.

Abstract

The number of U.S. medical students is increasing. Schools plan to train the majority of these additional students through class expansion in existing programs. Larger class sizes require more faculty and innovative teaching methods. Since 2005, the authors have investigated the use of simulated patients (SPs) to introduce biochemistry concepts in a large classroom.
Methods:
On the first day of medical school, the entire class was introduced to trained-actors (simulated patients) experiencing difficulty breathing. During a clinician-facilitated mock interview the students learned about the basic elements of patient assessment, differential diagnosis and common causes of hyperventilation. Following completion of all basic science courses, two, three or four years after the SP experience, students completed a survey describing their recollection of the session, its impact on their understanding of the relationship between biochemistry and clinical medicine, their subsequent studying related to the biochemistry course, and whether such sessions would have been useful in other basic science courses.
Results:
Of 497 students contacted, 290 completed the survey. Almost 90% of respondents found the SP sessions engaging, over 75% reported a better understanding of the importance of biochemistry to the practice of medicine, and in excess of 70% reported an increased desire to study basic sciences, especially if more courses incorporated SP experiences. The number of SP encounters used in the biochemistry course has increased during the past six years.
Conclusions:
Students find early clinical encounters with simulated patients, in large classrooms an engaging way to introduce basic science concepts and report that their utility as a teaching method should be expanded.

INTRODUCTION

In the USA, the enrollment of first-year medical students in 2014 is projected to be 36% greater than it was in 2002.[1] The majority of these almost 7,000 additional students (approximately 3,800 allopathic [MD] and 3,200 osteopathic [DO]) will be training in medical schools that have expanded their enrollments, some by more than 50 percent. Class expansion necessitates that medical schools increase their training resources (facilities, faculty and staff will need to grow), become more efficient (train more students with the same resources), or some combination of both.[2] In preparation for an increased enrollment of approximately 20% in Midwestern University's Chicago College of Osteopathic Medicine (MWU/CCOM) entering class size, decisions were made to modify some of the teaching approaches used in first-year courses. This article describes our experience over a three-year period with a teaching method designed to: 1) introduce basic aspects of patient evaluation into a basic science course, 2) help students appreciate the relationship between clinical medicine and the basic sciences, 3) increase students' motivation to study the basic sciences, and 4) accomplish the first three goals in a cost-effective and efficient manner.

In a large classroom (capacity = 202) on the first day of medical school at MWU/CCOM, first-year medical students were introduced to Sarah Abraham (2005 and 2006) or Harry Finlay (2007). It was obvious to all that Mrs Abraham and Mr Finlay (both names are pseudonyms for trained actors) were notably dyspneic and tachypneic. During a clinician-facilitated, one-hour mock interview, the students observed a demonstration of the basic elements of initial patient assessment, were introduced to the concept of differential diagnosis, and learned about common causes of

hypo- and hyperventilation. Biochemistry lectures on acid-base disturbances (two hours of lecture in 2005 and 2006) and ATP metabolism (two hours of lecture in 2007) followed these sessions.

AUGMENTING THE MEDICAL SCHOOL CURRICULUM

Starting with the first day of class and ending at graduation, a number of variables compete for the time and attention of medical students. The time that students spend in the classroom should include more active (student-centered/learning-oriented) experiences and less passive (teacher-centered/content-oriented) lecturing.[3] The transition to student-centered teaching methods requires changes on the part of both students and faculty. Students need to become more involved in the construction of knowledge as they develop clinical reasoning skills; faculty need to offer timely and appropriately delivered, formative feedback.[4,5] To enhance the learning process, faculty should use teaching methods that just don't instruct and give grades, but produce learning through whatever methods work best.[5]

BENEFITS OF PATIENT CONTACT DURING THE PRECLERKSHIP YEARS

Several positive effects have been reported when medical students are exposed to patient contact early in their medical school course work. Interacting with patients motivates students to study, promotes the development of a professional identity and fosters an appreciation of the effects of illness on patients.[6] The ability to arrive at the correct diagnosis is dependent not only on understanding facts and concepts, but also the ability to recall them from memory. Medical knowledge is better organized in one's memory when the learning environment includes clear examples or cases; learning medicine through prototypes facilitates learning, understanding and recall.[7] The significant time that students spend in class and studying, and the geographic distance between some medical school campuses and teaching hospitals can make access to patients challenging.

MWU/CCOM is not located near an affiliated teaching hospital so access to real patients is limited. Beginning in the 1960s, an educational approach using individuals (real patients and actors, commonly referred to as standardized patients) trained to portray various illness scripts began to be used to teach and assess physicians-in-training.[8] The use of healthy (and often more mobile) actors trained and coached to present realistic patient presentations (simulated patients; SPs) has proliferated among training programs for healthcare providers.[9-12] While SPs are used to both teach and assess students, most studies and reports have focused on their utility for assessment or for teaching in small groups, or during one-on-one (SP:student) encounters.

INTEGRATING CLINICAL MEDICINE AND BASIC SCIENCES

Simulation is a useful learning and training method. Simulation allows events or conditions to be imitated to allow individuals without experience the opportunity to observe a situation, to develop new skills and/or to practice responses in anticipation of future occurrences.[13] Various simulation technologies have been employed in the training of medical students.

High-fidelity videotaped patient encounters and computerized-manikins have been used to teach students neuroscience concepts and cardiovascular physiology respectively.[14] Simulated clinical encounters (SCE) using SPs to assess the ability of examinees to collect historical information and perform focused physical examinations have also been described.[15] SPs have been used to teach the mental status examination in large group settings.[16] A review of the literature failed to identify any publication citing the use of SPs to teach basic sciences in a large classroom.[17]

On the first day of medical school for three successive years, we introduced an SP experiencing difficulty breathing to the entire first-year class. Based on those encounters we surveyed the students to assess their reaction to: 1) the use of SPs to introduce basic science concepts, 2) whether SPs should be used in more basic science courses, and 3) the impact the SP encounter had on them approximately two, three and four years later.

METHODS

This study was approved by Midwestern University's Institutional Review Board. The subjects were the students that attended their first day of medical school from 2005-2007 at the Chicago College of Osteopathic Medicine (CCOM). The first two years of curriculum at CCOM are primarily discipline-based courses presented using lecture-based format, small group workshops and problem-based learning activities. The basic science courses follow a traditional sequence with anatomy, biochemistry, embryology, histology, immunology, and physiology during the first year, and microbiology, pathology, and

pharmacology presented during the second year. Courses spanning three quarters (the entire academic year) teach clinical medicine (Introduction to Clinical Medicine [Year 1] and Practice of Medicine [Year 2]) independent of the basic science courses.

SIMULATED PATIENTS

Based on the lecture sequence of MWU/CCOM's biochemistry course from 2005-2007, we developed two clinical scenarios. Development of the cases took less than two hours. Prior to the initial biochemistry lecture sessions for the fall quarter, two actors, a 60-year-old female (Sarah Abraham, 2005-2006) and a 65-year-old male (Harry Finlay, 2007), were trained to represent patients experiencing shortness of breath. Mrs Abraham presented experiencing an exacerbation of asthma while Mr Finlay presented in acute heart failure. During a 30-minute training session, each SP was provided with scripted responses to questions the clinician-facilitator would ask. In anticipation that the students might ask questions that did not have prepared answers, the SPs were advised to ad lib the responses. SPs were each paid $50 per session for their participation.

A student volunteer interviewed each SP in front of the entire class under the guidance of one of the authors, a clinician (DS). The interviews were interrupted whenever necessary to clarify questions asked by the student interviewer as well as to pose questions to the entire class to assess understanding of the interview process. The student interview was followed by additional questions for the SP from the class. The sessions ended with summary comments from both authors.

SURVEY INSTRUMENTS

A six-item survey instrument based on a seven-point (1 = strongly disagree; 4 = neither agree / disagree; 7 = strongly agree) Likert scale was created for this study (Figure 1).

Figure 1

Figure 1. Survey Regarding the Use of a Simulated Patient (SP) during the First Lecture Session of a Medical Biochemistry Course

1.	Having an encounter with a SP that was experiencing shortness of breath (asthma 2005 and 2006; heart failure 2007) the first day of class was very engaging.
2.	The encounter with the SP the first day of class helped me realize how important understanding the basic sciences is to the practice of medicine.
3.	The encounter with the SP the first day of class caused me to study (acid-base 2005 and 2006; ATP metabolism 2007) with more interest than likely would have occurred without that exercise.
4.	The SP exercise helped me better appreciate the close relationship that exists between the basic sciences and clinical medicine.
5.	It would be helpful if more basic science courses incorporated the use of SP.
6.	My desire to study the basic sciences would be increased if more basic courses incorporated the use of SP in their teaching.

During the spring quarter of 2009, all of the student groups that experienced the SP sessions were surveyed. This approach provided student responses approximately two, (Class of 2011), three (Class of 2010) and four (Class of 2009) years after the SP sessions. We waited to survey students until all basic science courses had been completed since several of our survey items ask students to relate their experiences with simulated patients in Biochemistry to other basic science courses. In addition to providing numerical responses to the six items, some students wrote narrative comments and suggestions directly on the survey instruments.

DATA COLLECTION AND ANALYSIS

The responses to each item were compared statistically among classes using analysis of variance (ANOVA) in combination with the Newman-Keuls multiple comparison test. Data were also assessed using one-sample t-tests to determine whether the mean response to each item differed significantly from neutral (i.e., 4.00 on Likert scale).

RESULTS

The response rates were 46% (71/ 155), 28% (48/171), and 100% (171/171) for the Classes of 2009, 2010 and 2011 respectively. (Note: at the time of data collection, students in the Class of 2011 were all still available on campus, whereas members of the other Classes were not.)

MEAN RESPONSES

Mean responses for the group that had most recently experienced the SP session (Class of 2011) were significantly higher than neutral (i.e., 4.00) for all items except Item 3 (Table 1).

Figure 2

Table 1. Student Survey Responses for the Class of 2011 (n = 171)

Item	Strongly Disagree (%)	Disagree (%)	Somewhat Disagree (%)	Neither Agree/ Disagree (%)	Somewhat Agree (%)	Agree (%)	Strongly Agree (%)	Mean*
1	2 (1.2)	1 (0.6)	1 (0.6)	11 (6.4)	29 (17.0)	77 (45.0)	50 (29.2)	**5.89**
2	2 (1.2)	5 (2.9)	9 (5.3)	17 (9.9)	50 (29.2)	56 (32.7)	32 (18.7)	**5.36**
3	9 (5.3)	24 (14.0)	18 (10.5)	43 (25.1)	37 (21.6)	26 (15.2)	14 (8.2)	**4.22**
4	1 (0.6)	9 (5.3)	3 (1.8)	26 (15.2)	48 (28.1)	56 (32.7)	28 (16.4)	**5.29**
5	1 (0.6)	4 (2.3)	3 (1.8)	23 (13.5)	37 (21.6)	53 (31.0)	50 (29.2)	**5.63**
6	3 (1.8)	8 (4.7)	8 (4.7)	35 (20.5)	38 (22.2)	36 (21.1)	43 (25.1)	**5.20**

**Each mean significantly exceeded 4.00 ($p<0.0001$) except item 3 ($p=0.08$).*

Although the surveys were administered to the different classes two to four years after the encounters, the numerical responses to the survey items were nearly indistinguishable (Table 2). The class of 2011 found the experience somewhat more engaging than did the other two classes (Table 2).

Figure 3

Table 2. Comparison of Student Survey Responses for the Classes of 2009 (n = 71), 2010 (n = 48) and 2011 (n = 171)

Item	2009 Mean (SD)	2010 Mean (SD)	2011 Mean (SD)
1	5.44 (1.46)	5.49 (0.99)	5.89* (1.07)
2	5.14 (1.61)	5.15 (1.02)	5.36 (1.31)
3	4.63 (1.49)	4.44 (1.64)	4.22 (1.63)
4	5.10 (1.54)	5.17 (1.04)	5.29 (1.30)
5	5.27 (1.73)	5.71 (1.15)	5.63 (1.26)
6	5.21 (1.69)	5.23 (1.28)	5.20 (1.51)

**Mean significantly different from means for other classes ($p < 0.01$).*

ARE SPS IN LARGE CLASSROOM SETTING ENGAGING?

Students overwhelmingly accepted the SP format as engaging in a large lecture hall setting (Table 3, Item 1).

Figure 4

Table 3. Summary of Student Survey Responses (Classes of 2009, 2010 and 2011; n = 290) Regarding the use of Simulated Patients

Item	% (number) Disagree	% (number) Neutral	% (number) Agree
1	4.5 (13)	7.9 (23)	87.6 (254)
2	9.3 (27)	13.4 (39)	77.2 (224)
3	27.6 (80)	23.8 (69)	48.6 (141)
4	7.6 (22)	16.6 (48)	75.9 (220)
5	6.9 (20)	11.0 (32)	82.1 (238)
6	11.0 (32)	15.9 (46)	73.1 (212)

Students who had not yet entered the clinical phase of their training (Class of 2011) were especially inclined to report being engaged during the SP session with more than 90% identifying it as engaging and only 2% disagreeing. More than 80% of all students agreed that it would be helpful if more basic science courses incorporated the use of SPs (see Table 3, Item 5), whereas less than 7% disagreed. Most students (73%) reported that the use of more SPs in basic sciences courses would increase their desire to study (see Table 3, Item 6).

DO SPS HELP STUDENTS APPRECIATE THE CLINICAL IMPORTANCE OF A BASIC SCIENCE?

More than 75% of students felt that use of the SP helped them realize how important understanding the basic sciences is to the practice of medicine (see Table 3, Item 2), while less than 10% disagreed. Similarly, more than 75% of students agreed that use of the SP helped them appreciate the close relationship between basic and clinical sciences (see Table 3, Item 4), while less than 10% disagreed.

DISCUSSION

Prior to entering residency training programs, medical school graduates should have attained a fundamental level of clinical competence.[18] Leading medical educators advocate for greater integration of the basic sciences throughout medical school since the practice of medicine is dependent on a sound understanding of the biomedical sciences.[19]

At MWU/CCOM more biomedical science concepts are being incorporated into the clerkship phase of training; SP sessions are being used to introduce and integrate basic science concepts using clinical scenarios.

This is the first study to report the use of SPs in a large classroom to introduce basic science concepts using patient interviews to engage the students on the first day of medical school. The survey data from three classes of medical students who had a SP encounter on their first day of medical school (after two, three and four years of time had elapsed) indicate that students perceive the sessions as engaging experiences. In fact, the student responses support the incorporation of SP encounters into more basic science courses.

WHY DID THE CLASS OF 2011 RATE THE EXPERIENCE WITH THE HIGHEST ENGAGEMENT SCORE?

The SP experience (Mr Finlay in acute heart failure) for the Class of 2011 was different than for the other classes (Mrs Abraham experiencing an exacerbation of asthma). It is possible that the actor portraying the acute heart failure case was more realistic or the nature of the condition more interesting to the students as they may have never encountered someone in acute heart failure. It might be that the faculty, with two years of experience with this teaching method, created a more robust case, trained and coached the actor better, or interacted in a more engaging manner with the student body. It is also possible (and more likely in the

opinion of the authors) that since the students in the Class of 2011 had not yet started clerkship rotations, their more limited patient contact accounted for a more vivid recollection of the SP encounter.

WHY DIDN'T THE SP CAUSE THE CLASS OF 2011TO STUDY WITH SIGNIFICANTLY MORE INTEREST?

It seems, at first, curious that students in the class of 2011 were, on average, neutral regarding survey Item 3 (Figure 1). Theoretically, an engaging exercise (Item 1 in Figure 1) should cause students to study the pertinent basic science (Item 2) with more interest (Item 3). This apparent contradiction can, in our view, be resolved if one considers the nature of the selection process for medical students. We agree with Albanese[20] who said that "students admitted to medical school generally have demonstrated superlative achievement in lecture-based competitively graded courses." Such students fit well into a paradigm requiring more efficient training of medical students.[2] (Although they also likely make more challenging the development of clinical reasoning skills.[5, 20])

In our view, it is virtually impossible for such medical students not to be interested in studying acid-base or ATP metabolism in order to do as well as possible on their first medical school examination. We think such study would occur regardless of whether the first class session were engaging. A more important question is whether engaging sessions help to make all pertinent information more memorable and lead to a greater interest in life-long learning. To achieve the latter goals, we felt that it would be necessary first to increase the number of SP sessions and faculty involvement in them.

WHAT IMPACT HAVE THE SP ENCOUNTERS HAD AT MWU/CCOM?

On the first day of class since 2005, the Department of Biochemistry at MWU/CCOM has used an SP session. During the first two years, only the authors and the biochemistry course directors were involved in the planning and implementation of these sessions. Six years later the paradigm has shifted. A total of 20 thirty-minute SP sessions are planned for the biochemistry courses during the 2010-2011 academic year. All faculty in the Department of Biochemistry now participate in the development and delivery of SP sessions.

LIMITATIONS AND RECOMMENDATIONS

This study has clear limitations. It is based on self-reported survey data from one institution, and the response rate of the class of 2010 was low. Since this study involved only one SP encounter, its impact on course examination scores, national licensing examinations and clerkship performance was not assessed. Further study would be beneficial to examine the impact of SP encounters in large classrooms on student empathy levels,[21, 22] orientation to patient-centered care[23, 24] and potential to ameliorate academic burnout.[25]

CONCLUSIONS

Our experience with SP sessions in a large classroom setting affirms that they can be developed at a low cost. Based on survey data collected from students experiencing the SP sessions and increased faculty involvement in the development and delivery of the sessions over the past six years, the use of SPs in a large classroom setting enhances the learning process for students and faculty. As the basic sciences and clinical medicine become more deeply integrated, we encourage other medical school faculty to incorporate this approach of bringing clinical medicine into the basic science curriculum and vice versa. Further study of this curricular innovation will refine its utility.

References

1. AAMC Center for Workforce Studies (March 2010): Results of the 2009 Medical School Enrollment Survey. Retrieved June 19, 2010, from http://www.aamc.org/newsroom/presskits/09enrollmentsurvey.pdf
2. Bonaminio GA, Leapman SB, Norcini JJ, Patel RM, Elnicki DM: The Educational Realities of Increasing Class Size. Acad Med; 2008; 83: S101-104.
3. Kember D: A reconceptualisation of the research into university acamedics' conceptions of teaching. Learning and Instruction; 1997; 7: 255-275.
4. Light G, Cox R: Learning & Teaching in Higher Education: The Reflective Professional. Paul Chapman Publishing 2005
5. Ragan-Smith MG: Teachers' experiential learning about learning. International Journal of Psychiatry in Medicine; 1998; 28: 11-20.
6. Diemers AD, Dolmans DHJM, Verwijnen MGM, Heineman E, Scherpbier AJJA: Students' opinions about the effects of preclinical patient contacts on their learning. Advances in Health Science Education; 2008; 13: 633-647.
7. Bordage G, Zacks R: The structure of medical knowledge in the memories of medical students and general practitioners; categories and prototypes. Med Educ; 1984; 18: 406-416.
8. Barrows HS: An Overview of the Uses of Standardized patients for teaching and Evaluating Clinical Skills. Acad Med; 1993; 68: 443-451.
9. AMEE Medical Education Guide No. 13: Real patients, simulated patients and simulators in clinical examinations. Medical Teacher; 1998; 20: 508-521.

10. Petrusa ER: Status of Standardized Patient Assessment. Taking Standardized Patient-Based Examinations to the next Level. Teaching and Learning in Medicine; 2004; 16: 98-110.
11. Becker KL, Rose LE, Berg JB, Park H, Shatzer JH: The Teaching Effectiveness of Standardize Patients. Journal of Nursing Education; 2006; 45: 103-111.
12. Austin Z, Gregory P, Tabak D: Simulated Patients vs. Standardized Patients in Objective Structured Clinical Examinations. Amer J Pharm Educ; 2006; 70: Article119: 1-7.
13. Damassa DA, Sitko TD: Simulation Technologies in Higher Education: Uses, Trends, and Implications. ECAR Research Bulletin; 2010; 3: 1-12.
14. Okuda Y, Bryson EO, DeMaria S, Jacobson L, Quinones J, Shen B, Levine AI: The utility of Simulation in Medical Education: What is the Evidence? Mount Sinai Journal of Medicine; 2009; 76: 330-343.
15. McGuire C: Perspectives in Assessment. Acad Med; 1993; 68: S3-8.
16. Nirndorf CA, Kaye ME: Teaching the Mental Status Examination to Medical Students by using a Standardized Patient in a Large Group Setting. Acad Psych; 2002; 26: 180-183.
17. Sefcik D, Van Winkle LJ: Motivating students to attend basic science lectures. Acad Med; in press.
18. Gottere GS, Petrusa ER, Gabbe SG, Miller BM: A Program to Enhance Competence in Clinical Transaction Skills. Acad Med; 2009; 84: 838-843.
19. AAMC Report IV: Contemporary Issues in Medicine: Basic Science and Clinical Research. August 2001
20. Albanese M: Problem-based learning: why curricula are likely to show little effect on knowledge and clinical skills. Med Ed; 2000; 34: 729-738.
21. Newton, B.W., Barber, L., Clardy, J., Cleveland, E., & O'Sullivan, P: Is there hardening of the heart in medical school? Acad Med; 2008; 83: 244-249.
22. Hojat, M., Vergare, M.J., Maxwell, K., Brainard, G., Herrine, S.K., Isenberg, G.A., Veloski, J., & Gonnella, J.S: The devil is in the third year: a longitudinal study of erosion of empathy in medical school. Acad Med; 2009; 84: 1182-1191.
23. Ogur, B., Hirsh, D., Krupat, E. & Bor, D: The Harvard Medical School – Cambridge integrated clerkship: an innovative model of clinical education. Acad Med; 2007; 82: 397-404.
24. Krupat, E., Pelletier, S., Alexander, E.K., Hirsh, D., Ogur, B. & Schwartzstein, R: Can changes in the principal clinical year prevent the erosion of students' patient-centered beliefs? Acad Med; 2009; 84: 582-586.
25. Dyrbye, L.N., Thomas, M.R., Power, D.V., Durning S., Moutier, C., Massie, F.S., Harper, W., Eacker, A., Szydlo, D.W., Sloan, J.A. & Shanafelt, T.D: Burnout and serious thoughts of dropping out of medical school: a multi-institutional study. Acad Med; 2010; 85: 94-102.

Author Information

Lon J. Van Winkle, PhD
Professor and Chair of Biochemistry, Midwestern University

Donald Sefcik, DO, MBA, MS
Professor, Department of Family and Community Medicine, Michigan State University College of Osteopathic Medicine