Designing virtual worlds for effective peer feedback: The case of Otago Virtual Hospital

Phil Blyth, Swee-Kin Loke
University of Otago

Despite the importance and reliability of peer feedback, medical students currently have few formal opportunities to give and receive peer feedback on their clinical practice. To provide medical students with such opportunities, a multi-user virtual hospital was developed. In the Otago Virtual Hospital, medical students role-play as junior doctors and manage realistic clinical cases within the Emergency Department. To encourage effective peer feedback, the instructional design of the virtual world needs to follow sound pedagogical principles. In this paper, we describe five of these principles and how the Otago Virtual Hospital has been redesigned to fulfill them. These redesign practices can serve to guide educators and instructional designers interested in implementing scalable and effective peer feedback on student performance.

Keywords: virtual worlds, peer feedback, medical education

Introduction

Feedback can be defined in several ways. In this paper, we adopt Hattie and Timperley's (2007) definition of "feedback" as "information provided by an agent (e.g., teacher, peer, book, parent, self, experience) regarding aspects of one's performance or understanding" (p. 81). Such information can range from a teacher verbally evaluating a student's answer during a lecture, to a peer/classmate pointing out a compromise in a treatment plan suggested by a medical student during a tutorial.

Feedback has a powerful influence on learning and achievement: in a synthesis of more than 500 meta-analyses on the main influences on student achievement, Hattie (2012) reported that feedback was among the top ten most powerful influences. Feedback yielded an effect size that was twice the average effect size and that was more impactful than other factors such as socioeconomic situation and homework.

Compared to teacher feedback, peer feedback offers at least four additional learning benefits: first, peer review engages students more actively with feedback processes (Nicol, Thomson, & Breslin, 2014). By giving peer feedback, students need to articulate their own evaluative criteria and/or apply the given criteria to judge a particular performance. Consequently, students develop their understanding of what counts as a desirable performance and can subsequently reflect on their own performance based on this understanding. This can potentially help students develop into independent, reflective practitioners (Schön, 1983).

Second, students often perceive peer feedback to be more understandable than teacher feedback (Falchikov, 2005). This is because peer feedback is often given in a more accessible language than teacher feedback.

Third, peer feedback has the potential to increase the volume and diversity of feedback that students receive, while not increasing teacher workload in the long term (Topping, 1998). Peer feedback thus provides one way of addressing the tension between rising student numbers and resource constraints in higher education.

Lastly, peer review of clinical practice has become an obligatory competency for medical professionals in New Zealand (Medical Council of New Zealand, 2013) and it is imperative that medical students develop this skill during their medical education.

Some teachers may fear that peer feedback might be inaccurate and unreliable. In medical education, peer feedback on clinical practice has been researched for several decades (Linn, Arostegui, & Zeppa, 1975). Findings indicate that medical students can meaningfully engage in the formative assessment of their peers' clinical competence (Dannefer et al., 2005) and that peer assessment of clinical practice is adequately reliable and valid (Topping, 1998).

Despite the importance and reliability of peer feedback, medical students at the University of Otago currently have few formal opportunities to give and receive peer feedback on their clinical practice. Barriers to this include a lack of formalised feedback in clinical practice (apart from audit), time and consent issues involved in sitting in on a peer's patient-interview, and the perception that students do not have the authority to contribute

meaningfully. Within the early years of medical education, there has been an increased focus on group work and providing feedback. However, this occurs less commonly within the more clinically focused latter years. One exception to this is the Safe and Effective Clinical Outcomes (SECO) clinic which utilises human actors as patients (http://dnmeds.otago.ac.nz/departments/gp/teaching/seco.html). The strengths of the SECO clinic are however balanced with the costs of running the clinic, and paying the actors and support staff.

Virtual worlds such as *Second Life* offer a low-cost alternative for simulating clinical practice (Salmon, 2009). We will now describe one such virtual world: the Otago Virtual Hospital.

The Otago Virtual Hospital

The Otago Virtual Hospital (OVH) is a multi-user virtual environment in which medical students role-playing as junior doctors make diagnoses and manage realistic clinical cases within the Emergency Department (go to http://ovh.otago.ac.nz/ for a walk-through). Using their avatars, students are able to: move around the hospital; communicate with patients, relatives and peers via text chat; perform a 'physical' examination of patients (e.g., clicking on the patient's chest allows students to listen to a series of heart sounds); order laboratory and radiology tests (e.g., CT scan of patient's head) and check the results of those tests; prescribe from an extensive range of medicines; and write patient handover notes. The OVH is built on the OpenSim-based New Zealand Virtual World Grid (http://www.nzvwg.org/).

Two pilot studies have indicated that the clinical decision-making required in an OVH clinical case resembles the type of clinical decision-making required in real world cases. In the first study, 11 medical students reported having to actually make clinical decisions that affect their patient and to adapt the generic patient care framework to the situation at hand (Loke, Blyth, & Swan, 2012). In the second, 12 participants at different stages of medical training (e.g., fourth-year students, trainee interns) performed at significantly different levels in the OVH, supporting construct validity (Roy, Wilkinson, Walker, & Blyth, 2013). Therefore, we are sufficiently confident that we can validly assess medical students' clinical decision-making based on their performance in the OVH.

The OVH was first built using a university teaching improvement grant in 2010. In 2014, another teaching improvement grant was obtained to redesign the OVH for scalable and instructor-less peer feedback. Students will be able to log into the OVH at a time of their convenience to participate in a given scenario. One student will role-play as the doctor, and the other as the patient. Using a computer-generated log of decisions made and feedback forms (more details given below), the 'patient' will give formative feedback to the 'doctor' at the end of the scenario.

To encourage effective peer feedback, the instructional design of the virtual world needs to follow sound pedagogical principles. In the next section, we will describe five of these principles and how the OVH has been redesigned to fulfill them. These redesign practices can serve to guide educators and instructional designers who are interested in implementing scalable and effective peer feedback on student performance.

Principles for effective peer feedback

Effective peer feedback should be valid (Brown & Knight, 1994). Given that the aim of the OVH is to develop students' clinical decision-making skills, valid feedback should be based on students' *actual* clinical decisions in the scenario (Olsen, 2006), not students' recollections or impressions of their performance. Feedback based on students' actual in-world decisions/actions has received little attention so far (Chodos, Stroulia, King, & Carbonaro, 2014; Fardinpour & Heinz, 2012) and we aim to redress the balance. To maximise the validity of the peer feedback given, we have begun to redesign the OVH to display a log of the key decisions made at the end of the scenario. The development of this log has started and will be ready in September 2014. Students will be asked to refer to the log of decisions made to substantiate their feedback (see revised forms at http://bit.ly/1sQBrCK).

Effective peer feedback should focus on how to perform a task more effectively, not on giving summative marks or praise/punishment. Measuring effect sizes related to feedback effects, Hattie and Timperley (2007) reported that the highest effect sizes involved students receiving feedback about how to do a task more effectively, and lower effect sizes involved rewards and punishment. Hence, we have redesigned the OVH feedback and debrief forms to focus on *formative* feedback on how students can improve their clinical decision-making (see revised forms at http://bit.ly/1sQBrCK).

Effective peer feedback should involve iterative cycles of practice. However informative, feedback remains inert until recipients get the opportunity to act upon it (Nicol et al., 2014; Topping, 1998). Hence, we have begun to redesign the OVH to feature a Holodeck (Linden Research, 2012) that is capable of rezzing a quasi-infinite number of the same scenario. Students can thus participate in the same scenario multiple times. Variation within this scenario is provided by its open-ended nature, given that the scenario is co-constructed 'on the fly' by the particular doctor and patient. Participating in a scenario several times would also increase the diversity of feedback students receive and in turn improve its reliability. The development of this Holodeck has started and will be ready in September 2014.

Effective peer feedback should be a dialogue and not a one-way information transmission (Nicol, 2010). Given that students construct their own meaning from the information given (Piaget, 1970), peer feedback should involve students asking questions about the feedback and discussing it with others (Nicol, 2010). Hence, we have redesigned the OVH to include a debrief lounge where students can conduct their peer debrief in-world, out-of-character, and in a collegial fashion.

Effective peer feedback should involve criteria that are transparent to both the receiver and giver of feedback (Norcini, 2003). Hence, we have redesigned the OVH feedback forms to let the 'doctor' express what aspects she wants feedback on, and to guide the 'patient' on what to look out for *prior* to the role-play (see revised forms at http://bit.ly/1sQBrCK).

Topping (1998) highlighted some common pitfalls of peer feedback: first, poor performers might not accept peer feedback as accurate. We plan to mitigate this issue by basing feedback on the actual decisions made in-scenario, not students' recollections or impressions. Second, students might not be willing to accept the responsibility for assessing their peers. Within the early years of medical education at the University of Otago, there has been an increased focus on group work and providing peer feedback. This increased focus is likely to mitigate this issue.

Future work

All fourth- and fifth-year medical students will be invited to trial the redesigned OVH in October 2014. During the trial, we will evaluate the feasibility of providing instructor-less peer feedback and examine how to improve the quality of student feedback. At a later stage, we also intend to measure the validity and reliability of peer feedback in the OVH.

Acknowledgements

We would like to thank the Committee for the Advancement of Learning and Teaching (University of Otago) for funding this project.

References

Brown, S., & Knight, P. (1994). *Assessing learners in higher education*. Philadelphia: Kogan Page.

Chodos, D., Stroulia, E., King, S., & Carbonaro, M. (2014). A framework for monitoring instructional environments in a virtual world. *British Journal of Educational Technology*, *45*(1), 24-35. doi:10.1111/j.1467-8535.2012.01370.x

Dannefer, E. F., Henson, L. C., Bierer, S. B., Grady-Weliky, T. A., Meldrum, S., Nofziger, A. C., … Epstein, R. M. (2005). Peer assessment of professional competence. *Medical Education*, *39*(7), 713–722. doi:10.1111/j.1365-2929.2005.02193.x

Falchikov, N. (2005). *Improving assessment through student involvement: practical solutions for aiding learning in higher and further education*. New York: RoutledgeFalmer.

Fardinpour, A., & Heinz, D. (2012). Towards developing automated assessment in virtual learning environments (pp. 211–216). Presented at the IADIS International Conference on Internet Technologies and Society.

Hattie, J. (2012). *Visible learning for teachers: maximizing impact on learning*. New York: Routledge.

Hattie, J., & Timperley, H. (2007). The Power of Feedback. *Review of Educational Research*, *77*(1), 81–112. doi:10.3102/003465430298487

Linden Research. (2012). Holodeck. In *Second Life Wiki*. Retrieved from http://wiki.secondlife.com/wiki/Holodeck

Linn, B. S., Arostegui, M., & Zeppa, R. (1975). Performance rating scale for peer and self assessment. *Medical Education*, *9*(2), 98–101. doi:10.1111/j.1365-2923.1975.tb01902.x

Loke, S.-K., Blyth, P., & Swan, J. (2012). Student views on how role-playing in a virtual hospital is distinctively relevant to medical education. In M. Brown, M. Hartnett, & T. Stewart (Eds.), *Future Challenges, Sustainable Futures* (pp. 565–574). Wellington.

Medical Council of New Zealand. (2013). *Recertification and continuing professional development booklet*. Wellington: Medical Council of New Zealand. Retrieved from http://www.mcnz.org.nz/assets/News-and-Publications/Booklets/Continuing-Professional-Development.pdf

Nicol, D. (2010). From monologue to dialogue: improving written feedback processes in mass higher education. *Assessment & Evaluation in Higher Education*, *35*(5), 501–517. doi:10.1080/02602931003786559

Nicol, D., Thomson, A., & Breslin, C. (2014). Rethinking feedback practices in higher education: a peer review perspective. *Assessment & Evaluation in Higher Education*, *39*(1), 102–122. doi:10.1080/02602938.2013.795518

Norcini, J. J. (2003). Peer assessment of competence. *Medical Education*, *37*(6), 539–543. doi:10.1046/j.1365-2923.2003.01536.x

Olsen, J. B. (2006). Performance testing: validity issues and design considerations for online testing. In D. D. Williams, S. L. Howell, & M. Hricko (Eds.), *Online assessment, measurement and evaluation: emerging practices* (pp. 259–274). PA: Information Science Publishing.

Piaget, J. (1970). *Science of education and the psychology of the child*. New York: Orion Press.

Roy, M., Wilkinson, T., Walker, R., & Blyth, P. (2013). Virtual reality based clinical cases: a novel method for assessment of competence and clinical reasoning ability. Presented at the Australian & New Zealand Association for Health Professional Educators, Melbourne. Retrieved from http://media.wix.com/ugd/363deb_f370150b93e4b9df09f7fd44d588dc7c.pdf

Salmon, G. (2009). The future for (second) life and learning. *Brtish Journal of Educational Technology*, *40*(3), 526–538. doi:10.1111/j.1467-8535.2009.00967.x

Schön, D. A. (1983). *The reflective practitioner: how professionals think in action*. New York: Basic Books.

Topping, K. (1998). Peer Assessment Between Students in Colleges and Universities. *Review of Educational Research*, *68*(3), 249–276. doi:10.3102/00346543068003249

Please cite as: Blyth, P., & Loke, S.-K. (2014). Designing virtual worlds for effective peer feedback: The case of Otago Virtual Hospital. In B. Hegarty, J. McDonald, & S.-K. Loke (Eds.), *Rhetoric and Reality: Critical perspectives on educational technology. Proceedings ascilite Dunedin 2014* (pp. 466-469).

Note: All published papers are refereed, having undergone a double-blind peer-review process.