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# Undergraduate health science students' development of reflective practice on communication skills via e-Portfolios

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**Abstract**

*Background:* Whilst e-Portfolios have been used in a variety of learning contexts, disciplines and academic levels, its effectiveness amongst tertiary health science students in Australia has yet to be explored. Investigating students' development of reflexivity through an individually assessed e-Portfolio will produce more information about how best to teach and assess these skills in line with key professional competencies.

*Aim:* This project aimed to evaluate students' development of reflexivity by engaging in an individually assessed e-Portfolio within a large, interprofessional, first year health science unit on *Communication in Health*.

*Methods:* Using an adapted version of Groningen's Reflection Ability Scale (GRAS) students were surveyed before beginning and after completing their e-Portfolios. Participating students' concluding summaries on their development of reflexivity were extracted from their e-Portfolios for qualitative analysis.

*Results***:** 289 students completed both the pre- and post-survey. The e-Portfolio enhanced reflexivity for 54% of students, 38% perceived that their reflexivity had decreased and 8% had no change between their pre and post scores. Qualitatively the students found the process of developing reflexivity to be positively challenging. They cited reflection on communication skills, using contemporary media, interprofessional reflection and cultural responsiveness as key elements learnt through the reflective process of the e-Portfolio.

*Conclusion:* A nuanced approach to interpreting the results is important as even those who seem to have become less reflexive may have realised that they were less so after engaging in reflective practice. With the right resources, technology and support the findings attest to the value and merit of e-Portfolios in developing reflexivity amongst tertiary interprofessional health science students.

**Keywords**

Communication skills, allied health, health science, e-Portfolios, reflective practice, interprofessional education

**Cover Page Footnote**

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## Introduction

In accordance with accreditation requirements and employers' expectations, health-science graduates from university must have high-level oral and written communication skills (Dune et al. 2016; Robles 2012). Research indicates that 60% of employers report that new employees do not regularly meet workplace demands for skilled communication, a 10% increase from 2012 (Yale 2014; Leggett 2013). Unsurprisingly, 75% of employers want tertiary institutions to better develop students' communication as a life skill (Yu 2011) for employment, especially in health, medicine and nursing (Bridgstock 2009; Leggett 2013). University undergraduate programs need to "develop courses, assignments and experiential learning opportunities for students to learn and practice their communication skills in innovative, engaging and real-life practical scenarios" (Stephenson 2001).

### *Communication skills*

The importance of communication in the clinical health sciences is formally acknowledged (Laidlaw & Hart 2011; Molinuevo et al. 2011). Laidlaw and Hart (2011) describe clinical communication as occurring between health professionals or between health professionals and patients, via any medium, oral or written. A general model sees communication as information transfer (a message; data), from one party (sender) to another (receiver) via any channel: verbal (words) or nonverbal (symbols, images, gestures, "body language", other cues or sensory data) from which meaning or a message might be interpreted, and transmitted in any format, with reception immediate or delayed. Communication can be two-way (a dialogue, with sender and receiver roles alternating) or one-way (for example, when someone reads a document, in which case the document author becomes the message sender and the reader the receiver). Communication consists of content (what is said) and expression or style (how it is said). If communication is effective the receiver will comprehend the message in the manner intended by the sender. Barriers to communication include the sender being prevented from generating the message (for example, when a patient cannot speak) or the receiver from accepting it (when a patient cannot hear); difficulties with the medium of transmission (such as an unreliable telephone connection, or two people speaking different languages); or incompleteness of information (such as the absence of non-verbal cues or audible expression in written messages). Overcoming these barriers requires specific skills in formulating, sending, receiving and interpreting messages.

Effective communication in turn enhances healthcare effectiveness. Ineffective communication leads to misunderstandings that threaten relationships, including therapeutic relationships essential to healthcare. Societies consisting of diverse populations are prone to cultural barriers such as linguistic incompatibilities, or senders and receivers not sharing or understanding each other's social conventions, which compromises interpretation. That cultural barriers to effective communication happen at all shows that communication conventions are culturally defined. They may hinder effective communication even among people speaking the same language.

People with strong communication skills are consciously aware of communication's complexity and factors influencing its effectiveness. Skilled communicators will, through personal reflection, recognise how the quality of their own communication efforts is affected by cultural and other factors. They will adjust and adapt their message content and expression and their approach to interpreting others' communication to overcome barriers. Health professionals' access to education places them in a better position to make these adjustments than many of their patients and clients, who may have lacked educational opportunities.

Within densely packed health-science curricula, educators and students may struggle to make time for the reflective processes involved in developing communication skills, or to see their relevance

and applicability (Plaza et al. 2007). Despite these constraints, tertiary teachers are employing creative and innovative teaching methods to improve students' communication skills (Holston & O'Neil 2008; Lanning et al. 2011). Methods include didactic and rote learning, role-plays and vivas, situational online gamification and e-portfolios (Dune et al. 2016). These approaches enable students to reflect on how they communicate with others, and how the students' communication may affect the health and wellbeing of their patients or clients.

### *Reflective practice*

Central to developing communication skills is the ability to reflect. Reflection is central to health-science students' fulfilment of professional competencies. Dewey, Kolb and Schön are among the foundation writers about reflection (Moon 2004). From a psychological and educational perspective, Dewey described reflection as a process of deliberate and deep consideration directed towards a rational, empirical basis for belief. Schön developed reflection in nursing education, seeing it as an alternative to traditional educational strategies (Timmins 2008). Kolb established reflection within a four-stage model of experiential learning (Stevens & Cooper 2009).

Bourdieu (2003) argued that to "know the world better" one must "know oneself better". As societies grow increasingly multicultural, practitioners must self-assess. Through scrutinising one's own world view, identity and practices, one can replace a singular world view with a multiplicity of perspectives. Oandasan and Reeves (2005) cite Schön's theory of reflective practice, which asks health-care practitioners to engage with "confusing problems which defy technical solutions" (p.3). As explained by Oandasan and Reeves (2005), reflection has a crucial role in health-science education:

> Through self and group reflective exercises, within safe learning environments, students may begin to develop the reflective skills necessary for developing an appreciation and understanding of each other's roles, their unique backgrounds and the professional perspectives on clinical decision making that ensures each profession is distinctive…. Reflection can only occur if opportunities are provided… that expose students to issues that they must grapple with.

In line with calls (Pecukonis et al. 2008) for innovative ways to develop communication skills in health-science students, an e-portfolio assessment was developed and evaluated using quantitative and qualitative methods. The project aimed to establish whether this new assessment framework improved self-reflection directed at developing communication skills among tertiary health-science students at a large Australian university.

### *E-portfolios in higher education*

An e-portfolio (also known as an electronic portfolio, digital portfolio or online portfolio) is a collection of digital information compiled and organised by a student user, and usually stored on an internet repository, such as an online learning system, from which the portfolio can be shared with other students or with educators. Student-creators continually add to their e-portfolio, adding hyperlinks to cited works and sharing personally authored works such as text, images, multimedia (video and audio, either received or personally authored), original blog entries and hyperlinks. The information may consist of objective factual material or more personalised, subjective content.

E-portfolios have been used educationally, particularly in colleges or universities, since the mid-1990s to encourage learners to reflect on their skills and clinical practice (Bahous 2008). Assessment

of the e-portfolio is possible, yet often optional. E-portfolios differ from other modes of collecting and presenting similar information in that their online nature reflects contemporary modes of consuming, creating and engaging with media and interacting with other users who share similar interests; students' need to negotiate professional expectations and their professional identity in public forums; and increased agency related to the creation and management of an evolving artefact extending beyond one's graduation.

Existing work confirms the role of e-portfolios in developing metacognitive knowledge through increased reflective practice, lifelong adult-learning principles, reflexivity and professional portfolios for future reference. Chitpin and Simon (2009) and Nevin et al. (2009) explored pre-service teachers' formation of professional identity through reflective practice collated in an e-portfolio. Upon the e-portfolio's completion and up to one year afterwards, the teachers considered that the e-portfolio had helped them develop and retain their reflective skills. While these e-portfolios were developed and reviewed through structured processes with instructors and peers, they did not contribute to the students' grade. Chitpin and Simon (2009) note the controversy surrounding whether reflective texts should be assessed. For instance, questions remain about whether compulsory curricular work as part of a study to determine an increase in reflexivity results in student bias towards giving positive answers when being assessed. Even given this contention, most of the research identified in the literature search for the current study found that e-portfolios supported the development of self-reflection and ongoing reflective practice, although the process was not always smooth. Many students across disciplines and countries found their e-portfolio hard to use (Plaisir et al. 2011) and their tutors demonstrated limited ability to teach them how to create one (Plaza et al. 2007; Vernazza et al. 2011).

Although e-portfolios have been successful in helping students develop reflexivity in various learning contexts and disciplines, we decided to examine whether this teaching innovation would similarly benefit our undergraduate health-science students' self-perceived communication skills. We focused on communication skills as professional competencies inseparable from reflexivity (Arnold & Boggs 2015), but they are difficult to both teach and assess using methods such as didactic and multiple-choice exams. After developing and piloting an assessable individual e-portfolio, we investigated whether students' ability to reflect improved and how the results of this investigation could inform teaching methods.

## Methods

### *Teaching context*

The project occurred within a first-year interprofessional health-science unit, Communication in Health. The unit is taught to approximately 600 students per semester across 11 disciplines including paramedicine, physiotherapy, occupational therapy, personal development and health-promotion education, health science, health promotion, therapeutic recreation, public health, sport and exercise science, podiatry and health-services management. The unit is designed to develop students' written and oral communication skills in preparation for work within the health professions across these areas. Communication skills addressed include those needed to form therapeutic relationships with individual clients and groups, as well as skills required to communicate health information to clients and groups in a wider, multicultural community. The unit also develops students' communication skills for working effectively with professional colleagues. Instruction includes a one-hour lecture, a one-hour tutorial, an online learning portal with resources and activities and two assessments in addition to the e-portfolio (an individual interview and reflective essay on students' communication skills worth 20% and an interprofessional group case review, management plan and individual

reflection worth 30%). The unit structure and tasks were developed to support the following unit learning outcomes:

1. Critically analyse and evaluate the characteristics of health-professional relationships with clients, colleagues and the wider community; and the importance of communication in these relationships.
2. Reflect on their personal attitudes, beliefs, values, communication strengths and weaknesses and how these aspects affect their own communication.
3. Apply in practice essential verbal and written communication skills appropriate for interaction with individual clients, consumers, significant others, colleagues and industry representatives.
4. Describe communication skills and processes related to group health-promotion contexts.
5. Analyse and apply strategies to adapt communication processes to meet the varying health-literacy or special needs of clients, family and significant others.
6. Examine the impact of culture on communication.
7. Explain the ethical issues related to formal and informal communication processes in the health setting.
8. Employ teamwork skills relevant to working in health-care settings.
9. Describe the specific issues encountered when working with vulnerable people.
10. Articulate verbal and apply written communication skills necessary for professional presentations.

### *Teaching innovation*

The e-portfolio was one of three assessments within the unit, worth 50% of students' overall mark. It replaced a multiple choice exam worth 50%, as students, tutors and lecturers considered that the exam did not engage students with the essence of communication in their specific discipline areas, and that it inadequately supported reflexive practice. The e-portfolio was designed to catalyse holistic reflective practice, reinforce individual learning styles and promote agency in learning.

The e-portfolio, created using Wordpress, asked students to reflect on their own communications in the context of 12 topics related to communication in health and aligned with the weekly unit content. The topics were: 1) Communication theory – sender, channel, receiver; 2) Types and styles of communication; 3) Barriers and enablers to communication; 4) Active listening; 5) Empathy in communication; 6) Interviewing skills in therapeutic relationships; 7) Communicating with others from a different cultural background; 8) Communicating with clients who have a disability; 9) Ways of working in an interprofessional team; 10) Management styles and communication conflicts; 11) Written communication; and 12) Managing motivation. Reflections on each topic required students to analyse and apply academic evidence specific to their profession, and explore how they might reproduce those clinical behaviours and skills to better address the needs of their clients, patients or community (see Barrett 2012).

Prior to the start of the semester, tutors for the unit were briefed on the e-portfolio goals, features and structure, marking criteria and set-up, and how to support students in developing reflective practice. In the first week of the teaching semester the unit coordinator (TD) and the tutors introduced students to the e-portfolio, along with the other assessment and engagement requirements of the unit. Students were provided with support in the development of their e-portfolios from their unit coordinator (TD), who created a template e-portfolio and guidelines to assist students, and gave a lecture on the development of reflective practice and how it could be applied to the students' e-portfolios. Students were also provided with additional resources and tips developed by one of the

unit tutors, who was also the research assistant for this project (KCG). She created instructional videos and provided links to other resources (readings, videos, templates) on how to structure, prepare and develop e-portfolios. During their weekly tutorials, tutors reviewed students' progress and provided feedback and guidance.

Whilst the e-portfolio was itself an act of communication, its content was also about communication. As implemented, the e-portfolio encouraged students to develop content such as their own short videos, or images of themselves communicating, to demonstrate their understanding of each topic. By engaging students in self-initiated and self-directed learning, the e-portfolio task was intended to heighten engagement with unit content and improve students' critical-thinking ability. As a result, it was anticipated that students would better understand the process of reflection in clinical and professional practice (reflexivity), and continue reflective practice across their academic and professional careers. As discussed by Chitpin and Simon (2009) and Chetcuti et al. (2011), students were encouraged to maintain their communication e-portfolio throughout their studies and into their professional careers.

### *Data collection*

To evaluate students' development of self-reflection, this study adapted the Groningen Reflection Ability Scale (GRAS) (Table 1). Authors TD and JB reviewed each item, and amendments were made to align with Australian writing conventions and to make some items less specific to clinical work and more applicable to the health sciences generally. The GRAS is a one-dimensional practical measurement instrument that contributes to inferences about the personal reflection ability of health-science students and health practitioners, at both the individual and group levels. This self-report scale emphasises reflection related to respondents' ability to empathise and communicate with others (Aukes et al. 2007). Responses were recorded on five-point Likert scales ranging from Strongly disagree (1) to Strongly agree (5), with Neutral (3) the central value. Demographic and open-ended questions were added.

**Table 1. Original and adapted Groningen Reflective Ability Scale**

| Original items | Adapted/added items (italicised) |
|---|---|
| 1. I want to know why I do what I do. | *1.* I want to know why I do what I do. |
| 2. I am aware of the emotions that influence my behavior. | *2.* I am aware of the emotions that influence my behaviour. |
| 3. I do not like to have my clinical decisions discussed. | *3. I am comfortable with receiving feedback on my performance.* |
| 4. I do not welcome remarks about my personal functioning. | *4. I welcome comments about the effectiveness of my communication.* |
| 5. I take a closer look at my own habits of thinking. | *5. I reflect on my own habits of thinking.* |
| 6. I am able to view my own behavior from a distance. | *6. I can view my own behaviour from the perspective of others.* |
| 7. I test my own judgements against those of others. | *7.* I test my own judgements against those of others. |
| 8. Sometimes others say that I do overestimate myself. | *8. I evaluate my own ability to communicate effectively.* |
| 9. I find it important to know what certain rules and guidelines are based on. | *9. I want to know the basis of rules and guidelines for professional conduct.* |
| 10. I am able to understand people with a different cultural/religious background. | *10. I understand people with a different cultural or religious background to my own.* |
| 11. I am accountable for what I say. | *11. I accept responsibility for the effects of what I say on other people.* |
| 12. I reject different ways of thinking. | *12. I easily accept different ways of thinking.* |
| 13. I can see an experience from different standpoints. | *13. I attempt to interpret situations from a variety of perspectives.* |
| 14. I take responsibility for what I say. | *14. I accept responsibility for what I do.* |
| 15. I am open to discussion about my opinions. | *15.* I am open to discussion about my opinions. |
| 16. I am aware of my own limitations. | *16.* I am aware of my own limitations. |
| 17. I sometimes find myself having difficulty in illustrating an ethical standpoint. | *17. I sometimes find myself having difficulty in expressing my own ideas.* |
| 18. I am aware of the cultural influences on my opinions. | *18.* I am aware of the cultural influences on my opinions. |
| 19. I want to understand myself. | *19.* I want to understand myself. |
| 20. I am aware of the possible emotional impact of information on others. | *20.* I am aware of the possible emotional impact of information on others. |
| 21. I sometimes find myself having difficulty in thinking of alternative solutions. | *21.* I sometimes find myself having difficulty in thinking of alternative solutions. |
| 22. I can empathise with someone else's situation. | *22.* I can empathise with someone else's situation. |
| 23. I am aware of the emotions that influence my thinking. | *23.* I am aware of the emotions that influence my thinking. |
| | *24. I always know what to say in social situations.* |
| | *25. I have never offended anybody with my words or behaviour.* |
| | *26. I always manage social situations effectively.* |

The scale and demographics questionnaire was combined into a single survey administered online before students begin working on their e-portfolio (the *pre*-portfolio survey, during Week 1 of term) and after the completion of their e-portfolio (the *post*-portfolio survey, during Week 14). For quality assurance, three filler items, for which truthful high agreement is implausible, were embedded the post-portfolio survey: claiming to always know what to say in social situations, never offending anybody with words or behaviour, and always managing social situations effectively.

Pre- and post-portfolio surveys were matched by student identification numbers. The concluding summaries from those students consenting to participate in the research were extracted from their e-portfolios for qualitative analysis. These summaries asked students to reflect on:

1. The most challenging aspects of their journey of developing reflective profession-specific practice.
2. The most rewarding aspects of their journey of developing reflective profession-specific practice.
3. Three things that they learnt in the unit and will implement in their life and future practice.

Participating students were given an additional 5% towards their grade for the unit in appreciation of their time. The research was approved by the Western Sydney University Human Research Ethics Committee.

## Analysis

Statistical analysis was conducted using Statistica 7.1. Any missing responses for each student were filled using the mean of all valid responses from that student. Descriptive statistics were calculated for pre- and post-portfolio survey responses separately for all 23 questions and then averaged across all items to give a total score. All items were scored positively, as agreement with any item was considered to signify a reflective orientation. The statistical significance of the difference from pre to post was obtained using paired *t* tests with Bonferroni correction for the number of tests. Principal axis factor analysis was used to identify patterns with GRAS responses suggestive of underlying constructs accounting for correlations between responses. One-way ANOVAs were conducted to test for differences in the mean change in scores from pre- to post-portfolio surveys for gender, year of study and allied health discipline. Students' age was correlated with their scores for both surveys, and for the change from pre to post. Average results for filler items were compared with genuine items using a dependent *t* test.

Qualitative data resulting from students' concluding summaries was analysed thematically (Flick 2014). Emergent and substantive categories within participants' statements were identified in relation to the study's objectives. Our analysis focused on topical responses and coding particularly for word repetition, direct and emotional statements and discourse markers including intensifiers, connectives and evaluative clauses. Coding was done independently by authors TD and RF, who then discussed their coding before reaching a consensus on the final themes.

## Results

### *Quantitative findings*

A total of 523 university students were invited to participate in the initial, pre-portfolio survey at the start of the term. Enrolment attrition saw only 457 students invited to participate in the post-portfolio survey. Of these, 289 students completed both the pre- and post-portfolio surveys. The mean age across both surveys was 21.20 years. The majority of the cohort was female (67%). The sample

included a predominant number of first-year students (n = 258), with 14 second-year, 10 third-year and five fourth-year students. The sample consisted of students from occupational therapy (n = 75), physiotherapy (n = 50), paramedicine (n = 45), podiatric medicine (n = 39), therapeutic recreation (n = 29), health sciences (n = 21), personal development, health and physical education (n = 12), sports and exercise science (n = 6), traditional Chinese medicine (n = 5), medical science (n = 2), nutrition science (n = 2), veterinary science (n =1) and information technology (n = 1).

Table 2 compares descriptive statistics for the pre- and post-portfolio survey responses for all 23 statements from the GRAS, and the scale total. The mean scores for the pre-portfolio survey were initially high; they tended to be slightly higher in the post-portfolio survey. Fifty-four percent of students increased their mean score on all items from pre to post, 38% lowered their score and 8% showed no change. Percentage agreement reduced slightly from pre to post. However, few items showed significant change, especially after Bonferroni adjustment. Significant improvement occurred for welcoming comments about effectiveness of communication, reflecting on habits of thinking and being open to discussion about opinions. Students scoring lower on pre-portfolio survey items tended to increase their score on post-portfolio survey items compared with students initially scoring higher ($r \geq .54$, all $p < .001$).

Change in mean scores from pre to post showed no significant differences between genders ($p = .843$), first-year compared with higher-year students ($p = .257$) and those in allied health disciplines ($p = .668$). Correlations showed that student age was unrelated to either pre and post survey scores or change between pre and post ($r \leq .06$, all $p \geq .342$, N = 288).

Table 2 also shows the percentages of students responding *Agree* or *Strongly Agree* for each GRAS item, and averaged across all items. The mean results show high levels of agreement. The overall conclusion is that scale scores and levels of agreement were high initially, leaving not much scope for improvement. Significant increases tended to occur with initially lower scores, such as in items 5 through 8.

**Table 2. GRAS descriptive statistics for pre- and post-portfolio surveys**

| Item | Statement | Pre-portfolio survey N = 289 | | | | Post-portfolio survey N = 289 | | | | *p* value for means |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | SD | 95% CI | Agree | Mean | SD | 95% CI | Agree | |
| 1. | I want to know why I do what I do. | 4.20 | 0.75 | 4.11-4.28 | 85% | 4.19 | 0.77 | 4.10-4.28 | 83% | .951 |
| 2. | I am aware of the emotions that influence my behaviour. | 4.18 | 0.65 | 4.11-4.26 | 90% | 4.25 | 0.60 | 4.18-4.32 | 93% | .152 |
| 3. | I welcome others' comments about the effectiveness of my communication. | 4.18 | 0.70 | 4.10-4.26 | 88% | 4.24 | 0.62 | 4.17-4.31 | 92% | .137 |
| 4. | I welcome comments about the effectiveness | 4.14 | 0.71 | 4.06-4.22 | 88% | 4.26 | 0.59 | 4.19-4.32 | 94% | .006* |

| Item | Statement | Pre-portfolio survey N = 289 | | | | Post-portfolio survey N = 289 | | | | *p* value for means |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | SD | 95% CI | Agree | Mean | SD | 95% CI | Agree | |
| | of my communication. | | | | | | | | | |
| 5. | I reflect on my own habits of thinking. | 3.89 | 0.75 | 3.80-3.97 | 76% | 4.11 | 0.68 | 4.03-4.19 | 85% | < .001** |
| 6. | I can view my own behaviour from the perspective of others. | 3.84 | 0.74 | 3.75-3.92 | 72% | 3.95 | 0.63 | 3.88-4.02 | 78% | .017* |
| 7. | I test my own judgements against those of others. | 3.66 | 0.74 | 3.57-3.74 | 61% | 3.76 | 0.71 | 3.68-3.84 | 67% | .047* |
| 8. | I evaluate my own ability to communicate effectively. | 3.98 | 0.73 | 3.89-4.06 | 80% | 4.10 | 0.63 | 4.02-4.17 | 85% | .016* |
| 9. | I want to know the basis of rules and guidelines for professional conduct. | 4.31 | 0.66 | 4.23-4.39 | 90% | 4.26 | 0.63 | 4.19-4.33 | 91% | .258 |
| 10. | I understand people with a different cultural or religious background to my own. | 4.26 | 0.69 | 4.18-4.34 | 87% | 4.27 | 0.61 | 4.20-4.34 | 92% | .800 |
| 11. | I accept responsibility for the effects of what I say on other people. | 4.31 | 0.63 | 4.24-4.38 | 92% | 4.31 | 0.61 | 4.24-4.38 | 94% | .937 |
| 12. | I accept different ways of thinking. | 4.28 | 0.65 | 4.21-4.36 | 91% | 4.34 | 0.61 | 4.26-4.41 | 94% | .206 |
| 13. | I attempt to understand situat ions from a variety of perspectives. | 4.16 | 0.66 | 4.08-4.24 | 87% | 4.22 | 0.67 | 4.15-4.30 | 89% | .132 |
| 14. | I accept responsibility for what I do. | 4.47 | 0.60 | 4.40-4.54 | 96% | 4.38 | 0.60 | 4.31-4.45 | 95% | .019 |
| 15. | I am open to discussion about my opinions. | 4.12 | 0.74 | 4.04-4.21 | 82% | 4.25 | 0.66 | 4.17-4.33 | 90% | .005* |
| 16. | I am aware of my own limitations. | 3.96 | 0.69 | 3.88-4.04 | 80% | 4.00 | 0.68 | 3.92-4.08 | 83% | .409 |
| 17. | I sometimes find myself having difficulty in | 3.44 | 1.01 | 3.32-3.56 | 53% | 3.46 | 1.03 | 3.34-3.58 | 57% | .717 |

| Item | Statement | Pre-portfolio survey N = 289 | | | | Post-portfolio survey N = 289 | | | | *p* value for means |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | SD | 95% CI | Agree | Mean | SD | 95% CI | Agree | |
| | expressing my own ideas. | | | | | | | | | |
| 18. | I am aware of the cultural influences on my opinions. | 4.10 | 0.73 | 4.01-4.08 | 84% | 4.14 | 0.68 | 4.06-4.22 | 86% | .372 |
| 19. | I want to understand myself. | 4.33 | 0.72 | 4.24-4.41 | 87% | 4.40 | 0.71 | 4.32-4.48 | 91% | .100 |
| 20. | I am aware of how my words and actions affect other people emotionally. | 4.24 | 0.74 | 4.15-4.32 | 88% | 4.29 | 0.62 | 4.22-4.36 | 94% | .249 |
| 21. | I sometimes find myself having difficulty in thinking of alternative solutions. | 3.10 | 0.95 | 2.99-3.21 | 38% | 3.20 | 1.00 | 3.08-3.32 | 43% | .153 |
| 22. | I can empathise with someone else's situation. | 4.29 | 0.69 | 4.21-4.37 | 92% | 4.35 | 0.63 | 4.28-4.43 | 92% | .126 |
| 23. | I am aware of the emotions that influence my thinking. | 4.07 | 0.75 | 3.98-4.15 | 84% | 4.14 | 0.64 | 4.06-4.21 | 89% | .147 |
| | Average across all 23 GRAS items | 4.06 | 0.37 | 4.02-4.11 | 81% | 4.12 | 0.35 | 4.08-4.16 | 75% | .002* |

* $p$ <.05, unadjusted for 24 tests

** $p$ < .05 after Bonferroni adjustment for 24 tests

The mean score on filler items was 3.15 ($SD$ = 0.75), which was significantly lower than the mean across all post-portfolio survey items ($p$ < .001, N = 288). The difference in means between filler items and genuine survey items amounted to 0.97 scale intervals, suggesting that students were considerably less likely to agree with the contrived filler items than with GRAS items about reflexivity.

Principal axis factor analysis on the pre-portfolio survey identified two factors with eigenvalues of more than 1, with only the first factor accounting for a sizeable proportion of variance. All GRAS items except items 17 and 21 loaded onto this factor. This result was reproduced almost exactly with the same analysis on the post-portfolio survey items, with a single factor emerging, and comprising all items except 17 and 21 (Table 3).

**Table 3. Principal axis factor loadings on GRAS items and explanation of variance in the pre- and post-portfolio surveys**

| Item | Statement | Pre-portfolio survey | | Post-portfolio survey |
|---|---|---|---|---|
| | | Factor 1 loadings | Factor 2 loadings | Factor 1 loadings |
| 1. | I want to know why I do what I do. | .32 | .40 | .42 |
| 2. | I am aware of the emotions that influence my behaviour. | .55 | .17 | .54 |
| 3. | I welcome others' comments about the effectiveness of my communication. | .55 | .04 | .61 |
| 4. | I welcome comments about the effectiveness of my communication. | .58 | .15 | .62 |
| 5. | I reflect on my own habits of thinking. | .52 | .04 | .61 |
| 6. | I can view my own behaviour from the perspective of others. | .57 | -.07 | .50 |
| 7. | I test my own judgements against those of others. | .37 | .07 | .41 |
| 8. | I evaluate my own ability to communicate effectively. | .61 | -.08 | .67 |
| 9. | I want to know the basis of rules and guidelines for professional conduct. | .53 | .17 | .53 |
| 10. | I understand people with a different cultural or religious background to my own. | .59 | .04 | .62 |
| 11. | I accept responsibility for the effects of what I say on other people. | .50 | .06 | .56 |
| 12. | I accept different ways of thinking. | .57 | .01 | .64 |
| 13. | I attempt to understand situations from a variety of perspectives. | .65 | -.01 | .60 |
| 14. | I accept responsibility for what I do. | .57 | .04 | .58 |
| 15. | I am open to discussion about my opinions. | .56 | -.02 | .56 |
| 16. | I am aware of my own limitations. | .47 | -.03 | .41 |
| 17. | I sometimes find myself having difficulty in expressing my own ideas. | -.15 | .67 | .01 |
| 18. | I am aware of the cultural influences on my opinions. | .58 | .09 | .50 |
| 19. | I want to understand myself. | .43 | .36 | .46 |
| 20. | I am aware of how my words and actions affect other people emotionally. | .48 | -.04 | .51 |
| 21. | I sometimes find myself having difficulty in thinking of alternative solutions. | -.05 | .63 | -.01 |
| 22. | I can empathise with someone else’s situation. | .54 | .13 | .56 |
| 23. | I am aware of the emotions that influence my thinking. | .54 | .02 | .57 |
| | Explained variance | 26% | 6% | 28% |

### *Qualitative findings*

Four themes were aligned with the open-ended questions posed to students in relation to their development of reflexivity through their e-portfolios: challenges, rewards, lessons for the future and maturity.

*Challenges*

"Learning to reflect" (therapeutic-recreation student) and the process of self-reflection were "daunting" (Paramedic student) experiences. One student wrote:

> *One of the most challenging aspects of this journey of developing reflective practice was critiquing and identifying personal shortcomings, as well as possible causes behind them. I found this to be very confronting.* (Occupational Therapy student)

Students connected their challenges with developing reflexivity to evidence-based models for reflection, even though this was not explicitly required.

> *The most challenging aspects of communication is self-reflection with the use of the Johari Window. It can be difficult to review and assess yourself. Having to reflect on experiences and determine areas of improvement can prove difficult as they may be "unknown" to our self.* (Podiatry student)

Developing reflexivity helped with the challenge of understanding the role of social and cultural experiences and identities, and what they imply for health care.

> *The most challenging aspects of developing reflective profession-specific practice for an OT is understanding that everyone comes from different cultural backgrounds and upbringings. This means that even though one approach is effective for one individual, it does not mean it works for another.* (Occupational Therapy student)

> *The most challenging aspect of my journey with developing effective communication in physiotherapy was accepting difference and communicating with other people who have different cultures and values. However, I now know the significance of accepting difference and how this will empower the patients/people.* (Physiotherapy student)

Managing the technology was challenging for some students. For these students, "creating the e-portfolio was difficult", as it required that they "first familiarise [themselves] around the website" (Health service management student). Even so, "with practice [students] could get better and improved". One student wrote:

> *The most challenging aspect of my journey was creating the e-Portfolio using WordPress as I have no IT background. I had to watch many tutorial videos to assist with navigating around WordPress to create the e-Portfolio.* (Personal Development, Health and Physical Education student)

The technology encouraged the "refinement" of skills and provided an "opportunity for creativity" (Physiotherapy student). Other students also reflected on their experience with developing e-resources as challenging, but found that developing their e-portfolio improved their perception of online communication.

> *This website has been the first time I have developed a website, which has been challenging and rewarding to have learnt how to make a basic website. I can see the huge benefits of having a website and being able to communicate with so many people.* (Podiatry student)

> *I had not created a social networking website related to my chosen profession before…. I initially struggled with preparing its contents and development…. Even though this experience was challenging for me, I saw the advantages of social media that will highly benefit me in the future.* (Paramedicine student)

*Rewards*

Although students found the development of reflective practice and reflexivity challenging, they saw the rewards of the e-portfolio. They wrote that developing reflexivity encouraged a deeper understanding of "oneself", the relevance of "effective communication" in real life and professional practice and the importance of "technologies" in modern life.

> *Doing self-studies on each topic and being able to reflect...on my future career was one of the biggest reward[s] I have gained throughout this e-portfolio.* (Physiotherapy student)

> *Because of this reflection…I am better aware of both my weaknesses and my strengths. I am also able to see improvements in my communication skills. I find this to be very rewarding.* (Traditional Chinese Medicine student)

While the students developed a better understanding of reflection in communication with clients and patients, they also found it rewarding to develop their ability to reflect on their interactions with their interprofessional peers and colleagues.

> *The most rewarding aspect of this journey was communicating with a variety of students who come from different disciplines, and having a tutor that passed his knowledge and experiences to me that made me a better person.* (Podiatry student)

*Lessons for the future and maturity*

In the process of developing their e-portfolios, students identified lessons for the future that they will carry into their future lives and careers. For some students these lessons increased their perceived maturity.

> *I will implement the use of interview skills that I have learnt to create comfort and trust when interacting with other individuals. Through the e-portfolio, I have developed certain skills that have helped me to mature not only as a future health professional but as an individual, and am thankful for the information obtained.* (Therapeutic Recreation student)

Students demonstrated maturity in learning to think about, learn about and respect others.

> *I have learnt about cultural sensitivity, and with this, I aim to learn about more cultures and their social norms. With the knowledge that I learn, I will then implement it into my professional and social life.* (Occupational Therapy student)

In summary, students valued the e-portfolio as a means for developing reflexivity and reflective practice. The e-portfolio enabled students to feel more aware and competent about themselves, and to discern their areas of strength and areas for improvement.

## Discussion

This project evaluated students' development of reflexivity by engaging in an individually assessed e-portfolio within a large, interprofessional, first-year health-science unit, Communication in Health. Scores on the GRAS measure of reflexivity were initially high, limiting the scope for improvement. The three scales that showed significant improvement after adjustment for the number of tests concerned willingness to evaluate and reappraise one's own communication performance, which is an encouraging finding for the e-portfolio. That students' mean scores tended to increase whilst their percentage agreement tended to decrease from the pre- to post-portfolio surveys suggests that ratings among students scoring at lower levels tended to improve more, whilst those initially scoring higher showed smaller increases in their scores. Aside from the limited (five-point) range on GRAS items, this result could be explained by lower-scoring students gaining reflective awareness, and higher-scoring students moderating their self-appraisal – which, paradoxically, could indicate more awareness of their own limitations. Results suggest uniformity in mean responses across the tested demographic categories. The lower mean result for the filler items compared with genuine GRAS items argues against a major influence of social desirability on responses.

Factor analysis suggests that responses to the GRAS scale are patterned on the basis of a single underlying dimension that might reasonably be labelled *reflexivity*. Thus there is an underlying unity with the GRAS scale as implemented for our sample. The exceptional items (17 and 21), which were about difficulty in thought and expression, elicited lower agreement in both surveys, indicating possible reluctance to acknowledge perceived shortcomings expressed in this way.

Students in this study found the process of developing reflexivity to be positively challenging, as it helped them better understand themselves and the relevance of effective communication in their lives outside university and their professional career. Pelliccione and Raison (2009) highlight that students who engage in reflexivity through an e-portfolio become better practitioners. Barrett (2000) notes that the reflexive nature of the e-portfolio is innovative, making it different from an online presentation or an upmarket resume without any real presence, context or identity (see also Abuzaid et al. 2017).

For the 38% of students who reported a decrease in reflexivity, a nuanced interpretation is needed. The incremental magnitude of the average change – only a small fraction of a rating-scale interval – could reflect unfavourably on the learning activity's effectiveness. Attitudes and dispositions developed over a person's formative years may be difficult to reverse in a short-term learning activity. Initial high scores allow little scope for improvement. Results may indicate that the instrument lacks responsiveness to the type of change initiated by the learning activity, even though changes in scores showed a relationship with initial scores. Similar conclusions have been made in interprofessional education studies where movement from pre to post reflects modest improvement or inverse movement (Murphy & Nimmagadda 2015; Hayashi et al. 2012; Olson et al. 2016). If so, reductions in students' post scores could represent progress in reflexivity, with the lower scores reflecting awareness of one's limitations in a way that they could not have imagined earlier.

Thematic analysis of responses to open-ended questions showed that the creation of an e-portfolio provided insight to the way health-science students learn and perceive ways they can apply critical thinking, reflexivity and communication competencies in their career and other aspects of life. Students perceived self-reflection as one of the major benefits of an e-portfolio. This is an important endorsement for e-portfolios and their potential relevance to the development of communication skills that meet industry requirements. E-portfolios satisfy the ever-increasing expectation from industry that students should be able to transfer their knowledge and competencies into professional skills that can be applied within the workforce (David et al. 2001). Industry-relevant skills include the ability to engage, manipulate and manage technology (Ledoux & McHenry 2006) – a skill that some students in this study reported as challenging. Whilst such a challenge should not deter educators or students from using e-portfolios to develop students' reflexivity, adequate technological and professional support should be provided to students and staff.

Although much has been said about the professional relevance of e-portfolios and reflexivity, these educational interventions offer a way of exploring a creative space for individuals throughout their lives (Richter et al. 2009). As Cohn and Hibbitts (2004) point out, e-portfolios use the internet to integrate the personal, professional and creative and allow students to move from consuming media to creating it (Dune et al. 2016).

## Limitations

The five-point scale for GRAS items limits the capacity to record improvement for students already scoring highly, even if their initial high scores come from overestimating their reflexivity. Greater insight into reflexivity after the intervention could even bring a reduction in scores. Alternatively, reduced scores could indicate that e-portfolios are ineffective in promoting reflexivity: the interpretation of reduced scores is ambiguous.

The study design, being a single-group case series design, does not support strong causal inferences about the effectiveness of e-portfolios. A controlled trial involving either a no-intervention group or an alternative intervention as a comparison condition, preferably with random allocation, is scientifically preferable.

Despite the encouraging results from the comparison between genuine GRAS items and the filler items in this study, the self-report nature of the GRAS survey only enlarges the potential for biased responses. This may further be the case when reflective work is assessed, as it may bias students towards responding positively on evaluative surveys.

## Summary

The majority of students recorded increasing reflexivity after the e-portfolio intervention, although at the item level the changes were small and mostly non-significant. It cannot be claimed that the use of an e-portfolio greatly increased self-reported reflexivity. Other results attest to the educational value of the e-portfolio. The students found the process of developing reflexivity to be positively challenging. They cited reflection on communication skills, the use of contemporary media, interprofessional reflection and cultural responsiveness as key elements learnt through the reflective process of the e-portfolio. Students whose results showed a reduction in reflexivity may have more realistically appraised their reflexivity on the second survey than the first.

## Disclosure statement

The authors declare that there is no conflict of interest to report.

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