



Enhancement of scientific research and communication skills using assessment and ePortfolio in a third year Pathology course

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Abstract

While science students are often aware of their gain in scientific knowledge through their degree, the same cannot be said for their understanding of their development of generic skills. Often, such development is tacit, both for the students and the staff teaching them. ePortfolios have been used to address the important issue of professional skills building and career preparedness for undergraduate science students in several courses across two degree programs. This report focuses on a third year Pathology course, *PATH3205 Molecular Basis of Inflammation and Infection*, taken by students who typically focus on pathology at the University of New South Wales (Sydney, Australia). The overall teaching, learning and assessment strategy requires the students to engage in the use of an ePortfolio as part of their reflective learning process in developing life-long and life-wide skills in research thinking and writing which underpin research-intensive activities. The Mahara ePortfolio application was made available via Moodle and linked explicitly to a series of assessment tasks associated with current research activities in pathology. The study documented the responses of students to the use of ePortfolios and related learning activities, through both the recording of acquired skills and emerging understanding of the student perceptions of themselves as professionals from a generic skills perspective. These skills are ultimately transferable into professional scientific careers. This study was designed to further inform

the development of reflective practice, enhancement of generic skills and career awareness and readiness in a program-wide implementation in Medical Science and Advanced Science. Through that implementation we hope students will better understand their present and imagine their future.

Key words: Mahara, ePortfolio, Moodle, medical science, reflection, communication skills, research skills

Literature review

An ePortfolio is "a digitised collection of artefacts including demonstrations, resources, and accomplishments that represent an individual, group, or institution" (Lorenzo & Ittelson, 2005). It can be a digital repository for a range of learning materials, including those produced for course-based assessment such as videos, images and text based reflections and use any form of digital cloud space, such as Google Apps or developed spaces such as Mahara or PebblePad. ePortfolios have developed further from this repository of learning materials into personal digital spaces, student-centric monitors of learning across disciplines to document learning and put the student in a position where they can take charge of their own learning (Butler, 2006) through the selection of the artefacts for view or presentation to selected audiences. As ePortfolio presentations are planned and curated by students rather than by the educator, they start to play an active role in developing life-long skills of reflection and selection for students. ePortfolios are found in many areas of higher education from assessment to career development and provide evidence of acquired graduate capabilities. This reflection on learning has been found to facilitate both life-long and life-wide learning that enables the learner to comment on their collection of evidence (Cambridge, 2008).

The use of ePortfolios in Australian higher education is characterised by portfolios for learning, assessment, reflection (Abrami & Barret, 2005; Barrett, 2005; Barrett, 2006) and for professional development and graduate recruitment (Hallam et al., 2008; Leece, 2005). These studies have indicated that the development of an ePortfolio for learning and assessment is supported by the life-wide approach to the technology as students 'take' their learning with them after graduation, beyond assessment submissions, as a career development tool (Leece, 2005). ePortfolios can transform and enhance the curriculum and demonstrate to students and educators the connections between their learning, assessment criteria, program outcomes and graduate capabilities (Barrett, 2005). This clear alignment of assessment with learning outcomes encourages students to document their learning and consider how the course assessment relates to the program of study and how it can be used beyond the course, as a digital repository or collection space. ePortfolio thus constitutes a form of sustainable assessment as it enables students to present themselves in a number of ways, to a number of audiences, empowering them as learners in many instances.

The Role of Reflection, ePortfolio, Professional and Career Development

Recently in higher education, there has been a growing imperative to have a portable record of work undertaken across a number of areas of responsibility in a student's academic life for assurance of learning. An ePortfolio serves this purpose and several important functions with this in mind; it records past and current practice, provides opportunities for reflection upon practice to effect change, and acts as a change agent by enabling long-term ongoing evaluation of student performance and associated learning outcomes.

Career development learning, professional readiness and ePortfolios

Career development learning (CDL) is a process that "empowers individuals to identify, develop and articulate the skills, qualifications, experiences, attributes and knowledge that will enable them to make an effective transition into their chosen futures, and manage their careers as life-long learners, with a realistic and positive attitude" (Stanbury, 2005). It is both a trans-disciplinary process and a subject discipline with its own history, evidence base, theoretical frameworks and methodologies.

The goal of CDL is to help students to acquire knowledge, concepts, skills and attitudes which will equip them to manage their careers, therefore their life-long progression in learning and work (Watts, 2006). Although there are different theories and developmental approaches to careers education, the most widely used framework by career centres around the world is the 'DOTS' model (Fig. 1). The basic assumption underpinning this model is that effective career learning is composed of a dynamic relationship between Self, Opportunities, Decisions and Transitions (DOTS) (Watts, 2006). These four elements involve:

- Self-awareness - the ability to identify and articulate motivations, skills, and personality as they affect career plans
- Opportunity awareness - knowledge of opportunities and the ability to research these
- Decision making - being able to weigh up personal factors to make a sound plan
- Transition learning - understanding of how to seek and secure employment opportunities.

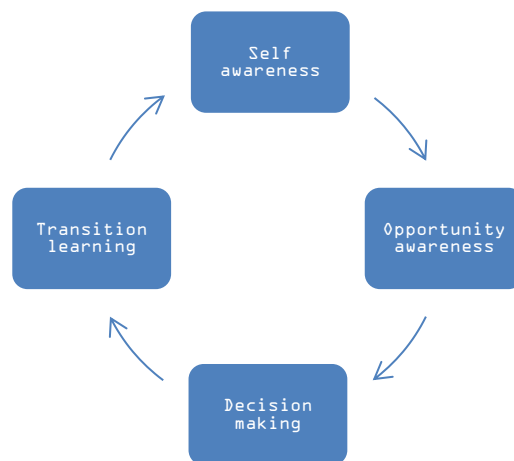


Figure 1: Decision Making, Opportunity Awareness, Transition Learning, Self-awareness (DOTS) model

These stages build iteratively upon each other so, ideally, a student moves through the cycle more than once during their course and is afforded the opportunity to do so.

As CDL requires the student to undertake self-assessment and perform an appraisal of the context of their learning in relation to their discipline, it lends itself to learning and teaching methods that require reflection (McIlveen et al., 2009). Boud, Keogh & Walker (1985) suggested that reflecting on learning is said to transform experience into learning as it allows opportunity for the student to reassess an experience and make decisions on how to change or improve on the learning outcomes. As Boud (2000) recommended, it also enables students to:

- identify their learning
- make judgments about their learning
- prepare them for learning

An ePortfolio enables students to document their journey through the DOTS model cycle. It is a space where they can collect their experiences, reflect on the connections between theory and practice and present evidence of development of their graduate attributes, so that upon graduation they are well situated to make a successful transition into their chosen employment.

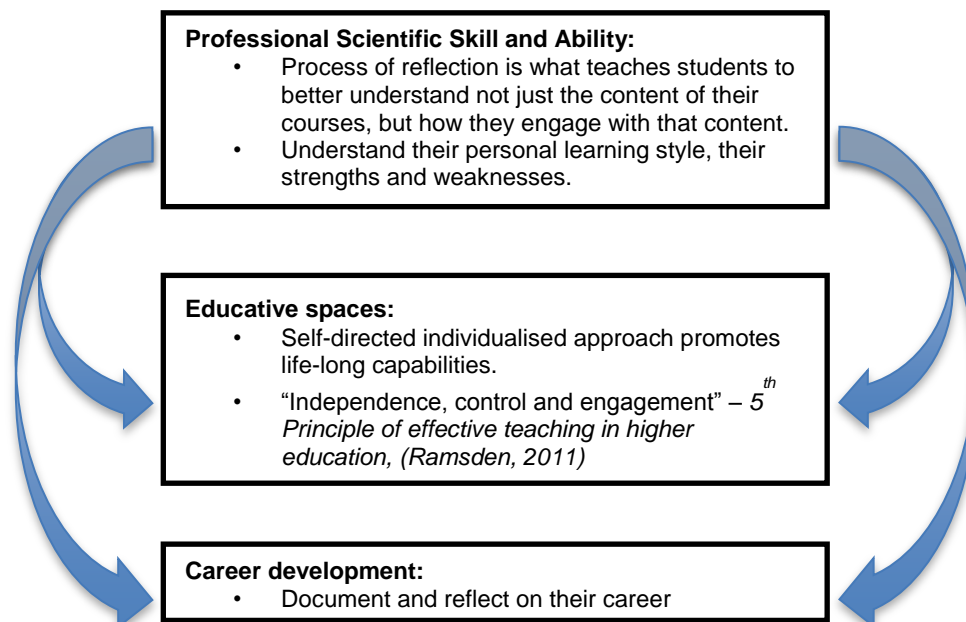


Figure 2: ePortfolio pedagogy and technology cycle

Study aims

This pilot study sought to engage 3rd year students, who are, for the most part, undertaking the Medical Science program, in reflection upon the relationships between their educational experiences in core courses, their personal and professional development, future career aspirations, aptitudes, and opportunities. The project focuses on making explicit the more tacit and deeper outcomes of developing an ePortfolio and highlights the interrelatedness of learning processes, knowledge and skills that the student gains throughout a science degree program. This study further sought to address the principal aim of exploring the often tenuous relationship in higher education between ‘hard’ and ‘soft skills’.

Program-wide context

The development of this project arose through the combined interests of teaching-research academics and career advisors at UNSW. Together we have identified opportunities to address the UNSW Graduate Capabilities through skills development and the introduction of ePortfolios (Fig. 3). This particular study is appropriately staged at Year 3 such that near-graduates, who will have developed professional skills and need to develop career pathway awareness, begin to reflect on their transferable and technical skills acquired throughout their undergraduate studies and address any weakness that might hinder their ability to achieve their career target. Together, these elements can help fortify student professional skills and career awareness by encouraging students to consider their developed skills and capabilities, work interest areas, career paths and decisions, employment opportunities and attitude for career success.

It is not enough, in times of evidence-based education practices, for students to claim at the end of their programs of study that they have achieved capabilities of scholarship, leadership, professionalism and global citizenry (Fig. 3). They are now required to substantiate such claims with clear records of achievement. ePortfolios offer the perfect opportunity to both record and enhance professional skills and tailor them to the workforce in which graduates will practice. Further, use of ePortfolio as part of the formal curriculum, through assessment, will enable the University to warrant, by proxy, claims of its graduate capabilities through the students’ own acknowledgements of achievement. This is particularly important when, at the Program level, it is difficult for the institution to provide such warranty.

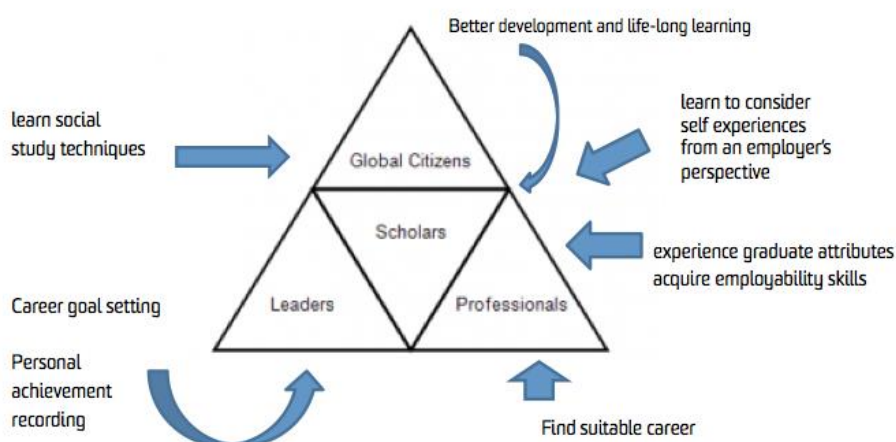


Figure 3: Demonstration of graduate capabilities and employability skills using an ePortfolio

In 2012, the Mahara ePortfolio platform was implemented to address the above-mentioned issues, as an extension to an ongoing pilot of the Moodle learning management system at UNSW. Mahara ePortfolio was introduced into a range of courses across the Advanced Science and Medical Science programs. Mahara was implemented in the Medical Science program from stages/years 1-4 in order to begin addressing a program-wide approach to skills building, professional readiness and career awareness. In Year 1/Stage 1, Semester 1 SCIF1111 *Perspectives in Medical Science* & SCIF1121 *Advanced Science: Professional Perspective and Practice* Mahara ePortfolio was applied to stimulate and record reflective practice, professional practice (skill development/enhancement) and to encourage greater connection with and between curricular elements. In Year 2/Stage 2, Semester 2, PATH2201 *Processes in Disease* /PATH2202 *Processes in Disease for Health and Exercise Science*, Mahara was introduced to further develop skills in reflective practice and writing. In Year 3/Stage 3, Semester 1, PATH3205 *Molecular Basis of Inflammation and Infection*, the focus of this report, the use of Mahara ePortfolio aligned with development in written and oral communication research skills, while in Year 3/Stage 3, Semester 2 PATH3208 *Cancer Sciences*, the alignment was explicitly with career readiness, to

be continued in Year 4/Stage 4 School of Medical Sciences Honours in the Advanced Science and Medical Science degree programs.

Study design

Course focus

The course *PATH3205 Molecular Basis of Inflammation and Infection* is a Stage/Year 3, Semester 1 subject offered to students across a range of degree programs across the Faculties of Science and Medicine at the University of New South Wales. This course was chosen as it has a wide breadth of authentic assessment tasks and is a key semester 1 course for the Pathology specialisation in Year 3. Two key assessment tasks, a research laboratory report and a research team presentation, were used to facilitate development of professional skills in written and oral research communication and career readiness in medical research, as part of the program-wide pilot study in the Medical Science degree described above (Fig. 4).

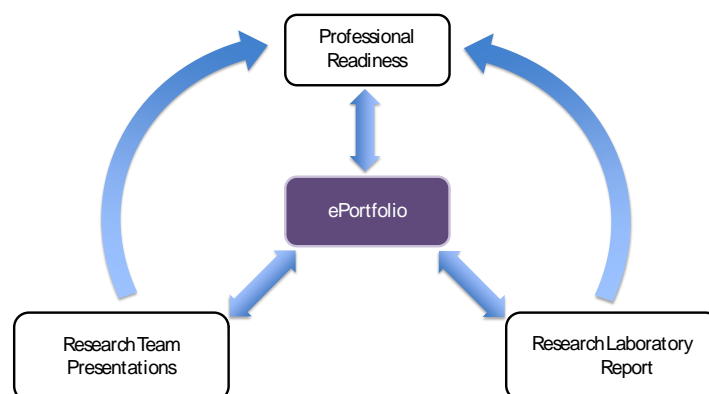


Figure 4: Professional skills development through authentic Assessment and reflection using an ePortfolio

Teaching and learning strategy

Students in PATH3205 attend lectures, which focus on the most recent research advances in molecular medicine, and then participate in workstation-based laboratory workshops, demonstrating 'state-of-the-art' molecular techniques that are key in disease diagnosis. Students are then assigned one of the research topics and asked to prepare a research laboratory report, documented in a standard scientific format: Introduction, Hypothesis, Aim, Methods, Results and Discussion. Students write up all eight topics in their ePortfolio and produce one full report. Students, in groups of 4-5, are also given a Pathology topic that they have to research, prepare and then deliver as a 15-minute presentation (including questions). As a team-based activity, all members must be prepared but only one delivers the presentation, the others having to answer questions. There is review of the presentation, including the ability to answer questions, by peers and academics, using an instrument in class, with a focus on content. Group membership is assigned on prior academic performance to provide balance within groups.

ePortfolio use and rationale

Students were asked to use the Mahara ePortfolio to document: 1. a narrative around the learning process shown through the research laboratory lectures and workshops, 2. demonstrate engagement, in a reflective manner, with that process, 3. build an awareness of their skills development, understand subject-related skills, personal values and relevance to their professional future, and 4. recognise strengths and weaknesses of the research laboratory and team presentations. The use of a digital portfolio space in this course encouraged these students to document and demonstrate their learning by building awareness of transferable and technical and professional skills required for different research areas in the field. The laboratory report writing task is authentic to research practice and offers a real world experience; it also allows students to think and write as reflective practitioners in determining their personal values, work experience, and strengths and weaknesses, through self-reflection upon learning across the many research laboratories and techniques presented as part of the PATH3205 course.

Study Outcomes

Our findings indicate that 3rd year medical science students engaged with the ePortfolio and used it to develop their reflective practice. The use of ePortfolio demonstrated that students could interrelate their learning process of content and research communication skills development, the integration of 'hard and soft skills' through the abovementioned assessment tasks. While exemplar quotes are provided below, more extensive excerpts have been included as Appendix 1. Entries in ePortfolios highlighted a range of the desired outcomes of the course and its processes, including skills development, particularly around research;

Overall, this research lab was helpful because it helped me think through the advantages and disadvantages of the different [research] models that are commonly used in scientific research. It also helped me to develop my problem solving skills as we were encouraged to think through how we might go about investigating a question in regards to asthma.

perception as professionals;

As an aspiring doctor that is always trying to improve my interpersonal skills, I really saw the value in this research assignment. The ability to be able to work in a collaborative group is also crucial to research and I feel this project helped develop those skills.

This informed my perception of research by extending my definition of research as gathering and synthesising relevant sources, and a continual process of self-reflection and asking questions, to obtain answers, which generated further questions. This project allowed me to think more about conveying the information I had helped to gather, as well as the idea of working as a team cohesively, supporting each other... and utilising the skills and abilities of our group members.

and career awareness;

I think this ultimately gave me a deeper understanding of the content. Also gave me something to show potential employers.

Survey and results

The survey tool was primarily career-oriented and considered to be appropriate to the Program-wide study. It was administered in Weeks 1 and 13 of semester, representing 'entry to' and 'exit from' the PATH3205 course. The items covered in the survey can be seen in Figure 5. Survey data were obtained prior to commencement of any course activities and pre-ePortfolio use (Fig. 5, blue bars) and upon completion of the core assessment tasks described above (Fig. 5, blue + red bars). The entry and exit data series were analysed for statistical difference using the IBM SPSS Statistics 21 package; difference was considered significant at $p < 0.05$. Our data shows that students significantly improved in self-confidence in areas relating to knowledge of degree-specific (technical) and transferable (non-technical) skills. Notably, students demonstrated a 12% improvement in self-confidence in knowing degree-specific skills ($p = 0.001$), suggesting that the linkage between content knowledge and important technical skills covered throughout the course is made explicit and this is also reflected in the course-oriented contributions in Mahara ePortfolios. Students also demonstrated a significant enhancement in knowledge of transferable skills ($p = 0.021$), indicating that the use of Mahara ePortfolios improved insight into the transferable generic skills gained throughout the course. Interestingly, students also showed significant increase in self-confidence in areas relating to career awareness, items 6 ($p = 0.003$), 7 ($p < 0.001$) and 16 ($p = 0.005$). While not part of the formal curriculum, it is speculated that raising such topics through the survey itself, or coverage of career-oriented topics in other courses, or participation in extracurricular activities, may have led to these effects; the basis for this change needs to be investigated further.

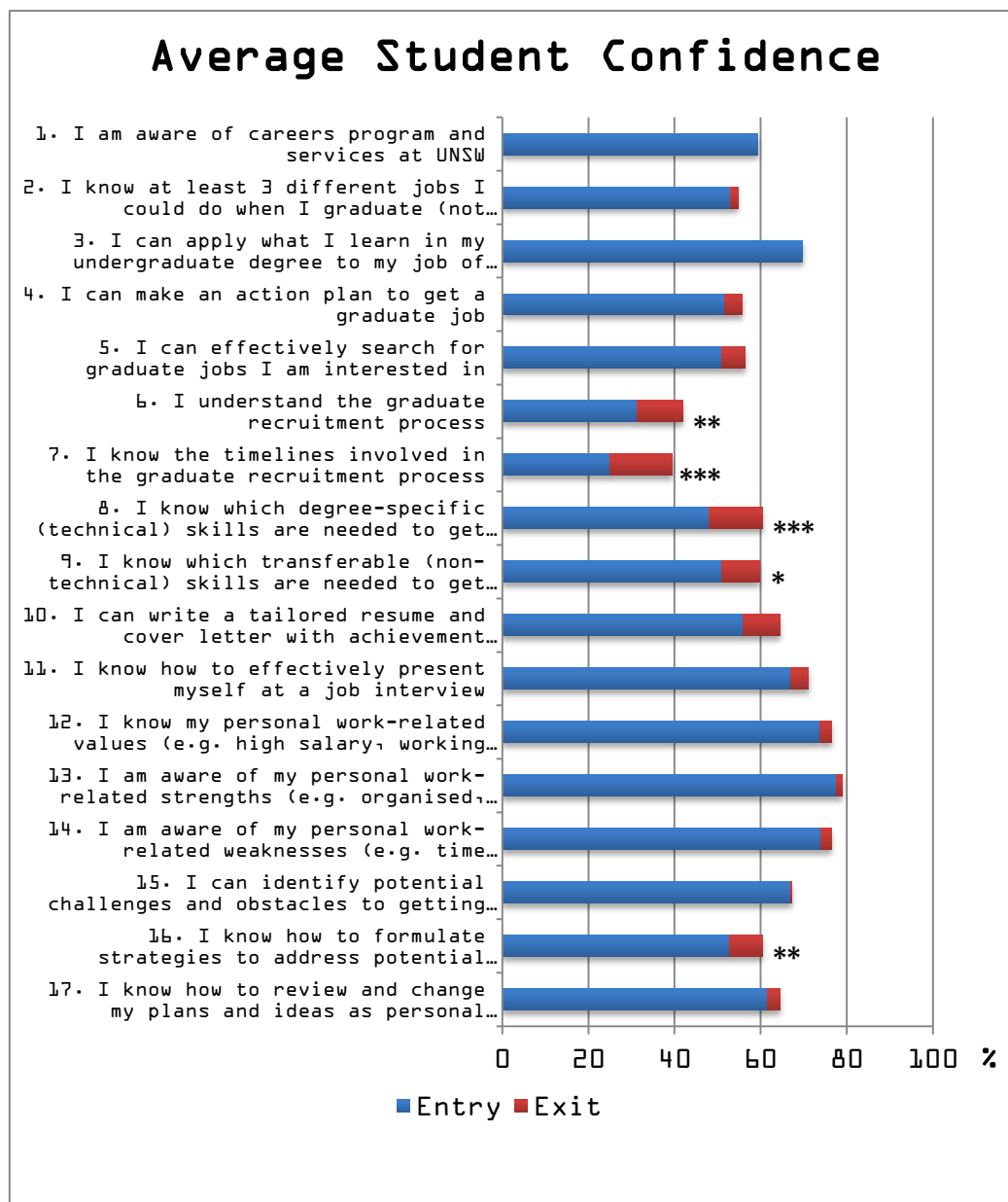


Figure 5: Improved confidence in technical skills, career awareness and professional readiness in PATH3205 students

Discussion

Although Medical Science and Advanced Science students typically perform well academically, these students are often less conscious of the need for professional skills development. We showed in this study that the use of ePortfolio for reflective practice to improve student awareness of degree-specific and transferable skills through regular documentation of learning processes supported and improved student-learning outcomes of graduate capabilities, as highlighted in previous studies ([Abrami & Barret, 2005](#); [Barrett, 2005](#); [Barrett, 2006](#)). A key goal of the course considered in this study aims to improve graduate written and oral communication skills in the research context, through authentic assessment (Boud, 2000). Our study outcomes demonstrate that ePortfolio appears to be an effective and sustainable tool in helping to achieve this goal. Although the use of digital portfolios in creative industries is commonplace, this study provides novel evidence for ePortfolio implementation to enhance research and communication skills in science in higher education. Moreover, our study revealed that the use of ePortfolios helped improve student consciousness in their development of perception as professionals and career awareness, as described by others (Leece, 2005).

The use of ePortfolio in PATH3205, aligned with authentic assessment tasks such as research oral and written communication skills, serves the purpose of recording past and current practice, and enables long-term on-going evaluation of students' own performance and associated learning outcomes. Students in this course were able to make connections between course content that was taught and the application of these concepts in future studies and work. ePortfolios as educative spaces enable both a self-directed and an individualised approach to learning that can promote life-long capabilities and can enhance students' professional preparedness in Science by approaching the learning experiences through an orientation of process rather than product (Loughran & Corrigan, 1995). Similarly, we found that students became more career conscious through creating their own ePortfolio, even though this was not part of the formal curriculum. As these students engage in this reflection upon the relationships between their educational experiences in this course, they showed awareness of both personal and professional future career aspirations, aptitudes, and opportunities. As students develop the appropriate skills and confidence to self-regulate their learning and become responsible for their learning, they can engage both individually and collaboratively in the ePortfolio (Dornan, Carroll, & Parboosingh, 2002; Grant, Kinnersley, Metcalf, Pill, & Houston, 2006). This highlights and makes clear the inter-relatedness of learning processes, knowledge and skills that the students gain across a program, thus providing opportunities for students to reflect on their practice and how this has resulted in their development of graduate capabilities and career preparedness (Orland-Barak, 2005; Wade & Yarbrough, 1996).

The Australian Government has become increasingly concerned with the development of work-ready graduates. Therefore, as stated in the Australian Qualifications Framework (AQF), the Threshold Learning Objectives (TLOs) represent what a graduate is expected "to know, understand and be able to do as a result of learning." Such standards have been developed for Science and are currently being contextualised for other disciplines (Australian Learning and Teaching Council, 2011). The ePortfolios presented by students in this study demonstrate that it is an encouraging method of promoting skills development and awareness in university students, thereby aligning with the goal stipulated by the AQF to equip graduates with relevant skills for employment. In addition, Australian universities are also currently looking for ways to enhance students' knowledge and the application of that knowledge through self-initiated mechanisms (Botterill, Allan, & Brooks, 2008). As a proof-of-concept, this study also shows that the integration of ePortfolio into course curriculum and assessment, as a self-regulated resource, provides a suitable solution in addressing this concern and allows educational institutes to demonstrate student knowledge and capabilities.

Future considerations

The research showcase activities can be refined, with less but more carefully selected representatives of current research, though choice is driven somewhat by program-level curriculum, and the need for balance between reinforcement of concepts in different contexts, and repetition, and perhaps a better balance between theory and application/context. There is a need to make more explicit the processes in teaching and learning activities, particularly those relating to skills, such as the experience of collaboration. This is likely to drive better outcomes with respect to the recognition by students of these skills and the importance of these skills in the professional context, particularly in a research environment. Certainly, the process of student reflection provides, in effect, student feedback, thus informing curricular development. The next iteration of the course may see the introduction of peer review, associated with use of paired reports, the first report serving primarily as a formative activity, scaffolding the production of a second, more highly weighted, primarily summative report. Peer review or support could also be employed to enhance the production and quality of the ePortfolio. The use of peer review would align at the Program level, given its extensive use in the Year 1 SCIF courses (Cox, Posada and Waldron, 2012) that, for most students, precede PATH3205. Thus, the integration of our pilot studies using ePortfolios in other science courses from years 1-4 at UNSW along with PATH3205 ePortfolio use in Advanced Science and Medical Science at UNSW provides a cohesive Program-wide approach to achieve these important learning goals. Furthermore, this Program-wide approach of using ePortfolios can be implemented at other Australian universities that offer science degree programs.

Significance and Conclusion

The science degrees in which this course is taken may be considered foundational in that many career pathways can be taken upon completion. These pathways include: further studies in postgraduate education including Masters and PhD programs in research – basic, clinical or industrial research and development, post-graduate professional degrees offered as postgraduate programs including Medicine, Dentistry and Pharmacy; or other non-traditional scientific areas – technical support, sales, marketing and communications. Whilst these students are academically successful, many are unaware of the skills they are developing and/or pathways to achieving career success available to them after the completion of their bachelor degree. The hope is that the use, across an increasing number of courses, of reflection, facilitated through an electronic environment such as that afforded by Mahara, along with appropriate teaching and learning strategies, will continue to support students in their professional development and their awareness of their own career readiness and pathways.

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Appendix 1 – excerpts from Mahara eportfolios

Student A, page 1

In which I attempt to make sense of everything I've learnt in the research labs.

Hepatitis C Research Lab

Maybe because it was our first lab for the series, and because we were still fresh into the new semester and were excited for the first lab of PATH3205, that we find the lab quite a disappointing one. All I can think of as a reason is perhaps we were expecting something new in pathology, where we actually get to do an experiment manually, even though we should have known what to expect (it's pathology, of course) in terms of "laboratory work" in a computer lab room.

In this lab, we have investigated...I'm not sure exactly what we have investigated, that's the thing. I know that we were looking at HCV...epitopes? We had to access a database and put a bunch of numbers and other stuff in as the supervisor instructed, and then we get a bunch of numbers and letters given back to us by the database...

I've never come across ELISpot before, but my understanding of what we use it for is to measure levels of reaction by the lymphocytes when exposed to a particular Hap C virus epitope.

Experiments are a lot harder to interpret especially if you didn't perform them yourself.

Asthma Research Lab

I really wasn't sure if the lab had been an easy one to follow or a difficult one. I took heaps of notes during the lab, understood why there needs to be a separation between the different models which can be used in a lab setting, how ELISA works (I think I don't remember exactly what the difference is between the antibodies used and why they need to be different) and how it is different from immunohistochemical staining. I understood everything but still couldn't see how it all fits into a picture. So I received mixed feelings about this lab.

But I really enjoyed the group discussions on the different ways experimental models can take form. I've always known experiments are tedious, but I appreciate this new understanding I have and was glad to be given the opportunity to learn. I am more aware now that science isn't just applying chemicals to culture plates or inducing diseases in mice, they have been designed in a way, taking other factors into account so that hypotheses can be tested in the best possible way.

Maybe it's the fact that the disease in focus (or rather, disorder) itself doesn't have clear-cut answers.

Maybe it's actually the fact that as a perfectionist and as a student, I expect answers to be given to me right away.

As a budding scientist, to come across something that is largely unknown is supposed to be a cause for celebration. Like, *yay there is something for me to further investigate out there, because hey, everyone by now knows that the earth is round, that the sun rises in the east etc etc etc*. Asthma is supposed to be one of those areas where there is room for more discovery. It still comes as a huge shock to me because I thought with the prevalence of asthma it would've been a well-established disorder, no mysteries.

Of course asthma isn't so common where I've come from. But having lived in Australia for quite sometime now I really thought answers would have been ready for me as a pathologist to receive. It turns out that my generation will have to do some more in this area (this is assuming that I will actually be involved in it in the future) (wistful thinking FTW)

エトセトラ



Being the chronic procrastinator that I am, I made this keep-calm-and-meme on a day where I was supposed to study for Pharmacology. Yeah, maybe I will make one for that subject too. Later. Too lazy right now.

Student A, page 2

The research assignment for PATH3205 had been the most successful team assignment I've had in my three years of uni career. I've never really hated working in groups, but I can never say group assignments are my favorite type of assessments because the success depends on the personalities which make up the group. Ok, maybe this unpredictability is what pisses people off most of the time because not all of us get to be assigned with people we like, or at least people who care about their marks as much as we do to want to put the same amount of effort as us if not more.

Coming back to the research assignment, I was put in the same group as a couple of other students whom I've come to know over the years but whom I wasn't very close with. We had been assigned Wegener's Granulomatosis, and on top of that we had to present on the first week for the research series. The thing about the assignment is that for a 10 minute presentation only one person will be picked by random draw...Which calls for every member of the group to come prepared on the day of the presentation.

This was how my group became close. We met once to twice a week in the library, teaching each other what we do know and then stressing over the information overload by the end of the day. It was actually kind of fun, because within our group we treat each other as equals and we all try and give feedback in the most respectful way. There was no issue as to who gets to be the "dominant" one or who actually does the most work. We've all put the same amount of effort in. We initially had a bit of a disagreement over the use of Prezi for the presentation as opposed to just the traditional power point...And we were the only group in the course to have used Prezi... (I have the feeling our mark got dragged down because our visuals gave the audience motion sickness but oh well) but in the end everyone had fun contributing to the preparation the minute we all agreed to just go forth with what we had.

This assignment made me realize that as I pursue my career further in a research setting team work will have to be something which should come as second nature. And this will be challenging because by then my team will be aiming for something that is beyond a university assignment.

Student B

Overall, I found that this lab report was very challenging and hard to write, due to the word limit (1000 words). The content of the lab, and the lab itself are easy to follow and highly detailed, but it is because of this detail that makes this report a challenge to put together. What I have written up in the report only consisted of one part of the lab (1 out of 3 stations), and already it is pushing the word limit. I would have liked to be able to go into some detail on some aspects of the lab (and had found several good articles and points which I had to unfortunately cut out), and also it would have been nice to be able to include Stations 2 and 3, which are more focused on the manifestations of Rheumatoid Arthritis (macroscopically and microscopically).

A lot of the points in my report could have been elaborated on, and I feel quite disappointed that I could not do so, but it was a great challenge finding the right balance between giving enough information and not going over the appointed word limit. 1000 words though is way to little for a detailed report on this lab, and its such a shame, as there are a lot of interesting aspects and details within this lab.

Somewhere in my ePortfolio is a more complete entry on this lab, which was a greater joy to write due to there being no word limit. Overall however, I think I did a satisfactory job writing up this report :)

Student C

This assignment made me realize that as I pursue my career further in a research setting team work will have to be something which should come as second nature. And this will be challenging because by then my team will be aiming for something that is beyond a university assignment.

Student D

In the process of completeing and preparing for our research group project, I learnt a lot about collaboration and teamwork, and what it means to be a researcher.

Student E

Overall, this informed my perception of research by extending my definition of research as gathering and synthesising relevant sources, and a continual process of self-reflection and asking questions, to obtain answers, which generated further questions. This project allowed me to think more about conveying the information I had helped to gather, as well as the idea of working as a team cohesively, supporting each other (contributing and accepting responsibility rather than asking others to do things for us) and utilising the skills and abilities of our group members.

Student F

Working as a group has never been a pleasant experience for me, but this time it went surprisingly well (minus a few bumps and bruises gathered along the way). Everybody in my group had different strengths to contribute, which gave our final presentation a nice well-rounded finish (in my opinion anyway).

Our topic was Hypertrophic cardiomyopathy, which came with a wealth of information available online which took a lot of time to sieve through, but we managed to gather up the main points and incorporate them into a presentation. Each person had differing opinions on what should, and should not have been included into the presentation, and I found that frequent group meetings and discussions were very helpful in resolving this issue.

With presentations, they are very much different from lecture series in my opinion, and are meant to be more engaging and entertaining than a lecture. Personally, I prefer making brief, entertaining presentations, without too much detail, so this was no problem for me :) I do however need to learn to improve on my presentation skills and nervousness- although I wasn't picked to present, I know I would have been too nervous to give a good presentation...

I enjoy being very involved in group projects, which may, or may not be a good thing. I need to learn to delegate more, be a better listener, and hopefully next group project will be as good a success as this one :)

We had to think like scientists, and propose possible pathways that led to the formation of the systemic disease. Throughout the course of this project, personally it has improved my communication, leadership and researching skills. We could easily complement each other's strengths and weaknesses, and overall I believe we did a fantastic job at the end.

Overall, this task has enabled me to not only learn new ways on how to research material and information, but also has propelled my characteristics in approaching teamwork and group projects. Such attributes include interpersonal skills that hopefully one day will allow me to become the best possible researcher or doctor I can be.

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