

1. DEFINITION

Assessment is a process that measures student improvement over time, motivates students to study, evaluates the effectiveness of teaching methods, and ranks the students' performance in comparison to their cohort (Jabbarifar, 2009). In simulation-based education, assessments offer students the opportunity to integrate knowledge, practice their skills, exhibit professional competency and handle real life situations.

2. BEST PRACTICES

- a. In designing assessment mechanisms, the instructor should keep in mind the key learning objectives of the simulation and the targeted skills the simulation is designed to enhance. Assessment tools should be chosen based on what is best suited to assess the students' desired learning outcomes.

Assessment of student knowledge:

1. **Examinations.** A post-simulation exam can be used to assess how much knowledge students have gained on the content of the simulation (Bray, 2011). Alternatively, a take-home exam can ask students to undertake a detailed analysis of certain topics or issues central to the simulation. Examinations can assess both content and the ability of the students to connect their personal experiences in simulation with the broader learning objectives of the course.
 2. **Writing Exercises.** This method can take multiple forms. Students can be tasked with crafting an introspective piece that asks them to reflect on what they have learned throughout the simulation. This kind of reflective writing prompts students to consider how the exercise would have been different in the real-world, whether it synched with their expectations, as well as broader self-reflection on their own performance and learning (Smith et al., 2006; Moore, Beshke & Bohan, 2014). Regular journal entries can also be used if the instructor wishes to prompt reflection on content throughout the simulation.
- b. Assessment of applied skill development:
 1. **Task-specific Exercises.** Students can be given a number of tasks of varying difficulty to perform levels during or after the simulation to demonstrate competencies acquired. Students are assessed based on their performance, as well as follow-up reflection or explanation (Trundle & Bell, 2010). For example, medicine students were tasked with demonstrating their surgical skills in animal models (Sidhu, 2005)

while tourism management students were asked to demonstrate their tour-guiding skills by conducting mini-tours around the campus (Armstrong, 2003).

2. **Discussion.** In role-play simulations, students can be assessed through a facilitated discussion. During the discussion, the students can be asked to explain their in-role stance, reflect on what transpired during the simulation, and explore alternative outcomes. Students are graded on the depth of their self-reflection and their ability to connect knowledge gained through the exercise with real-world practice (Moore et al., 2014).
 3. **Case study.** The use of interactive cases is another tool for the assessment of students' problem solving and critical thinking skills. Here, specific cases representing different complex situations are integrated in the simulation. The students have to explore the cases and come up with acceptable solutions for the problems (Wu, 2015a; Wu, 2015b; Kelley et al., 2008).
- c. Assessment of interpersonal skills and professionalism:
1. **In-person Feedback.** This can take the form of a semi-structured interview where service users and students are given the opportunity to discuss their experiences in front of the instructor. Students are assessed based on the feedback as well as their response to it (McMahon-Parkes et al., 2016). This kind of assessment is important for those disciplines where the students will have to directly interact with the service users as part of their professional careers.

3. DISCIPLINES

Health sciences

Interactive cases are great assessment tools for assessing critical skills for health professionals. One study shows the use of multi-scenario cases for the assessment of diagnosis skills and management plans for anesthesia resident students. In this case, seven different scenerios were presented to the students followed by a set of questionnaire for the assessment purpose. The instructor used a rubric and a 7-point scale to ensure an accurate and transparent evaluation of student performance (Blum et al., 2014).

Natural sciences

Task-specific exercises during or after the simulation can assess students' understanding of the subject matter and their ability to apply their acquired knowledge into practice. Starry Night™ is a planetarium software used to teach standards-based lunar concepts. This software has a series of task-based tests for the asseement of students' understanding of different lunar episodes (Trundle & Bell, 2010).

Social sciences

Combination of assessment tools can also be used to assess different aspects of students' learning. Ambrosio (2004) used two assessment tools to assess his students in an Ethnic Conflicts course role-play simulation. The first assessment tool was a post-simulation discussion that demonstrated students' understanding of theoretical dynamics encountered in ethnic conflict situations. The second assessment tool was a take-home exam which assessed students' ability to connect their experience in simulation to the existing literature on ethnic conflicts.

4. RESOURCES

Ambrosio, T. (2004). Bringing ethnic conflict into the classroom: A student-centered simulation of multiethnic politics. *PS: Political Science and Politics*, 37(2), 285-289.

Armstrong, K. (2003). Applications of role-playing in tourism management teaching: An Evaluation of a Learning Method. *Journal of Hospitality, Leisure, Sport & Tourism Education*, 2. (1), 5-16.

Blum, R.H., Boulet, J.R., Cooper, J.B., Muret-Wagstaff, S.L (2014). Simulation-based assessment to identify critical gaps in safe anesthesia resident performance. *Anesthesiology*, 120(1), 129-14.

Bray, B.S., Schwartz, C.R., Odegard, P.S., Hammer, D.P., Seybert, A.L. (2011). Patient simulation : Assessment of human patient simulation-based learning. *American Journal of Pharmaceutical Education*, 75(10), 1-10.

Jabbarifar, T. (2009). The importance of classroom assessment and evaluation in educational system. Proceedings of the 2nd International Conference of Teaching and Learning (ICTL 2009) INTI University College, Malaysia. 1-9.

Kelley, K.K., Beatty, S.J., Legg, J.E., McAuley, J.W. (2008). A Progress Assessment to evaluate pharmacy students' knowledge prior to beginning advanced pharmacy practice experiences. *American Journal of Pharmaceutical Education*, 72(4), 1-9.

McMahon-Parkes, K, Chapman, L., James, J.(2016). The views of patients, mentors and adult field nursing students on patients' participation in student nurse assessment in practice. *Nurse Education in Practice*, 16, 202-208.

Moore, C. D., Beshke, C. A., & Bohan, C. H. (2014). Simulations and games in the civics classroom. *Social Studies Research & Practice*, 9(2), 77-88.

Smith, C.A., Hart, A.S., Sadowski, L. S., Riddle, J., Evans, A.T., Clarke, P.M., Ganschow, P.S., Mason, E., Sequeira, W., Wang, Y (2006). Teaching cardiac examination skills - a controlled trial of two methods. *Journal of General Internal Medicine*, 21, 1-6.

Sidhu, R.S., Park, J., Brydges, R., MacRae, H.M., and Dubrowski, A. (2005). Laboratory-based vascular anastomosis training: A randomized controlled trial evaluating the effects of bench model fidelity and level of training on skill acquisition. *Journal of Vascular Surgery*, 45(2), 343-349.

Trundle, K.C. & Bell., R.L. (2010). The use of a computer simulation to promote conceptual change: A quasi-experimental study. *Computers & Education*, 54, 1078-1088.

Wu, X.V., Karin Enskä, K. , Lee, C.C.S., Wang, W.(2015a). A systematic review of clinical assessment for undergraduate nursing students. *Nurse Education Today*, 35, 347–359.

Wu, X.V., Heng, M.A., Wang, W. (2015b). Nursing students' experiences with the use of authentic assessment rubric and case approach in the clinical laboratories. *Nurse Education Today*, 35, 549–555.