

INSTRUCTIONAL DESIGN AND ASSESSMENT

Teaching Electrocardiogram Basics Using Dance and Movement

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Objective. To implement and assess an innovative approach to teaching electrocardiogram (ECG) rhythms using dance and movement.

Design. Recognition of ECG rhythms was taught to a group of third-year pharmacy students using dance and movement via collaboration with a dance faculty member. A control group was taught using traditional pharmacy lecture and PowerPoint slides.

Assessment. A pretest and posttest were administered to both groups. There was a trend in test score improvement in the dance and movement group. After the sessions, a focus group was held to assess student perceptions using qualitative methods. Students thought the addition of dance helped them with speed of retention and recognition of ECG rhythms. Some students reported feeling out of their comfort zone.

Conclusion. Interprofessional collaboration between pharmacy and dance faculty members resulted in an innovative teaching methodology for ECG rhythms that increased test scores.

Keywords: interprofessional, collaboration, methodology, dance, electrocardiogram

INTRODUCTION

As educators, we should constantly strive to create a high-quality learning environment that is stimulating and creative for students and faculty members alike. Faculty members who have been teaching for 20+ years, may actually have taught only the first year and then repeated it 19 times. Asking faculty members to change and pursue different approaches to teaching and learning can be time consuming and difficult and require an outside perspective as they strive to address a variety of learning styles, many of which are different from their own.

Collaborative inquiry can be a useful tool for stimulating such change. Utilizing an interdisciplinary faculty approach for designing educational experiences can provide a rich learning environment that leads to a diversity of ideas. Such collaboration can also give perspective as well as insight as to how interdisciplinary teams can function. Good learning experiences can stimulate personal and professional growth.¹

In our pursuit to enhance student learning and embrace varying learning styles, as well as increasing our knowledge of teaching methodologies, faculty members at Bernard J.

Dunn School of Pharmacy pursued an interprofessional collaborative alliance² with School of Arts and Sciences dance faculty members at Shenandoah University. The School of Pharmacy already had a successful model for teaching electrocardiogram (ECG) recognition. The curriculum involved students sitting passively for many hours in a darkened room watching PowerPoint presentations. Pharmacy faculty members wanted to invigorate and vary teaching styles, increase test scores, and offer students the opportunity to literally move out of their seats.

The instruction design faculty member hypothesized that utilizing dance could be fun, creative, and strengthen ties to the University's internationally recognized dance faculty. No such collaboration had taken place on campus between disciplines prior to this time, nor could we find any previous documented study in the literature of utilizing dance and movement to increase knowledge retention among pharmacy students. Pursuing collaborative innovative teaching and instruction design was a concept supported by the Accreditation Council for Pharmacy Education's (ACPE's) competencies,³ Shenandoah's University-wide mission statement,⁴ and the Bernard J. Dunn School of Pharmacy's basic tenets,⁵ as well as faculty members' individual teaching philosophies. Specifically, the creation and assessment of this teaching and learning process was supported by ACPE Standard No. 12, which states that "Attention should be given to teaching efficiencies and effectiveness as well as innovative ways and means of curricular delivery...to meet the

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needs of diverse learners.”³ Standard 14, Guideline 14.1 supports experimental and innovative approaches taking place continuously being “adequately planned and coupled with an appropriate evaluation system.”

The use of dance as an innovative teaching methodology for enhancing retention of knowledge is documented in the literature. Thinking is a motor act that uses motor neurons in the motor cortex of the brain which are directly connected to the muscles of the body.⁶ When the body experiences movement there is remembrance in our muscles. As Catterall explains: “Experiences reorganize neural pathways, neural receptors, and functioning of specific brain regions such that subsequent experiences are received differently, at levels ranging from trivial or behaviorally undetectable to profound and exceedingly apparent.”⁷ Using movement to learn information activates neurons in our bodies and through repetition the neurons remember the movement due to a phenomenon called *muscle memory*. Thus, movement can be correlated with visual and auditory learning methods to enhance retention of material. Triggered neural impulses travel paths through specific regions of the brain—those involved with cognition, memory, feeling, value, and autonomous response.⁷ With repetition, the neurons will recognize how information is stored and retrieved.

Not only do movement and sensory awareness patterns help us communicate and understand our non-verbal world, but according to the National Standards for Arts Education, the art is the educational experience. Regardless of a student’s background, talents, or disabilities: “In an increasingly technological environment overloaded with sensory data, the ability to perceive, interpret, understand, and evaluate such stimuli is critical. The arts help all students to develop multiple capabilities for understanding and deciphering an image- and symbol-laden world.”⁸ Based on both scientific and artistic approaches,⁶⁻⁹ an ECG/movement experiential laboratory was implemented to evaluate how the learning of cognitive material can be enhanced and enriched through the use of kinesthetic learning tools.

DESIGN

This project prospectively used qualitative and quantitative research methodologies. Institutional review board (IRB) approval was obtained prior to beginning the study.

ECG recognition was taught in the second semester of the second year of the PharmD program as part of a Standardized Patient Assessment (SPA) laboratory course. The purpose of the ECG laboratory session was to help students:

- Identify ECG parameters that describe atrial depolarization, ventricular depolarization, and ventricular repolarization;

- Differentiate between the various types of atrial and ventricular arrhythmias in terms of clinical characteristics and clinical presentation;
- Visually identify, given an ECG, cardiac rhythms encountered in the patient care setting: normal sinus rhythm, bradycardia, tachycardia, atrial flutter, atrial fibrillation, ventricular tachycardia, ventricular fibrillation, Torsades de Pointes, and asystole.

Two face-to-face planning meetings took place between pharmacy and dance faculty members to collaborate on the laboratory session prior to study initiation. Researchers selected 9 electrocardiogram (ECG) rhythms to teach during each 2-hour laboratory session. Pharmacy faculty members provided the dance faculty members with basic information regarding ECG interpretation and PowerPoint slides depicting each rhythm.

The ECG laboratory session was taught the semester following the cardiovascular didactic course. Although we had access to a large dance studio with balance bars and full wall mirrors to teach the dance and movement intervention, we chose to use the familiar setting of the SPA laboratory for 3 reasons: (1) to provide easy access for the pharmacy students whose schedules made it inconvenient for them to travel to the main campus where the dance conservatory was located; (2) to provide a familiar environment for the pharmacy students to participate in interpretive dance and avoid the possible distractions that wall-to-wall mirrors may have caused; and (3) to help the dance faculty members teach the exercise/session from the pharmacy students’ point of view by first becoming familiar with the students’ learning environment.

For the 2-year study, third-year pharmacy students were randomly placed in 1 of 2 laboratory sections for their Standardized Patient Assessment (SPA) course. The ECG laboratory sessions with the dance and movement intervention were co-taught by dance and pharmacy faculty members. The pharmacy faculty members introduced each ECG rhythm, discussed the major distinguishing characteristics used for interpretation of each rhythm, and provided visual examples of each ECG using PowerPoint slides. The dance faculty members subsequently introduced the concept of muscle memory and rhythm interpretation, as well as a general introduction to the basic elements of space and time as defined through movement. These specific elements were chosen by the dance faculty members because of the relationship of space and time to the visual design and rhythmic patterns of the ECG rhythms. During this discussion, the entire laboratory section practiced basic dance movements to varying rhythm patterns that reflected the graphic patterns

depicted on ECGs. The exercise was unaccompanied (no music) so that students would be able to develop a sense of the rhythmic phrasing of the heartbeat. As an entire group, students created dance movement to ECG rhythms. Students in the laboratory section then experienced these elements through movement improvisation as directed through verbal cues from the dance faculty members. The elements explored included: *pathways* (straight and curvy); *levels* (high, middle, low); *shape* (round and angular); *tempo* (fast and slow); *size* (big and small); and basic *rhythmic patterns*. Students were then divided into small groups and assigned an ECG rhythm. As a group they were asked to create a pattern of movement employing those elements that best represented the rhythmic phrasing and visual design of the ECG rhythm. All students in each group were required to participate in presenting the group's ECG rhythm to the class.

Recall was accomplished by having 9 pharmacy students demonstrate their own interpretation of the ECG rhythm while a PowerPoint slide of the graphic version was shown to the class. Further reinforcement of the material took place when pharmacy students demonstrated a particular ECG rhythm through dance and movement and fellow students were required to name the rhythm.

For the control arm of the study, the laboratory session was taught via traditional lecture style without dance intervention. One pharmacy faculty member taught the 9 ECG rhythms by lecture accompanied by PowerPoint slides. The PowerPoint slides were identical to the slides utilized in the dance and movement group and were repeated several times in order to mimic the same timeframe and repetition that occurred in the main study arm.

In an attempt to maintain the integrity of the study, minimal changes were made between the 2 years of the study. Since the original dance faculty member was not available to teach in the second year of the study, a more senior dance faculty member facilitated the dance movements.

EVALUATION AND ASSESSMENT

A 9-item EKG recognition test was created to serve as a pretest and posttest for the study. The pretest was administered during a laboratory session prior to teaching the ECG material. A posttest, identical to the pretest, was administered to each study group approximately 2 weeks after the conclusion of the laboratory to assess long-term retention of the ECG material. The pretest and posttest scores from both years were combined to create an overall pretest and posttest mean score. Statistical analysis was performed using SPSS, version 15 (SPSS, Inc., Chicago, IL) and a *t* test was used to compare pretest and posttest scores between the 2 study arms.

Regarding a comparison of the students between the 2 years, there were no changes in terms of demographics, incoming grade point averages (GPAs), or testing criteria that would suggest an influence in the outcomes of this study. As to preconceived ideas about the class, none of the students entering the study in the second year expressed a pre-knowledge of the dance methodology that had been used to teach ECG rhythms the previous year.

Focus groups of 10 randomly selected students met to discuss a semi-structured interview at the conclusion of each laboratory session. A transcript of the discussion was created and sent to all participants. All participants reported the transcript was accurate as recorded. Conclusions drawn from the qualitative data by the researchers were verified by the participants.

One hundred thirty-nine third-year pharmacy students participated in this study, as well as 2 pharmacy faculty members, 2 dance faculty members, and 1 graduate student in dance. There were 71 students in the intervention arm of the study and 68 students in the control arm. The mean score on the pretest for students (both years combined) in the control arm were 3.5 ± 1.8 (35%) versus 3.4 ± 1.5 (34%) for students in the intervention arm; $p = 0.672$.

When comparing test scores 2 weeks after class between the movement section and the traditionally taught section, there was a strong trend toward improved test scores in the movement section for both years combined, with the movement section earning a mean percentage of 73% versus 67% in the traditionally taught section; $p = 0.054$. All scores for both years are presented in Table 1.

Three major themes were identified from the qualitative assessment of students in the dance intervention groups: (1) strong student engagement; (2) a sense of enjoyment with a novel way of learning and the opportunity to get up and move; and (3) an appreciation of collaboration between pharmacy and dance faculty members. Students in the intervention group stated they enjoyed the experience and were glad to have a different and creative way of having the material presented. They also thought this was a good way to learn despite the fact that some felt they were out of their comfort zone in having to create or mimic dance movements. Specific themes were the following: the repetition was helpful; the pedagogical technique was novel; participation via movement was fun and helpful although different from all other experiences; they felt "too uptight" to "let themselves go" for full enjoyment of the experience.

Qualitative data include insightful quotes from students, such as: "It was fun. We were nervous, in a weird funny way. For learning, exercising is much better versus lecture." One student expressed the sentiment of many of

Table 1. Comparison of Test Scores Between Pharmacy Students Who Were Taught Electrocardiogram Rhythms Either in a Class Using Dance Movements or a Class Using Traditional Teaching Methods

| Variable | Section Taught Using Dance Movements (n=71), No. (SD) | Section Taught Using Traditional Teaching Methods (n=68), No. (SD) | P |
|-----------------------|-------------------------------------------------------|--------------------------------------------------------------------|-------|
| Pretest ^a | | | |
| Year 1 | 3.8 (1.7) | 3.6 (1.9) | 0.568 |
| Year 2 | 2.9 (1.1) | 3.4 (1.7) | 0.153 |
| Both years combined | 3.4 (1.5) | 3.5 (1.8) | 0.672 |
| Posttest ^b | | | |
| Year 1 | 7.2 (1.5) | 6.4 (2.0) | 0.066 |
| Year 2 | 7.4 (1.9) | 6.9 (2.0) | 0.354 |
| Both years combined | 7.3 (1.7) | 6.7 (2.0) | 0.054 |

^aPossible points out of 10

^bPossible points out of 10

the students about the dance exercises when he stated, “There was no comparison with what we did today in laboratory with what we usually do. With 60 slides, you just can’t get anything. You just go brain dead.”

Themes identified from qualitative data for students in the control group were that the material was presented in a logical and methodical manner, and because the faculty member was a well-established authority on the topic and practiced regularly in the clinical setting, they had full confidence in the way the session was taught and the accuracy of the presentation.

Qualitative outcomes with the pharmacy and dance faculty members who participated in the collaboration indicated a sense of novelty, enjoyment, and appreciation for the knowledge and skills that each discipline had. Collaboration between faculties of different disciplines was more time consuming than presenting the material in the traditional manner, but certainly stimulating for those involved as well as for the students. Faculty members reported no barriers to communication other than heavy workloads and identifying time to meet.

DISCUSSION

As students express growing concern over the demand for them to learn more in less time, coupled with faculty members feeling pressured to race through information in a 50-minute timeframe, it is imperative that our curriculum design encompass learning environments that are engaging and result in outcomes that ensure long-term retention of material. Numerous adult educators have underscored the fundamental role that experience plays in learning.¹⁰⁻¹⁴ This particular collaborative and innovative teaching strategy harnessed the active role and experience that the students play, literally, in interpreting the rhythms of ECG in a collaborative group effort. They did this individually and as a group by moving in the ECG rhythm patterns.

A comparison between the 2 groups demonstrated a strong trend toward improved test scores in the groups that utilized dance and movement to teach ECG rhythms. Although the difference was not significant, the positive outcomes of interdisciplinary collaboration and affirming qualitative data have led us to embrace and explore additional innovative ways of teaching.

In terms of qualitative measures, some student’s self-reported being out of their comfort zone. Nevertheless, the majority of students enjoyed the experience and indicated that the dance helped with their speed of retention and recall of recognition of EKG rhythms. Faculty also indicated benefits from participating. Interdisciplinary collaboration fostered a greater appreciation of the skills and knowledge from both disciplines. Both faculty and students appreciated the creation of an innovative, fun, and productive teaching methodology. It created an unexpected curiosity and interest among passers by who heard the laughter and enjoyed seeing the activity.

We learned several lessons during this experience. The laboratory session was easier to schedule and conduct in the second year of the study because a sense of trust and collaboration already had been established among faculty members of the 2 disciplines in the first year. We also introduced an element of uncertainty in each session because faculty members from outside the discipline of pharmacy brought different teaching techniques that were foreign to the pharmacy students. We also found that students who took the course the first year did not talk about the dance exercise with students who took the class the following year; thus, students who participated the second year had no preconceptions about the laboratory experience.

There were several limitations to this study. Physical distance between the faculty members involved in the research inhibited planning of the methodology and led

to underutilization of faculty members' expertises. The pharmacy classroom was not as conducive to dance movements as the dance studio because there was less open space. Student self-consciousness may have led to a decrease in enjoyment and/or ability to take full advantage of the learning opportunity. Possible student bias to support the 2 well-known pharmacy faculty members with the innovative teaching strategy may have contributed to positive reporting of the experience.

SUMMARY

In a collaborative teaching effort between pharmacy and dance faculty members, an innovative teaching methodology was used to evaluate the impact of movement on pharmacy students' retention of ECG recognition. A pre-test and posttest were administered to participants and to students in a control group, and a trend toward test score improvement was identified in the dance and movement group. After the sessions, a focus group was held to assess student perceptions. Students thought the addition of dance helped them with speed of retention and recognition of ECG rhythms. This collaboration enabled our students to be active learners while interacting in an innovative, vibrant environment; thus, a commitment to interdisciplinary collaboration should be continued, valued, and encouraged.

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