SIMPLE SIMULATED HEARING TEST EXPERIENCE FOR UNDERGRADUATE STUDENTS

Susan E. Fulton
University of South Florida Sarasota–Manatee

Abstract

Simulated learning environments (SLEs) have been used effectively in several health-related education programs. Few SLEs have been used in communication sciences and disorders (CSD). This paper describes a simple, interactive learning exercise developed for undergraduate CSD students enrolled in a fully online program. Through the exercise, students have the opportunity to interact with a simulated patient, assess hearing sensitivity, develop a comprehensive treatment plan, and develop their own virtual clinician to counsel their patient.

KEY WORDS: hearing, simulated learning experience

1. INTRODUCTION AND BACKGROUND

Critical to becoming successful clinicians, students in health-related programs need to effectively assess patients' needs, apply appropriate test measures and interpret results, and determine necessary treatments and therapy plans. Students must apply theoretical knowledge gained in the classroom to real-world situations. Unfortunately, students often report difficulties and apprehension using clinical skills in university teaching clinics (Williams, 2006). Additionally, learning to assess patients' needs can be very challenging. Many students have not developed the expertise and experience to counsel and generate treatment plans for patients. Beginning students need direct supervisor observation and direction when interacting with patients. However, in the online environment, supervision can be challenging for both the student and the instructor. One way to help students develop clinical skills in a controlled, online environment is through the use of simulated learning experiences (SLEs). SLE activities often utilize trained actors, mannequins, videos, or virtual patients. Although simulated experiences have been used successfully in health-care programs, such as nursing (Rash, 2008), mental health (Gregg and Tarrier, 2007; Satter et al., 2012), and pharmacy (Al-Dahir et al., 2014), few have used simulation experiences in communication sciences and disorders (CSD) (audiology and speech-language pathology).

Simulated learning environments have many advantages, such as creating a controlled learning environment, assessing student skills on standardized learning experiences, exposing students to unusual or serious patient conditions, and creating an environment that allows students to make and correct errors without negative patient outcomes (Alinier, 2007). Some CSD programs have effectively created SLEs using actors (Naeve-Velguth et al., 2013) and mannequins (Ward et al., 2015). Computer-based programs have been found to be effective in creating interactions with virtual patients who stutter (Strang and Meyers, 1987) or virtual environments that create immersive, real-world communication situations (Williams, 2006).

Lieberth and Martin (2015) demonstrated the educational effectiveness of virtual testing equipment for teaching technical skills. Undergraduate students were assigned to two testing groups: using either a web-based audiometer simulator or a portable audiometer. An audiometer is the standard equipment used by audiologists to generate hearing test stimuli. Competencies in basic hearing evaluation were assessed for each group. Students using the virtual audiometer showed better technical skills than those using the portable

audiometer. However, those same students were found to demonstrate less developed skills interacting with patients. The virtual audiometer did not allow students to instruct or interview patients. However, Naeve-Velguth et al. (2013) showed that SLEs can teach counseling skills. Survey data was obtained from 29 graduate students who participated in a simulated audiological counseling experience using actors. A total of seven questions using a five-point Likert scale were used. All of the students surveyed responded that the simulated patient counseling experience was a helpful learning experience and that the experience helped identify areas in which they could improve their counseling skills.

Although SLEs are viewed as an effective tool to strengthen clinical skills, few programs have implemented their use. In a recent survey of 10 CSD university programs in Australia, only four reported using SLEs (Macbean et al., 2013). Standardized patients, part task trainers, mannequins, and environmental simulations were SLE techniques reportedly used. All respondents agreed that SLEs had the potential to improve clinical placement outcomes and experiences. Reported barriers included available technology, technical support, development time, and maintenance. Actors and standardized patients require training, compensation, and scheduled assessments. Virtual patient interactions do not require patient training, can be made available online at any time, and have been rated as highly effective. In fact, virtual patient interactions are rated second only to standardized patients (actors) as being effective in increasing clinical education and reducing supervisor workload (Macben et al., 2013). Virtual patient experiences may be a promising, effective tool for online CSD education.

With the growth of health-related online learning programs, there is a need to create controlled, interactive experiences for students to gain experience planning for patient care. Although simulated patient experiences may enhance student learning, few CSD programs use SLEs. Simple, inexpensive SLEs are needed to help CSD students develop necessary clinical skills. The innovation described in this paper is an example of a simple SLE that allows students to interact with simulated audiology patients. Students are able to practice technical skills using an audiometer, practice developing an effective treatment plan for their virtual patient, and hone counseling skills through development of a virtual clinician.

2. METHOD

2.1 Simulated Patient with Hearing Loss

This experience was used in a course for undergraduate students in communication sciences and disorders (audiology and speech-language pathology). However, the overall design could be adapted for a variety of disciplines. Fifty-three undergraduate students in the University of South Florida Sarasota-Manatee Communication Sciences and Disorders program participated in the SLE as part of a CSD course. The course is taken the last semester of the undergraduate CSD online course sequence. Students were presented with virtual patients in an interactive module that provided detailed instructions, necessary forms/paperwork to complete the tasks required Voki (Voki, 2016), patient simulations, a simulated audiometer, and grading rubrics.

Using SoftChalk software (SoftChalk, Version 8.03.09, 2014), a page for each of the simulated patients was generated within an interactive module (see Appendix). A brief introductory paragraph describing the patient was provided at the top of the page. Each page contained an embedded Voki, in which the "patient" described relevant medical history and hearing difficulties. Voki have been effectively used in patient simulations in other fields (Anderson et al., 2013) and help create a more realistic virtual patient experience. Since the audiometer simulation (described below) included patient descriptions and scenarios, Voki simulations were based on the predetermined patient demographics (see Fig. 1).

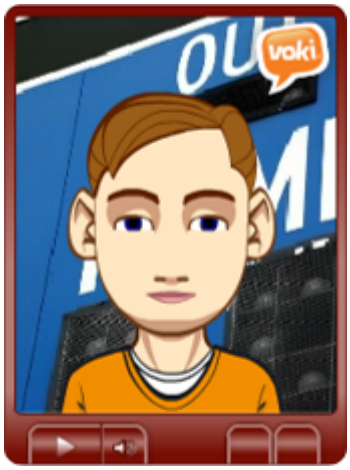

FIG. 1: Example of Voki avatar created to simulate a patient

An example script from the introduction of the patient is as follows:

> "My name is Joel. I have noticed trouble hearing speakers in large meetings. I also have trouble hearing on my phone. I can hear people talking, but they seem to be mumbling all of the time. I am around a lot of loud music, as I work at a music venue. There are a lot of loud bands that play there! I also notice ringing in my ears. It seems to really get loud at night. I have trouble going to sleep sometimes because it is so loud. I don't have a history of ear infections or trouble with my ears."

The students were then instructed to test the hearing status of their patient using an audiometer simulator (Bradley, 2008). The audiometer simulator was imbedded in the module page as an iframe, so students did not have to follow a link to access the activity. The students selected their patient in the simulator and performed a hearing test. Students were required to select the presentation intensities (–10 to 110 dB HL), set the test frequencies (250, 500, 1000, 2000, 3000, 4000, 6000, and 8000 Hz), select the transducers (headphones and/or bone oscillator), select the test ear (right, left), and manually present the test stimulus. The patient response was indicated by a patient response bar (yes or no). Students were provided with a blank audiogram to plot the patient's hearing sensitivity.

The students completed the testing of the simulated patient and graphed the obtained hearing thresholds at each frequency for each ear and transducer on the audiogram. This exercise not only gave students technical practice, it also gave them experience graphing thresholds on an audiogram, recording the appropriate standardized audiological symbols, and interpreting test results.

Students were then presented with the simulated patient's hearing goals via another embedded patient Voki. Since the students were not able to conduct a two-way conversation with their patient, the information needed for setting appropriate goals was included in the narrative provided by the Voki patient. An example follows:

> "In which situations would I like to hear well? Let me see... I would really like to be able to hear my boss in my work meetings. I cannot hear half of what he says. I also would like to hear my wife better. She yells from another room and gets mad at me when I don't understand her! What else... I would like to hear better in church. The preacher mumbles and I cannot hear his sermons. I don't even want to go to church. I also want to hear my friends better when we go out to eat. I don't feel part of the conversation and feel very left out. Finally, I want to be able to hear better on the phone. I miss a lot of information and don't even really want to use it! Can you help me?"

The students were provided with instructions on how to set goals using the client oriented scale of improvement (COSI) (Dillon et al., 1997, 1999) and given a link to a form used to record and monitor COSI

goals. They are asked to develop COSI goals for their simulated patient. Using COSI, clinicians are able to set realistic measurable goals that are tailored to a patient's specific needs and degree of hearing loss.

Finally, the students were given a link to Voki.com, where a customizable avatar could be created. Students were instructed to create a virtual clinician using the Voki of their choice. Their virtual clinician interpreted the test results and counseled the patient. The clinician Voki gave students experience verbally counseling a patient in a simulated environment. Since interacting with a patient is an integral part of the clinical experience, learning effective counseling skills is essential. Generating a clinician Voki gave students the opportunity to demonstrate verbal counseling skills in a nonthreatening environment. The exercise also gave instructors the opportunity to observe counseling skills and provide feedback and guidance. Since undergraduate students have limited patient experience, if any, basic clinical skills were examined (see Table 1).

TABLE 1: Clinical skills assessed during simulated clinician counseling

Clinician presents information in a professional manner.
Information is presented at a level appropriate for patient understanding (limited use of professional jargon).
Clinician provides accurate summary of test results.
Clinician presents clear and accurate summary of patient's communication skills/needs.
Goals are appropriate and clearly described/related to patient's reported difficulties.

Documentation of the completed assignment included (1) the audiogram with comments, (ii) the completed COSI goal form, and (iii) the link to the student's virtual clinician Voki. The documents were submitted through the university learning management system (i.e., Canvas, Blackboard, etc.).

Students provided feedback regarding the course using a Likert scale of 1–5, with 5 = outstanding, 4 = excellent, 3 = good, 2 = fair, and 1 = poor. Students also were given the opportunity to provide subjective comments. All feedback was given on a volunteer and anonymous basis.

3. RESULTS AND DISCUSSION

Peters and Vissers (2004) suggest that SLEs give students the ability to practice useful skills in a controlled, artificial environment. The simulated patient with hearing loss experience proved to be an effective tool for providing a virtual patient interaction for online students. The SLE allowed students to interact with simulated patients in a controlled environment. Students gave the course experience an overall average rating of 4.89 out of 5. One student comment was, "The interactive module offered the material in an interesting and applicable manner." Another student commented, "The creative approach to assignments kept things interesting and contributed to my learning in the class." Students successfully obtained hearing threshold data for their simulated patient. Some did evidence difficulties interpreting the data from the hearing test. The information was useful in developing curriculum that would prepare students for this SLE for the future. Students were able to use the information contained in the module to create measurable and appropriate COSI goals. Students found generation of their own clinician Voki to be engaging and educational. In addition, creation of the virtual clinician gave students practice verbally counseling a patient in a controlled environment. Overall, the project was a beneficial learning experience for the students.

Some limitations of the project included technical difficulties and errors in interpreting hearing test results. Technical difficulties occurred when students attempted to access the module. In the future, students will be

required to run a browser plug-in analysis and run any updates prior to the assignment. Errors in interpreting the results could be reduced by providing a review of audiogram interpretation prior to the SLE. Students learned this material in the previous semester and may have forgotten essential information.

This simple SLE consists of several virtual patients with hearing loss. Student clinicians were exposed to common scenarios seen in an audiology clinic. The controlled environment allowed for the same patient/clinician exposure across students in a course. In addition, students were able to demonstrate clinical skills by virtually testing the hearing sensitivity of their patient, synthesizing relevant information, and presenting a treatment plan for their patient. They also had experience counseling patients in a controlled environment by developing their own virtual clinician to discuss results and recommendations.

REFERENCES

Al-Dahir, S., Bryant, K., Kennedy, K.B., and Robinson, D.S., Online Virtual Patient-Cases versus Traditional Problem-Based Learning in Advanced Pharmacy Practice Experiences, *Am. J. Pharm. Educ.*, vol. **78**, no. 4, pp. 1–8, 2014.

Alinier, G., A Typology of Educationally Focused Medical Simulation Tools, *Med. Teacher*, vol. **29**, pp. 243–350, 2007.

Anderson, J.K., Page, A.M., and Wendorf, D.M., Avatar-Assisted Case Studies, *Nurse Educator*, vol. **38**, no. 3, pp. 106–109, 2013.

Bradley, S., Audiometer Simulator, Copyright Board of Regents, University of Wisconsin System; http://facstaff.uww.edu/bradleys/audiometersimulator/practice/, Accessed on June 27, 2015.

Dillon, H., James, A., and Ginis, J., The Client Oriented Scale of Improvement (COSI) and Its Relationship to Several Other Measures of Benefit and Satisfaction Provided by Hearing Aids, *J. Am. Acad. Audiol.*, vol. **8**, pp. 27–43, 1997.

Dillon, H., Birtles, G., and Lovegrove, R., Measuring the Outcomes of a National Rehabilitation Program: Normative Data for the Client Oriented Scale of Improvement (COSI) and the Hearing Aid Users Questionnaire (HAUQ), *J. Am. Acad. Audiol.*, vol. **10**, no. 2, pp. 67–79, 1999.

Gregg, L. and Tarrier, N., Virtual Reality in Mental Health, *Social Psych. Psych. Epidemiol.*, vol. **42**, pp. 343–354, 2007.

Lieberth, A.K. and Martin, D.R., The Instructional Effectiveness of a Web-Based Audiometry Simulator, *J. Am. Acad. Audiol.*, vol. **16**, pp. 79–84, 2015.

Macbean, N., Theodoros, D., Davidson, B., and Hill, A.E., Simulated Learning Environments in Speech-Language Pathology: An Australian Response, *Int. J. Speech-Language Pathol.*, vol. **15**, no. 3, pp. 345–357, 2013.

Naeve-Velguth, S.N., Christensen, S.A., and Woods, S., Simulated Patients in Audiology Education: Student Reports, *J. Am. Acad. Audiology*, vol. **24**, 740–746, 2013.

Peters, V.A.M. and Vissers, G.A.N., A Simple Classification Model for Debriefing Simulation Games, *Simul. Gaming*, vol. **35**, no. 1, pp. 70–84, 2004.

Rash, E.M., Simulating Health Promotion in an Online Environment, *Educ. Innov.*, vol. **47**, no. 11, pp. 515–517, 2008.

Satter, R.M., Cohen, T., Ortiz, P., Kahol, K., Mackenzie, J., Olson, C., Johnson, M., and Patel, V.L., Avatar-Based Simulation in the Evaluation of Diagnosis and Management of Mental Health Disorders in Primary Care, *J. Biomed. Informatics*, vol. **45**, pp. 1137–1150, 2012.

SoftChalk Software, Version 8.03.09, http://www.softchalk.com; Copyright 2012-2014.

Strang, H.R. and Meyers, S.C., A Microcomputer Simulation to Evaluate and Train Effective Intervention Techniques in Listening Partners of Preschool Stutterers, *J. Fluency Disorders*, vol. **12**, pp. 205–215, 1987.

Voki, *Oddcast, Inc.*, 2016, http://www.Voki.com, Accessed on July 1, 2015.

Ward, E.C., Hill, A.E., Nund, R.L., Rumbach, A.F., Walker-Smith, K., Wright, S.E., Kelly, K., and Dodrill, P., trainDeveloping Clinical Skills in Paedatric Dysphagia Management Using Human Patient Simulation (HPS), *Int. J. Speech-Language Pathol.*, vol. **17**, no. 3, pp. 230–240, 2015.

Williams, S.L., The Virtual Immersion Center for Simulation Research: Interactive Simulation Technology for Communication Disorders, International Society for Presence Research, *9th An. Int. Workshop Pres.*, August 24–26, Cleveland, Ohio, USA, 2006.

APPENDIX: CREATING A SIMPLE SIMULATED HEARING TEST EXPERIENCE

1. Decide patient characteristics and needs. The audiogram is already programmed with patient names and preassigned test results.

2. Develop a script for what the virtual patient will say when interacting with students.

3. Using Softchalk or a LMS (Canvas, for example, allows creation of "pages"), create an empty learning module.

4. Create narrative that describes the SLE and gives detailed instructions. Things to include:

    a. Detailed instructions on the experience.

    b. Learning goals.

    c. Instructions on how to check browser plug-in updates.

    d. Include links or embed grading rubrics, any forms needed (e.g., blank audiograms, COSI goals worksheets).

5. Go to Voki.com and create your patients. For this experience, two avatars are needed for each simulated patient, i.e., one to discuss relevant history and one to discuss hearing difficulties (for COSI goals).

    a. Log in or sign up.

    b. Select "create Voki".

    c. Select your avatar and customize (hair, skin color, clothing, etc.).

    d. Give your avatar a voice.

        i. Use text-to-speech and paste your script.

        ii. Use the microphone and record a voice reading the script.

        iii. There is no option to close caption Voki avatars, so printed copies of the scripts can be added to your module.

    e. Choose the background.

    f. Publish.

    g. To embed Voki avatars, select "share" and then "embed" (<|>) to obtain the embed code. The process to embed the code depends on what platform you are using to create the module.

h. Embed the link for the simulated audiometer in the module page.

i. The order of each patient page is as follows:

i. Instructions and learning goals.

ii. Link to grading rubric.

iii. Browser update instructions.

iv. Patient introduction.

v. Embedded Voki avatar reporting his/her history.

vi. Link to text for Voki script.

vii. Instructions for audiometer and link to blank audiogram.

viii. Embedded simulated audiometer.

ix. Instructions for setting COSI goals.

x. Link to COSI forms.

xi. Embedded Voki avatar reporting hearing goals.

xii. Link to text for Voki script.

xiii. Instructions for counseling the patient.

xiv. Instructions on creating a Voki.

xv. Link to Voki.com.

xvi. List of required submissions for grading.

xvii. Link for submissions.