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Abstract

Context: When authentic clinical experiences are unavailable, instructors may need to consider alternatives for evaluating clinical reasoning. Objective: Describe an educational technique that simulates clinical experiences to allow students to demonstrate clinical reasoning. Background: The COVID-19 pandemic created a situation where providing clinical experiences became impossible. Yet, students still needed to exercise clinical judgement as part of their athletic training education program. The unfolding case study technique aligns well with Kolb's Theory of Experiential Learning and can be used to help students improve clinical reasoning and critical thinking skills. Description: An unfolding case study was used to simulate a clinical experience for students when clinical sites became unavailable to students due to COVID-19. The technique involves using a case study over time where the student receives information, evaluates the information, makes a clinical decision in response to the information, and receives further information and feedback based on their decision. This repeats until the student reaches the conclusion of the case. Clinical Advantages: Students found this assignment to be beneficial as it allowed them to practice clinical reasoning and critical thinking in a realistic, yet low risk environment. Students were able to learn new skills in documentation and billing for services. The assignment allows for critical feedback to be given to the students at multiple points. Conclusions: The unfolding case study can be an effective substitute for a clinical experience in extreme situations. The unfolding case study allows students to exercise clinical judgement in a safe environment.

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ABSTRACT
Context: When authentic clinical experiences are unavailable, instructors may need to consider alternatives for evaluating clinical reasoning. **Objective**: Describe an educational technique that simulates clinical experiences to allow students to demonstrate clinical reasoning. **Background**: The COVID-19 pandemic created a situation where providing clinical experiences became impossible. Yet, students still needed to exercise clinical judgement as part of their athletic training education program. The unfolding case study technique aligns well with Kolb's Theory of Experiential Learning and can be used to help students improve clinical reasoning and critical thinking skills. **Description**: An unfolding case study was used to simulate a clinical experience for students when clinical sites became unavailable to students due to COVID-19. The technique involves using a case study over time where the student receives information, evaluates the information, makes a clinical decision in response to the information, and receives further information and feedback based on their decision. This repeats until the student reaches the conclusion of the case. **Clinical Advantages:** Students found this assignment to be beneficial as it allowed them to practice clinical reasoning and critical thinking in a realistic, yet low risk environment. Students were able to learn new skills in documentation and billing for services. The assignment allows for critical feedback to be given to the students at multiple points. **Conclusions:** The unfolding case study can be an effective substitute for a clinical experience in extreme situations. The unfolding case study allows students to exercise clinical judgement in a safe environment.

Key Words: simulation, clinical education, critical thinking, problem-based learning

Key Points:

- Unfolding case studies can simulate clinical experiences
- Unfolding case studies can be used to help students improve clinical reasoning
- Unfolding case studies can be used to teach new skills

INTRODUCTION

Athletic training clinical education is used to provide real world experiences to students so they can apply what they have learned to patients in a controlled situation.[1-3] During the clinical experience, students are expected to gain confidence in their clinical knowledge and improve their clinical decision making.[4] In the context of Bloom's taxonomy, clinical experiences allow students to analyze a situation and apply their knowledge.[5-6] Clinical education gives the opportunity for active learning and applying new knowledge to solve a problem.[7] Athletic training uses a clinical education model to help improve critical thinking and clinical reasoning.[8-9] Unfortunately in some situations, such as during the COVID-19 pandemic, direct patient care experiences are not possible. During the spring semester of the 2019-2020 school year, many educators, including ourselves, were forced to move to online/virtual learning. Therefore, the goal of this educational technique paper is to share our experience converting a face-to-face simulated clinical assignment to a simulated online learning experience.

ASSIGNMENT DESCRIPTION AND PURPOSE

During normal, face-to-face learning experiences, students at a mid-sized, mid-western regional university take a clinical lab course during the spring semester of their 3rd year in the program. These students have previously taken courses in rehabilitation, modalities and two courses in orthopedic evaluation. They have also completed a minimum of 235 hours of clinical education by this time. During the face-to-face course, students complete a project that includes evaluation and treatment of an in-person patient case. Unfortunately, the face-to-face component of this assignment became impossible during the Spring 2020 semester due to the COVID-19 pandemic. Therefore, the assignment had to be adapted to meet the same objectives with different circumstances.

To simulate the face-to-face, hands-on learning experience we used an unfolding case study format. Glendon and Ulrach stated "An unfolding case study is an adaptation of a traditional case study that goes a step further to allow the application of the knowledge, skills, and attitudes required in a clinical setting that simulates real world events." [8(p 244)] The unfolding case study is much like a standard case study, but the learner is engaged over a period of time and does not get all of the information at once.[8,10-12] An unfolding case study can be much like a simulated patient and can be just as unpredictable for the learner, which forces them to use their clinical judgement.[13] In an unfolding case study, students are provided with some of the data that you would expect in a standard case study, but after being given that information the student has to make clinical decisions.[14] Once they have made these decisions, the students receive more information in reaction to the decision(s) that they made.[13-14] Case studies, whether scripted, unscripted, reverse, or unfolding, should be well-structured and realistic. Case studies should compel the student to engage in clinical reasoning and critical thinking. [12] These simulated experiences should mimic the clinical environment to provide a modicum of realism while allowing the student to practice clinical reasoning in a safe environment.[9-10]

Table 1. 2020 Commission on Accreditation of Athletic Training Education (CAATE) Standards Addressed by the Project

Standard 58 Incorporate patient education and self-care programs to engage patients and their families and friends to participate in their care and recovery.
Standard 59 Communicate effectively and appropriately with clients/patients, family members, coaches, administrators, other health care professionals, consumers, payors, policy makers, and others.
Standard 62 Provide athletic training services in a manner that uses evidence to inform practice.
Standard 65 Practice in a manner that is congruent with the ethical standards of the profession.
Standard 69 Develop a care plan for each patient.
Standard 71 Perform an examination to formulate a diagnosis and plan of care for patients with health conditions commonly seen in athletic training practice. Evaluating all results to determine a plan of care, including referral to the appropriate provider when indicated
Standard 73 Select and incorporate interventions (for pre-op patients, post-op patients, and patients with nonsurgical conditions) that align with the care plan.
Standard 89 Use a comprehensive patient-file management system (including diagnostic and procedural codes) for documentation of patient care and health insurance management.

The goal of this assignment was to simulate the experience of a student working in a rehabilitation clinic to employ their skills to treat a patient over time and to properly document and bill the services rendered at each visit. In addition, the assignment helps

address several Commission on Accreditation of Athletic Training Education standards (Table 1). Students worked individually and five clinic visits were simulated via email with the instructor. Students informed the instructor of which body part they wanted their project to focus on via an email which included the patient reported outcomes measure (PROM) and patient history questionnaire (PHQ) forms they wanted to use. The instructor then responded via email by creating a diagnosis appropriate to the chosen body part, filling out the PROM, PHQ, and providing the initial subjective complaints of the patient. The students then provided the instructor with any further questions that they had for the patient and a list describing the objective assessment procedures that they would use to evaluate their patient via email. The instructor then responded with an email that provided the student clinician with the results of the assessment as well as answers to any of the new questions that they asked the patient. The students then created their initial evaluation note, a video of themselves teaching the home exercise program (HEP) and filled out a "superbill" sheet using Current Procedural Technology (CPT) codes. The students had to estimate how much time they would have spent treating their patient and provide the appropriate number of units for the correct CPT code. After emailing this to the instructor, the instructor provided the student with the subjective information for their next visit that was based on the information in the initial note and their HEP video. The project components and deadlines are listed in Table 2.

Table 2. Project Calendar

Date	Expectations
Day 1	Chosen body part, PROM[a], patient history form to Instructor
Day 2	Diagnosis, completed PROM and history forms to students
Day 9	Initial evaluation, billing, HEP[b] demonstration video to instructor
Day 10	New subjective information and feedback on note and billing to students
Day 12	SOAP[c] note 1 and billing to instructor
Day 13	New subjective information and feedback to students
Day 16	Update note to physician and billing to instructor
Day 17	New subjective information and feedback to students
Day 20	SOAP note 2, second PROM form and billing to instructor
Day 21	New subjective, completed PROM, and feedback to students
Day 28	D/C[d] note and billing to instructor

[a] PROM = Patient Reported Outcomes Measure;
[b] HEP= Home Exercise Program
[c] Subjective Objective Assessment Plan
[d] D/C = Discontinuation

For the second note, students took the new subjective information that was given to them and had the opportunity to ask further questions based on the information they received. Students also provided the instructor with the objective evaluation they would perform. The instructor then provided the results of the objective evaluation to the students. The students then used this information to create a SOAP (subjective, objective, assessment, plan) note and fill out a billing sheet using the proper CPT codes and the correct number of units. The students each received feedback and a new subjective information after turning in this note. This process continued for a total of five visits with the students documenting the proper note type and billing for each visit. The students provided an update note to the physician after the third visit and a discontinuation note after the fifth visit.

At each step in the assignment, the instructor provided feedback on the quality of their documentation and billing. For example, on one student's SOAP note, the instructor commented: "Look for swelling, edema, heat, patellar position, and mobility. Compare both sides. Ask which leg is the dominant leg." One example of a patient case was with a student who expressed interest in baseball and indicated that they wanted to work on the shoulder. The student was given a diagnosis of rotator cuff tendinopathy for his patient. During his initial evaluation he did not test for any neurological deficits that may be involved in the injury. He was given this feedback and he checked this at his next visit. Later in the simulation, the student was given the information that he had achieved some of his short-term goals, but he did not update and change his short-term goals in his note for the fourth visit. He corrected this in his next note. In this same case the student would bill one unit of massage (CPT 97124) for trigger point massage and strain-counterstrain treatments instead of manual therapy techniques (CPT 97140). Once the student was made aware that for maximum billing potential, it is better to bill the manual therapy techniques code instead of the massage code due to increased value for the manual therapy code as well as increased opportunity for payment from a third-party biller, he corrected this in his billing. This student's update letter to the physician did not contain any new objective measurements. He received feedback that he should have re-measured pec minor length and rotator cuff strength and reported improvement or lack of improvement in the not to the physician. He was allowed to make this correction in his note and re-submit the note. Feedback like this was given on each note throughout the project.

OUTCOMES

As a regular part of the class, students fill out pre- and post-class surveys to provide informal feedback for quality improvement in the course. Additionally, students responded to a pre-project survey before starting the virtual experience to provide further informal feedback on the experience. Responses from these informal surveys are provided to give context of the experience from the student perspective (Table 3) The surveys consisted of Likert scale questions which ask the students about their perceived level of confidence when performing general and specific skills used by athletic trainers ranging from 1=Not confident to 4=Very confident. The survey also contained open-ended questions for students to provide additional detail about their experiences with the project and class. Seven students answered survey questions about their confidence in their abilities at all three evaluation points (pre-course, pre-project, post-course). Since these surveys were a part of the class and not a research study, the principal author's university Institutional Review Board (IRB) did not deem this research; therefore, no IRB review was required.

Table 3. Survey Responses

	What is your confidence level in developing and implementing a rehabilitation program for the upper extremity?	What is your confidence level in the set up and usage of manual therapy modalities (Trigger Point Massage, Soft tissue mobilization, Myofascial Release, Joint Mobilization, strain-counterstrain, muscle energy)?	What is confidence level in performing patient education and communicating with patients in general?	What is your confidence level in documenting patient progress so that others will understand what is happening with patients?	What is your confidence level in filling out medical forms and other forms for billing services?
Pre-course					
Mean	1.67	1.83	2.33	2.17	1
Median	2	2	2	2	1
Pre-project					
Mean	2.71	2.86	2.43	2.14	1.14
Median	3	3	2	2	1
Change (%)	25%	26%	2.50%	0.00%	3.50%
Post-course					
Mean	2.83	3.17	2.83	3.17	2.17
Median	3	3.5	3	3	2
Change (%)	3%	7.75%	10%	25.75%	26%
Pre-course to Post- course change (%)	29%	33.75%	12.50%	25.75%	29.50%

Pre-Course Perceptions

Prior to taking the class students indicated they were not confident in their abilities to perform billing, communication/documentation, and rehabilitation skills. All seven students indicated that they were not confident regarding the process for billing, and they were only somewhat confident in their abilities to properly communicate with patients and provide appropriate documentation. They also doubted their ability to make clinical decisions. Six out of seven students indicated that clinical decision making was also a weakness (Table 3). Answers to open-ended questions corroborated students were lacking confidence in clinical reasoning. One student stated: "I need more practice," while another said: "I need to work on determining what all my findings mean and creating my plan from that information."

Twelve weeks into the semester, but prior to starting the project, students were still insecure about their ability to properly bill for their services and communicate/document appropriately. There was reported improved confidence in their clinical decision-making abilities, but they still recognized a need for further improvement (Table 3). In open-ended responses, one student stated: "I have

mostly improved in my understanding how everything can [in the kinetic chain] be connected to cause an injury." Another student said:

> I believe that I am more confident now in my abilities than I was before. I do think there are still areas that I need to improve on before I am truly ready to say that I am one hundred percent confident in my skills.

Post-Project Perceptions

The students reported a 29.5% increase in confidence in their ability to properly bill for services from the class, with the greatest increase in confidence (26%) occurring after completing the project. From the start of the project to the end of the class, students reported increased confidence in documentation skills (25.75%) and communication skills with patients (10%). Students even reported a small increase in their confidence in applying manual therapy techniques (7.75%) (Table 3). Answers to open ended questions corroborated these scores. One student said: "I had no knowledge prior to this project, but now I am a little more comfortable with billing." Another stated:

> I feel that my documentation and billing sheet abilities have definitely improved throughout the project. Also, even [though] we could not work on in person, I feel that I improved my knowledge how to make rehab plan and progress it.

A third student also commented on their improved comfort with documentation:

> The whole process to write update notes to physicians, including billing sheet was helpful and more realistic for my future as [an] Athletic Trainer. The abilities to document and think critically improved through this project.

Students also expressed increased confidence in their clinical decision-making skills. One student said:

> "This project has helped with problem solving skills and helped me show where I need to improve with that."

Another stated:

> Through this project, I developed my evaluation abilities by thinking more about why and how. Also, I was able to think more about the biomechanics of activities and apply them to make progression.

When asked to reflect on the most beneficial aspects of the course, half of the respondents to the post-project survey felt the project was the most helpful part of the class. One student said:

> "I personally got more confident through the project because it is closer to the actual situation. [The] project summed up and brought together the things we have learned in the class."

Another stated:

> "The treatment project was the most helpful even though it was online and would have been more helpful if it was in class. Because [the project] allowed us to practice on real issues that people had."

Even though the project was online it appeared to be beneficial for students, as one student commented:

> "The treatment project was most helpful even thought it was online."

Lastly, a student summarized their perceived benefit of the project:

> Classes were helpful in understanding and learning the concepts better. However, I personally got more confident through the project because it is closer to the actual situation. [The] project summed up and brought together the things we have learned in the class.

CLINICAL ADVANTAGES AND DISADVANTAGES

Advantages

There are several advantages to using an unfolding case study to simulate a clinical experience. One of those advantages is it allows the instructor to control and manipulate the clinical simulation opportunity. It allows the instructor to appropriately challenge students while ensuring that learning objectives are met. An unfolding case study, such as this project, allows the instructor many opportunities to give feedback to the students. Lastly, students are forced to make clinical decisions, but without an actual patient the environment is low-risk and may help develop students' confidence in their skills. Instructors may consider using this type of project to better prepare students for actual patient care interactions. Additionally, the unfolding case study can be used during face-to-face or virtual learning.

Disadvantages

Unfortunately, there are also some disadvantages to this project. For example, using an unfolding case study in this manner to replace a clinical experience provides no "hands on" experience to practice clinical skills for the students. This was noted by one student who said: "I think that I need to [do] hands on things and more practice so that I can actually feel what I am doing and how I should feel." Another student stated, "Since it was online, sometimes I felt that it was difficult to work on it [the project]."

Another downside to this technique is that there is no-real time feedback from an actual patient. It is difficult for students to gain an idea of how patients react to their treatment without actually working on a patient. In lieu of patient feedback, the instructor must provide patient information and serve as the mock patient, which is time intensive. As the mock patient for all seven students, responses to each student and grading took approximately 30-45 minutes for each simulated visit; therefore, the instructor spent five to six hours per week for each week during this four-week project. Giving that much feedback and information to students over such a short period of time can be difficult and may preclude an instructor from using this technique in this manner with a medium to large class. Instructors could reduce the time demands of the assignment by integrating peer learning, where classmates could complete outcome measures and provide feedback on project components for each other.

STRATEGIES FOR IMPLEMENTATION

The unfolding case study can be useful to provide a clinical experience in a low-risk environment.[12] It is a method for measuring learning over time and can be adapted to any level of student.[10,12] In this particular situation, the unfolding case study allowed the instructor an excellent avenue to provide the students with an educational experience similar to that of a face-to-face clinical experience. It allowed the students to make clinical decisions and react to those decisions when given feedback from the instructor and it occurred in a safe environment. While this pedagogical technique was use online to deal with the COVID pandemic shut down, it can be used in many ways in the face-to-face classroom environment. Many of the same elements of the assignment can be used in a face-to-face environment, including the written assignment components (documentation, billing) and instructor feedback. The in-person environment would provide the additional benefit of having an actual or simulated patient available for hands-on application.

Whether online or in-person, the unfolding case study can be used for individuals or group projects. For an individual project in a class, this will be labor intensive for the instructor; therefore, this may not be the best solution for a large class. Instructors may consider an unfolding case study as a group project in larger classes, where the work is done over one or multiple class sessions. As an active learning strategy for small groups in class, unfolding case studies could be spread out over a semester adding new facets to the case as learning increases. A project such as this can be used as a formative assessment or turned into a summative assessment by having the groups make a formal presentation at the end of class. The instructor can vary the complexity of the case to meet the level of the student by making it more complex for advanced students and simpler for novice students.

The instructor could also modify the project into or in conjunction with a reverse case study and student groups could act as the simulated patient. Small groups could do a reverse case study and then the instructor can redistribute the cases created by the small groups to perform an unfolding case study where the groups must interact with each other to complete their cases. An instructor could take a case study and go section by section in a note or through an entire case to allow for more feedback or an instructor could use any combination of the strategies listed previously. It may be important to bear in mind that students who have poor time management skills may find this a difficult mode of learning. Students who wait until the last minute to do work often do not fare well if the unfolding case study is used as a summative assessment.[9] The course instructor should consider scaffolding the assignment to facilitate timely completion of the case study components if it is to be used as a summative assessment.

Additional modifications to this assignment could be used to increase the fidelity, or realism, of the simulated patient interaction. For example, the instructor could add a mock telemedicine evaluation or rehabilitation visit. This would be particularly beneficial if the students are paired and one acts as a mock patient, and the instructor could evaluate their interactions. If face-to-face

interaction is permitted, students can serve as mock patients for each other in-person. This not only challenges the student serving as the "clinician," but also challenges the student acting as a patient. Peer-assisted learning has been found to be beneficial for athletic training students, and some of the burden of feedback, completing PROMs, and serving as a mock patient can be taken off the instructor.[15] Lastly, simulators could be used to further increase the realism of the patient interaction.

CONCLUSION

This use of an unfolding case study to replace a clinical lab experience was an effective way to continue the education of athletic training students in an online environment. Even though the unfolding case study project did not provide for hands on clinical experience, it was still an effective way to teach the administrative skills of billing and documentation. It also provided an opportunity for students to improve their clinical reasoning skills. Students reported that they felt that this experience was more realistic simulation of the everyday practice of an athletic trainer than other previous lab experiences.

The unfolding case study can be used as an alternative to clinical experiences, if necessary, but it can also be used in small groups, as class project, or formative assessment. It can be used to teach new skills or improve skills that have already been acquired. Unfolding case studies help students translate theory into practice by requiring them to take an abstract theory and apply it to real-world situations, which challenges students in a way that aligns well with Kolb's Experiential Learning Theory.[13] The process of evaluation and reevaluation of information and synthesizing it into clinical decisions is an active learning strategy that allows students to problem solve through a natural progression.[6] With the continued threat of the pandemic, as well as the push for innovative classroom teaching strategies, the unfolding case study is a versatile tool that can be used to improve the clinical reasoning of athletic training students.

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