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Summary

Improving Science Communication through Scenario-based Role-plays

Jacqueline Dohaney, Erik Brogt, Thomas Wilson, Emma Hudson-Doyle, Ben Kennedy, Jan Lindsay, Brendon Bradley, David Johnston, Darren Gravley

AKO AOTEAROA
NATIONAL CENTRE FOR TERTIARY TEACHING EXCELLENCE

UC UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND

THE UNIVERSITY OF AUCKLAND
NEW ZEALAND
Te Whare Wānanga o Tāmaki Makaurau

Translating scientific results, conclusions and recommendations into language easily understood by non-experts is a critical skill for scientists and science learners. In short, science communication is a critical area of development for science education.

This project developed and evaluated a suite of scenarios that can be used as real-time role-plays that enhance communication skills. Through these role-plays, learners can gain experience in realistic and challenging situations where they need to rapidly respond in an uncertain environment, and effectively communicate with a range of stakeholders.

About the project

SCIENTISTS ARE NOT FORMALLY TRAINED FOR COMMUNICATING SCIENCE IN CRISES

Communicating scientific results, conclusions, and recommendations about natural hazards and disasters into easy-to-understand language can be difficult at the best of times. It becomes even more so during the stress and uncertainty of an actual crisis.

Scientists are not typically trained in communication, and communication experts are not typically trained in science. As a result, science communication can be suboptimal in times where clear and effective communication is most important. The need for improvement of this situation has been recognised, and effective communication between technical experts and other stakeholders, including the public, is a major focus of the multi-lateral United Nations Strategy for Disaster Risk Reduction, known as the Sendai Framework for Disaster Risk Reduction 2015-2030.

TRAINING SCIENTISTS IN SCIENCE COMMUNICATION THROUGH AUTHENTIC ROLE-PLAY

This project developed and evaluated a complex scenario-based role-play (SBRP), Communicate the Quake, to improve students' science communication skills. The SBRP is situated around a fictitious (but geologically realistic) earthquake in Greymouth, New Zealand, and is aimed at students in geology, environmental science, hazard and disaster management, and earthquake engineering. Participants practise communicating complex scientific and hazard management information to a wide variety of different stakeholder audiences.

Participants are either part of the Science Advisory Group (SAG), which provides science advice, or the Civil Defence and Emergency Management (CDEM) team, which manages the crisis. The roles and responsibilities of the participants and the tasks and protocols staged are modelled after real practitioners (GNS seismologists or CDEM welfare officers) and the real protocols and structures of New Zealand organisations. Both teams have access to a wide range of supporting data from scientific (i.e. geographic, geologic and engineering datasets) and emergency management (i.e. location of key lifelines) sectors.

Throughout the exercise, participants experience several authentic crisis communication tasks (see parts 1-4 on the next page). Additionally, they are asked to engage with modern communication tools and technology such as Google Earth, file-sharing software and Twitter.

COMMUNICATE THE QUAKE IS AUTHENTIC, CHALLENGING AND EDUCATIONALLY MEANINGFUL TO STUDENTS

This project used a design-based approach aimed to evaluate the scenario's authenticity and the effectiveness of the SBRP at enabling an optimal learning environment for communication. In a series of four iterations involving 30 students and 11 instructors, a mixture of classroom observations, video recordings, and student and instructor feedback were used to make iterative improvements to optimise the flow and effectiveness of the role-play.

Instructors (i.e. practitioners and academics) judged the SBRP authentic. Students found the SBRP challenging yet rewarding, and reported that the role-play increased their awareness of the importance and complexities of communicating earthquake science and emergency management information. Overall, results showed that the SBRP was a robust and flexible tool, able to meet a variety of learning goals.

Three instruments were used to collect communication performance data. Two of these, measuring Communication Experience (CE) and Perceptions of Crisis Communication (PCC) were developed as part of the study, while Self-Perceived Communication Competence (SPCC) was measured using an existing instrument from the literature.

The first instrument is an ordinal tally of different types of communication experiences that the students may have had in the past. The second compares participants' perceptions of how best to communicate science during a crisis with the opinions of experts. The third instrument measures communication confidence. Using these three instruments together, we were able to assess a variety of factors influencing communication performance (the overall ability of a learner to communicate).

THIS PROJECT DEVELOPED AN OFF-THE-SHELF COMMUNICATION CURRICULUM TOOL FOR EDUCATORS TO USE IN THEIR OWN CONTEXTS: COMMUNICATE THE QUAKE

Communicate the Quake is a complex role-play in which students take on roles as geologists, seismologists and emergency managers during a simulated earthquake event situated in Greymouth, New Zealand. The core activity is a 2-5 hour face-to-face role-play, in which students respond to, manage and mitigate harm from the impact of a large, regional earthquake, and work together to communicate the scenario to the public and specific stakeholders.

The role-play activity is supported by pre-activities which are designed to prepare students for the scientific, emergency management, and science communication tasks which are played out in the scenario. During the role-play, there are four distinct parts which can be used as individual activities:

- **Part 1:** town hall meeting
- **Part 2:** media release, radio bulletin and press conference
- **Part 3:** panel discussion
- **Part 4:** debrief

A customised set of Google Earth files shows students the infrastructure, geology and other important information of the region, allowing them to make decisions based on real-life data.

It is best suited to medium-sized (12-40) upper division undergraduate or postgraduate courses with support from several facilitators (instructors and research staff in seismology, active tectonics, engineering, emergency management, and natural hazards). Assessment for the module is typically done through preparation activities (i.e., critiquing of media releases, presentation of an earthquake hazards map) and on-the-day peer- and self-evaluation of performance (via rubrics) following the role-play. A detailed instructor manual is provided which walks the staff through the process of organising and implementing the role-play. **Find the role-play here: www.akoaotearoa.ac.nz/improving-science-communication-skills**

Key findings

COMMUNICATE THE QUAKE INCREASES STUDENT COMMUNICATION CONFIDENCE INDEPENDENT OF PREVIOUS LEVELS OF CONFIDENCE

Using the SPCC instrument, we found that students from the US had statistically higher pre-scores than NZ students. This indicates that students' backgrounds may influence their communication confidence. The average change (i.e. post- minus pre-SPCC) was positive and statistically significant. This indicates that Communicate the Quake is successful at increasing students' confidence when communicating.

Additionally, these changes were independent of students' pre-scores, meaning that the SBRP is effective in changing confidence levels regardless of where they begin. The SPCC changes we observed over the course of a single, multi-hour intervention were on par with changes observed in the literature for interventions that occur over much longer time frames.

COMMUNICATE THE QUAKE SHIFTS PARTICIPANT PERCEPTIONS OF CRISIS COMMUNICATION TO MORE EXPERT-LIKE PERCEPTIONS

Using the PCC instrument, we compared participants' perceptions of crisis communication to those of experts (academics, emergency managers and science communicators). Participants showed statistically significant positive shifts (i.e. had more agreement with experts). Several factors appeared to influence the level of change achieved, such as students' nationalities, their year of degree programme, and the SBRP team (CDEM or SAG) in which they were placed.

The PCC instrument is made up of 49 individual statements on different elements of science communication best practice. Analysis of the statements showed that there were some best practices in which most student groups agreed with experts (high perceptions) and others which they disagreed with experts (low perceptions). More importantly, there were several topics with which experts struggled with (i.e. they gave predominantly neutral responses, with distributions leaning towards agreeing or disagreeing) that coincided with mixed and low perceptions from the student participants. These topics were: comprehensiveness, showing the scientist's emotions, political influence/agenda, use of formal language, and use of graphs and plots. The statements for which the emergency management professionals disagreed with the student groups: the 'why' of the crisis, discussing past crisis scenarios, and the communication of probabilities. These differential topics are potentially important good practices which the research community should continue to explore and understand.

NEXT STEPS: BRINGING COMMUNICATE THE QUAKE TO THE PROFESSIONAL EMERGENCY MANAGEMENT COMMUNITY

Future work includes bringing the SBRP as a continuing professional development opportunity to practising geoscientists, engineers, and emergency management professionals in the field. The latter work is currently underway at the time of this writing (July 2016), and is supported by funding through the Earthquake Commission and QuakeCoRE.

This summary has been developed as a result of the project *Improving Science Communication Skills* and the research report *Improving Science Communication through Scenario-Based Role-Plays,* Dohaney et al. (2016). The work was supported through the Ako Aotearoa National Project Fund 2012.

More information and the full report is available at www.akoaotearoa.ac.nz/improving-science-communication-skills.

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