

# TEACHING AND EVALUATING GRADUATE ATTRIBUTES IN MULTIMEDIA SCIENCE BASED ASSESSMENT TASKS

Karma L. Pearce<sup>a</sup>, Jessica J. Vanderlelie<sup>b</sup>

Presenting Author: Karma Pearce ([karma.pearce@unisa.edu.au](mailto:karma.pearce@unisa.edu.au)) and Jessica Vanderlelie ([j.vanderlelie@griffith.edu.au](mailto:j.vanderlelie@griffith.edu.au))

<sup>a</sup>School of Pharmacy and Medical Sciences, University of South Australia, Adelaide SA 5001, Australia

<sup>b</sup>School of Medical Science, Griffith University, Gold Coast QLD 4222, Australia

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## ABSTRACT

New media literacy is an important employability skill for the future workforce and particularly important for graduates in the Health and Pharmaceutical Sciences. Digital story telling is a widely recognised strategy to engage student learning. This project evaluated student perspectives of the value digital story telling in the context of graduate skills development, digital media capability and leading areas of concern. Forth-year Pharmacy students (n=92) from the University of South Australia and 2<sup>nd</sup> year Health Science Students (n=83) from Griffith University were surveyed. Overwhelmingly, students reported the assessment was fun and they enjoyed working creatively and in teams. They also reported the development of graduate qualities including problem solving (85%), critical thinking (82%), oral communication (91%), team work (95%) and time management (90%). For educators interested in this form of assessment, key considerations include mindfulness of level of anxiety this new form of activity may place on students, in particular their “need” for instruction and access to software and hardware. Students reporting anxiety or apprehension were most concerned about technical skills (87%) and the time required to complete the task (83%) which was linked to lower levels of computing ability (55%) compared to 90% reporting as good/expert computing ability.

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## BACKGROUND

Many universities have identified a suite of generic graduate qualities or attributes that students will develop across their program and courses of study (Indicators of graduate qualities, 2016). Among these are the non-technical competencies and ‘soft’ skills required to effectively and innovatively apply disciplinary knowledge in the workplace. Employers strongly believe the development of these qualities is key to producing ‘work-ready’ graduates. ‘Interpersonal and communication skills’ and ‘critical reasoning and analytical skills such as problem solving, lateral thinking and technical skills’ have been ranked consistently in the top 3 criteria by the majority of employers since 2009 (Graduate Outlook 2013. The Report of the Graduate Outlook Survey: Employers’ Perspectives on Graduate Recruitment, 2014). With the fourth industrial revolution signalling a change to the workplace landscape, a greater emphasis is being placed on innovation and adaptation within a globally connected digital frontier (Committee for Economic Development of Australia Research Report, Australia’s Future Workforce, 2015).

The fourth industrial revolution will signal a changing workplace landscape, with greater emphasis on innovation and adaptation within a globally connected digital frontier (Committee for Economic Development of Australia Research Report, Australia’s Future Workforce, 2015). High-level digital literacy has been suggested as a key future work skill (Davies, Fidler, & Gorbis, 2011), with several researchers acknowledging the growing importance of digital literacy ‘coexists paradoxically with apparent foot-dragging on the part of many universities in assessment and amplification of these important competencies’ (Murray & Pérez, 2014, Hoban, Nielsen, & Shepherd, 2015) resulting in poorly prepared graduates (Duggan, 2013). As such, it is imperative that students and educators stay abreast of the rapid evolution of digital technologies and increasing importance of these modalities in the ‘traditional’ professional world, and develop graduate capabilities accordingly. In this regard the purposeful development new media literacy through assessment that draws upon digital storytelling, offers an engaging modality with which to foster such capability in our graduates.

Prenkys's seminal article on Digital Natives (students born after 1980) stated that 'our students are clamoring for these [new] technologies to be used as part of their education, in part because they are things that the students have already mastered and use in their daily lives, and in part because they realise just how useful they can be' (Prenkys, 2007). However in an Australian context, Kennedy et al. (2008) urges caution when considering that all digital natives have the proficiency to create new media. In this large Australian study of first year students, it was found that students generally indicated they regularly used email, computers to produce assignments (Word and PowerPoint) and mobile phones, however more than half have never edited a video or music or created a web page (Kennedy, Judd, Churchward, Gray, & Krause, 2008). This observation is not confined to Australia, with others in the US suggesting that electronic hardware outside the classroom, did not translate to a preference for technology inside the classroom (Kvavik, 2005; Kvavik & Caruso, 2009), even though the software to generate animations and edit videos is supplied with all Windows and Macintosh packages. However, in a recent book by Hoban et. al. (2015), it appears there are a number of tertiary institutions in Australia using digital media and storytelling to engage science students to advance their learning (Hoban, Nielsen, & Shepherd, 2015).

Despite the fact that multimedia construction has not formed part of scientific tertiary education curricula, recent advances in digital technologies have seen new pedagogical models emerge to keep pace with the digital culture (Clark, 2010). From this, a number of tertiary institutions in Australia are utilising digital media and storytelling to engage science students and advance their learning (Hoban, Nielsen, & Shepherd, 2015). Examples of which include the production of vlogs, animations, short videos and song to convey complex scientific information through digital storytelling (Hoban, Nielsen, & Shepherd, 2015). Digital stories are instructional multimodal products or electronic narratives created using computer based software with narration, music, images, animation or video clips. A digital story typically contains 10-12 ordered still images which are narrated over a time period of 3 to 5 minutes. In the context of undergraduate science or professional health science courses, storytelling with digital technologies requires the distillation of complex scientific messages into simplified key concepts, to deliver the key 'in a nut shell' messages using dynamic rather than static images.

In the past, access to software, digital music or images were considered barriers to the creation of digital stories. However, more recently all Windows or Macintosh platforms supply digital editing software as standard and at a quality that enables students with very little prior experience in digital editing or multimedia composition to readily create movies, blended media or animations. In addition, websites, such as 'creative commons' provide access to a vast range of copyright free music and images. Such access to quality tools and media makes it easier than ever before for students to create digital representations of theoretical content to support their learning and development of transferrable skills in scientific communication.

Cognitive Theory of Multimedia Learning (Mayer, Heiser, & Lonn, 2001) was originally developed from cognitive load theory and dual channel coding theory (Mayer, 2005) with the aim of overcoming the limitations of memory and encouraging deep learning. The theory encapsulated three fundamental principles of dual coding theory; firstly active learning is achieved by accomplishing a systematic set of cognitive processes; secondly, each channel has a finite capability for processing; and finally, individuals process multimedia information using either pictorial or visual processing and verbal or audio processing, i.e. dual channels). Cognitive load theory builds on this and defines the amount of mental effort required to process information: selecting appropriate pictures or images for the visual depictions, arranging these images into appropriate depictions, selecting appropriate words for the narrative, arranging these words into appropriate depictions, and lastly assimilating the words and images into appropriate depictions. Thus, when multimedia presentations are created so as to facilitate dual channel processing and reduce cognitive load, word and image complement one another, the recipient is not overwhelmed, and they can more completely comprehend the intended message. This pedagogical model was implemented in two tertiary institutions to engage second year Health Science students during 2015 and early 2016 and fourth year Pharmacy students in 2012 and 2013.

Effective communication across a wide range of literacy levels, critical thinking, problem solving and team work skills are key science graduate attributes (Gilbert, Lewenstein, & Stockmayer, 2013; Herok, Chuck, & Millar, 2013). Multimedia assessment tasks have the potential to develop these qualities, however there is a paucity of information on whether science undergraduate students view multimedia composition or digital story telling as valid assessment tasks to develop graduate

attributes as well as the body of knowledge in specific content areas.

## PROJECT GOALS

The primary aim of this study was to understand how second year Health Science students and fourth year Pharmacy students training to become health care professionals reacted to their first encounter with a series of activities to create multimedia presentations to promote graduate attributes (qualities) and communication skills across a wide range of literacy levels and their perception of the benefits and pitfalls in the task. It was hypothesized that the students would develop a range of graduate attributes (or graduate qualities) and communication skills when utilising multimedia to convey scientific messages to their peers and lay audiences. The secondary aim was to investigate whether timing within the program and the impact of a 4 week intensive course vs a 13 week semester impacted on their overall experiences and the ability of the task to develop graduate qualities.

## DESCRIPTION OF INTERVENTIONS

### Case 1: Health Science Students

2011MSC Metabolism, is a 13 week biochemistry course that is a compulsory program requirement for students at a Queensland University. The course consists of 4 hours of lectures per week and 3 hours of laboratory work per fortnight across the semester. The overall assessment design for the course has been published previously (Vanderlelie & Alexander, 2016).

Since 2011, the assessment strategy has included a group-based (5 per group) project, worth 10% of the final grade. This assessment task was to produce a 5-minute creative multimedia presentation summarising a biochemical pathway of their choice. The product could take the form of a song, animation or movie/role play that was uploaded onto the course Blackboard site. Detailed information regarding the assessment has been published elsewhere (Vanderlelie, 2013), however in short, students were required to

1. identify a biochemical pathway to summarise (occurred out of class)
2. submit an outline of their project that included a review of the relevant theory, plan of their presentation and story-board, and list of contributions for each group member. (occurred out of class)
3. construct a multimedia product (occurred out of class)
4. evaluate the work of other students within the cohort (occurred out of class)

After introduction to the task in Week 1 of the semester, students were required to submit an outline of their project (Week 7, 50%) that included a review of the relevant theory, plan of their presentation and story-board, and list of contributions for each group member. The final product was submitted in Week 12 onto the course Blackboard site with a combination of instructor (40%) and peer (10%) evaluation.

Students were encouraged to utilize any software they desired and were provided with an introduction to the Creative Commons website and encouraged to view online resources for media production contained within the DigiExplanations website (Hoban, 2014). Students were not provided with any technical assistance during the project, however received detailed feedback about the theoretical content and project plan submitted in Week 7. The focus of this task was to support students to develop a deeper understanding of relevant biochemical theory through the production of short engaging digital content. The task aimed to develop graduate capabilities in team work, communication, synthesis and analysis. The final products of each group were collated and contributed to a collection of resources available to support examination preparation and future study.

### Case 2: Pharmacy students

During 2012 and 2013, fourth year Pharmacy students undertook a four week intensive 4.5 unit Nutrition and Therapeutics course at a South Australian University as part of their program. The course consists of eight lectures and eight tutorials, all of these of two-hour duration, with the expectation that 180 hours of work would be conducted both inside and outside the classroom.

Over the four week intensive course, Pharmacy students worked in groups of 4 or 5 to produce a 4 – 5 minute multimedia product to convey health messages to minority groups within the community. It contributed 20% to their final course grade. The focus on this task was to build graduate qualities and

to create an awareness of all the issues encompassing 'health literacy' through community based interviews. The task was scaffolded to include;

1. a survey of members of the lay community from their target demographic to establish their level of diet–disease knowledge and conduct a subsequent literature review (occurred out of class)
2. construction of a storyboard and audio script (occurred out of class)
3. construction of a multimedia product (occurred in class)
4. confirmation that members of the lay community from their chosen demographic understood the key messages conveyed in the diet-disease relationship after viewing the multimedia product and self-evaluation of the task (occurred out of class)

The task is reported in detail elsewhere (Pearce, Birbeck, & May, 2013). Briefly, students were introduced to the concept of multimedia products and health literacy during the first tutorial. Students worked in groups over the 4 week period to complete the scaffolded series of tasks, mostly outside the classroom, with one of the two hour tutorial sessions allocated for the production of the multimedia / digital story to convey a diet / disease relationship e.g. the link between calcium and osteoporosis. Prior to this class, students surveyed members of a target community to gain an understanding of lay views of their chosen diet – disease relationship. They prepared a storyboard and script (on which they received feedback), then selected copyright free music, freeware pictures and backgrounds, etc. Students were also directed, but not required, to view online resources for the use of animation production using Windows software prior to class (Slowmation animations, 2009). During class, students were provided with an array of craft resources to employ as props. While formal training was not provided for multimedia production, students were able to seek support from their tutors on use of the Windows software (Moviemaker). Formal evaluation on the content of the digital story / multimedia product was provided prior to students showcasing their product within the community to ensure the information provided was factually correct. They then obtained feedback on the content of their message from the lay community using a range of methods, such as the 'teach back' technique or surveys. A more detailed description of the activity and associated marking rubrics are available online (Pearce, 2013).

There were two other assessment tasks for the course. The first comprised of tasks to be completed before the remaining 7 tutorials (anticipated to take between 1 – 1.5 hours to complete) and work completed in class; 40% of the final course grade. The second was an examination 4 months after the completion of the course; 40% of the final grade.

Quantitative and qualitative data to evaluate the students' perception in the creation of the multimedia product or digital story and the ability of the series of tasks to build graduate qualities was obtained through the use of a survey at the completion of the respective courses. The survey collected demographic information in order to establish whether there were any key differences between the groups, self-reported confidence with electronic technology, prior experience with multimedia production and their perception of the series of tasks to build graduate attributes. Self-reported confidence with technology was established by assessing the types of technology routinely used and the types of tasks performed on a computer. Frequency of use ranged across daily, weekly, monthly, annually and less than once a year. Computer skills and experience with multimedia production were rated on using a 5 point Likert scale ranging from no skill to expert.

Free text and multiple choice questions (permitting multiple answers) were used to determine the students' initial opinions with regard to constructing the multimedia product and provided insight into the difficulties they encountered during construction; response options included anxious, apprehensive, intimidated, excited, use of creative talents, fun, worried about technical skills, and time. The relevance of the tasks to future professional employment and the ability of the tasks to promote graduate attributes of problem solving, critical thinking, oral and written communication skills and team work were measured through seven-point the Likert scales ranging from completely disagree to completely agree. The survey explored students perception to difficulties in locating copyright free pictures, music and software, instructions to use software and access to mobile phones to take pictures. The survey had been previously validated; Cohen's kappa coefficient was used to establish the reliability and validity of the survey. The weighted kappa values for the survey questions ranged from 0.64 to 0.83, which implied satisfactory inter-rater reliability was achieved (Gwet, 2008). Correlation coefficients significant at a 95% CL suggested the survey was reproducible under different conditions (Pearce, 2014).

Both groups of students were invited to provide feedback at the completion of their courses, using the same evaluation survey.

Descriptive statistics were determined using the software IBM SPSS Statistics 20 (IBM Corp., Armonk, NY, USA, 2011, version 20.0). Differences in categorical variables were determined using the Chi-squared test of independence, while differences between continuous variables were determined using an unpaired t-test. Ethics approval was gained through the University of South Australia Human Ethics Committee no: 0000030493 and the Griffith University Human Ethics Committee no: 2016/483.

## RESULTS

### Socio-demographic characteristics

Eighty-four percent of students enrolled in a fourth year course (Pharm) as part of a professional Pharmacy degree (n=92) and 45% of students enrolled in the second year Biochemistry course (MSc) of a general health science degree provided anonymous feedback on completion of their course (n=82). This represented a total of 174 students. Forty three percent of students enrolled in the MSc were under 21 year and 86% students in Pharm were aged 21 - 25 years, while the majority in both courses were female (77- 86%). In contrast to the MSc course where most of the students were local students (95%), just under a third of the students enrolled in the Pharm course were International students and 41% indicated that English was not their native language ( $p<0.005$ ). Other key differences between the two student cohorts included the MSc course offered over a 13 week semester with students given the entire semester to produce their multimedia product, while Pharm students completed a four week intensive course and produced their multimedia products during a two hour tutorial session, with all foundation work occurring outside of the classroom. Students at both universities had not previously been given an assessment task requiring the production of a multimedia product as part of their university studies.

### Experience with electronic devices and software packages

Students provided feedback on their access to the Internet and their experience with electronic devices and hardware. As 79% of all Australians are reported to own at least one mobile phone (Drum et. al 2015), it is not surprising that all students reported using their mobile phones daily and most students used their computers (laptops, desktops) each day. Similarly, approximately two-thirds of the second year students and half of the fourth year students reported using their mobile music devices on a daily basis ( $p<0.05$ ). Students also took numerous digital photos, with almost half the second year students and a third of fourth year students reporting daily use ( $p<0.001$ ).

The increasing acceptance of mobile devices has driven the development and demand for cloud data storage because of the limited storage capacity and battery lifetime of these devices (Khan, Kiah, Ali, Madani, & Shamshirband, 2014). It was anticipated there would be an increase use of cloud storage between the 2012-2013 fourth year cohort and the more recent 2016 second year cohort, due to the increased popularity of cloud storage and reduced cost to access the technology. However this was not the case; 37% - 39% in both groups accessed cloud storage to back up data / assignments on a weekly basis ( $p>0.05$ ). In contrast, 40% of the second year students and 85% of the fourth year students backed up their data on a memory stick as a minimum on a weekly basis ( $p<0.001$ ). Furthermore, International students enrolled in the Pharm program were less likely to use cloud storage than domestic students ( $p<0.02$ ). In concordance with the findings in this study, Kennedy et al. (2008) showed 72% of first year students accessed and backed up data on electronic devices daily, however 23% of the sample accessed data storage in a cloud (Kennedy et al., 2008).

Domestic students in both the Pharm and MSc programs were users of Word and PowerPoint to prepare assignments for their studies with almost all indicating they use these packages on a weekly basis (95-99%). Despite the advances in technology, students have chosen not to be adopters of multimedia technology with 37% of the second year and 50% of the fourth year students indicating they edit audio or video material less than once a year, with the vast majority having never created an animation or web page. Combined, these findings concur with those of Kennedy et al. (2008), Littlejohn and Vojt (2011) and Kvavik (2005), who also established that proficient use of electronic hardware did not automatically translate into routine use of electronic software in the classroom (Kennedy et al., 2008; Kvavik, 2005; Margaryan, Littlejohn, & Vojt, 2011).

### Students' skills and experience with multimedia software

The student's use of computer software varied, with less than 7-14% believing their skill level was basic, while 75% of the second year students compared to 35% of the fourth year students considered their skill level to be good ( $p < 0.001$ ). International students rated their aptitude below domestic students as generally poor ( $p < 0.01$ ). In contrast, all students' generally had very limited multimedia (animation, video or blended media) experience which ranged from 10% for MSC students to 44% for Pharm students never previously using the technology, to 15% for Pharm students to 40% for MSC students having attempted it at an amateur level. In both groups of students, those who were concerned about their technical skills also reported lower levels of computing ability (55%). Conversely, students who self-reported good technical skills also believed they possessed good to expert computing ability (90%). However in both groups, the level of self-reported technical competency did not appear to be influenced by prior experience in editing audio and video or creating animations. Of the students who reported good or expert computer skills, 68% indicated they had prior editing audio/video experience, yet only 10% had previously created animations and 32% a webpage. In contrast, the students who were worried about the tasks reported lower levels of technical expertise, with just over half rating their technical level as either good or expert, even though a similar level of experience was reported with regard to editing audio or video (40%), creating webpages (16%) or animations (4%). Table 1.

**Table 1: Students' aptitude and experience with multimedia software**

| aTechnical computer skills              | % responses                          |  |
|---|--------------------------------------|--|
|   | MSC<br>2 <sup>nd</sup> year students | Pharm<br>4 <sup>th</sup> year students |
| Understand basics                       | 7                                    | 14                                     |
| Fair                                    | 6                                    | 35                                     |
| Good                                    | 75                                   | 35                                     |
| Expert                                  | 12                                   | 13                                     |
| a Experience with multimedia production |                                      |  |
| None                                    | 8                                    | 32                                     |
| None but interest in tech               | 2                                    | 12                                     |
| Limited (watched friends)               | 15                                   | 15                                     |
| Limited (attempted before)              | 40                                   | 15                                     |
| Some experience                         | 35                                   | 25                                     |
| Expert                                  | 0                                    | 0                                      |

MSC; health science students (2015), Pharm; pharmacy students (2012 – 2013) <sup>a</sup> $p < 0.001$

### Perception of creating the multimedia product

Prior to creating the multimedia product, students were asked to comment on how they felt about the task. Students generally reported that the activity was fun and / or exciting (22%-66%) and valued the opportunity to work creatively (40-52%). Some reported that in the context of learning, anxiousness may be beneficial, others caution that anxiety caused may be detrimental to learning and academic achievement (reviewed in AKBAP& Adnan 2007). Therefore, educators designing similar tasks in the future need to be mindful of the level of anxiety (18% MSC students to 39% Pharm students) that this new form of activity may place on students, with approximately a quarter of all students feeling intimidated and as many as a third feeling apprehensive.

Overall, approximately half of the students were concerned that they did not possess the necessary technical skills or resources to complete the task. This was despite being provided with electronic links to examples and instructions on how to prepare the animations (Slowmotion animations, 2009) and links to copyright free music and pictures through the 'Creative Commons' website. Similarly, just over a half were concerned about the time to prepare their digital products, irrespective of whether they were prepared in a two-hour tutorial session (Pharm) or over the entire semester (MSc).

Unexpectedly, 65% - 86% of the students expressed concern about gaining access to digital editing or animation software, even though both Pharm and MSc students were provided with details on how to locate the software, which is provided as standard on all Windows and Macintosh university computers. An additional 23% of Pharm students indicated they were unable to access the instructions located on their course homepages, suggesting they were possibly missing from class and / or did not fully read the instructions. As 79% of all Australians are reported to own at least one mobile phone (Drum et. al 2015), perhaps the most surprising finding was that 21% of the MSc students were worried about access to a mobile phone, despite almost all reporting that they use mobile phones on a daily basis. This suggests that they were using older mobile phones, were not aware of the capabilities of their phone (as nearly all mobile phones have had video capability for the past decade), and were possibly not accustomed to newer forms of technology.

**Table 2: Students’ perceptions of creating the multimedia product**

| Experience in making the multimedia product (prior to the task)    | % responders somewhat agree, agree or strongly agree (7 point Likert scale) |       |
|--|---|-------|
|  | MSC   | Pharm |
| <sup>b</sup> Anxious   | 18  | 39    |
| <sup>c</sup> Apprehensive  | 36  | 27    |
| Intimidated  | 24  | 26    |
| <sup>c</sup> Excited   | 22  | 45    |
| Use of creative talents  | 52  | 40    |
| <sup>d</sup> Fun   | 66  | 37    |
| <sup>b</sup> Lack of time  | 42  | 67    |
| <sup>b</sup> Lack of technical skills                              | 42  | 65    |
| <b>Difficulties in making the multimedia product</b>               |   |       |
| <sup>a, b</sup> suitable freeware picture                          | 0   | 10    |
| <sup>a</sup> suitable freeware music                               | 18  | 10    |
| <sup>b</sup> access to instructions to prepare multimedia products | 0   | 23    |
| <sup>d</sup> access to software                                    | 65  | 86    |
| <sup>b</sup> access to a camera or mobile phone                    | 21  | 4     |

Responses were measured through seven-point Likert scales ranging from completely disagree to completely agree. Results are reported as % responders to agree or strongly agree. MSc; second year health science students (2015), Pharm; fourth year pharmacy students (2012 – 2013), <sup>a</sup>available under the Creative Commons licence, <sup>b</sup>p<0.001, <sup>c</sup>p<0.01, <sup>d</sup>p<0.05.

Overall, of the 59% of students who reported feeling anxious and / or apprehensive about the tasks, 87% were concerned about their technical ability to produce the multimedia product and 83% were also concerned about completing the task in the allocated time. In contrast, of the 45% of students who viewed the activity as fun, 58% relished the opportunity to be creative and only 27% were concerned about their technical skill level. Similarly, of the 60% of students who reported feeling excited, only 40% expressed concerns about their technical ability and 55% expressed concerns about the time to perform the tasks. Comparable patterns were observed when the Pharm students and MSc students were viewed as separate cohorts, although the numbers were very small. Similarly, of the 60% of students who reported feeling excited, only 40% expressed concerns about their technical ability or 55% the time to perform the tasks. The same beliefs were held by International and Domestic students. This suggests that a belief in the lack of technical skills or prior experience may

initially overwhelm students and prevent them from fully embracing the tasks from the start. It may be pertinent to have students prepare a 10-sec animation/ multimedia product as a 'trial run' to allay fears and reassure students of the ease in using the software to obtain a reasonable product.

### Graduate attributes and educational outcomes

Recently, the importance of developing graduate attributes has become a significant issue as Universities have an increasing vocational role in preparing students for 'real world' employment (Herok et al., 2013). Additionally, a number of Universities and researchers have acknowledged the growing importance of digital literacy as a key future work skill and key core competency (Davies, Fidler, & Gorbis, 2011, Murray & Pérez, 2014, Duggan, 2013). Both the MSc and Pharm students found the series of tasks very engaging with many either somewhat agreed, agreed or strongly agreed the attributes and skills gained were relevant to future studies (74%) and their professional careers (69%). Table 3.

**Table 3: Graduate attributes**

| Graduate Qualities   | % responders agree or somewhat agree, strongly agree (7 point Likert scale) |       |
|--|---|-------|
|  | MSC   | Pharm |
| Problem solving  | 86  | 75    |
| Critical thinking  | 85  | 80    |
| Oral communication   | 87  | 94    |
| <sup>a</sup> Written communication                           | 69  | 87    |
| Team work  | 99  | 90    |
| Time management  | 100   | 90    |
| <b>Understand issues around communicating to individuals</b> | 82  | 87    |
| <sup>b</sup> More engaging than print material               | 100   | 86    |
| <sup>b</sup> Skills relevant to future academic career       | 84  | 77    |
| <sup>b</sup> Skills relevant to future profession            | 78  | 66    |

Responses were measured through seven-point Likert scales ranging from completely disagree to completely agree. Results are reports as % responders to agree or strongly agree. MSc; second year health science students (2015), Pharm; fourth year pharmacy students (2012 – 2013), <sup>a</sup>p<0.001, <sup>b</sup>p<0.05.

The findings also conclusively show the students seem to believe that multimedia and digital story telling assessment tasks developed the graduate qualities of problem solving, critical thinking, oral communication, written communication skills, team work and also time management skills (85%, 82%, 91%, 78%, 95% and 90% respectively). It is then of no surprise that a number of universities 'are considering adding video-making to a list of core skills required for graduation' (Young, 2011). Interestingly, students who perceived the activity as 'fun', rather than being 'apprehensive' about the multimedia task, were more likely to perceive a relevance to their future career (44% MSc, 31%Pharm; p<0.01 respectively), however the numbers are small. Students who perceived the activity as 'fun' also believe the activity developed problem solving skills (51%MSc, 33%Pharm; p<0.01 respectively), critical thinking skills (38%MSc, 26%Pharm; p<0.01 respectively) and oral communication skills (64%MSc, 49%Pharm; p<0.05 respectively). However, 'fun' or 'apprehension' toward the task did not influence the perception of the development of written communication skills (44% Msc vs. 40%Pharm), team work skills (84% MSc vs. 82% Pharm) or time management skills (82% MSc vs 78% Pharm; p>0.05 for all). One explanation may be that assessment tasks need to make the graduate quality of problem solving, critical thinking and oral communication skills explicit in the learning outcomes of the task, particularly for apprehensive students. An alternative explanation may be the task was not successful in building these graduate qualities in apprehensive students.

When the Pharm cohort was split by International or Domestic status, International students were more likely to see the relevance to future employment (58% vs. 36%), and the development of critical thinking (81% vs 38%), problem solving (85% vs 33%) and oral communication skills (74% vs 30%;  $p < 0.001$  for all). This further suggests that the links between multimedia production and digital storytelling and future careers, problem solving, critical thinking and oral communication skills needs to be made explicit, particularly for Domestic students in the learning outcomes of the task.

At the completion of the activity, almost all of the fourth-year Pharmacy students (86%) responded that generating a multimedia product or digital story enabled them to understand the issue around communicating scientific messages to the lay public more so than a structured academic literature review (87%). Additionally, they recognised that the series of tasks allowed them to more effectively connect with and disseminate their scientific message to the lay community, more so than written (print) material (86%). This finding is supported by earlier work, which established that the majority of students understood the key written and oral communication issues when conveying scientific messages to lay audiences (Pearce et al., 2013).

## CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE PRACTICE

Multimedia or digital storytelling, when coupled with entry level technologies, such as those used to create a stopmotion animation, when grounded in contemporary digital pedagogy, has the potential to promote students' digital literacy (Anderson, 2008; Clark, 2010). Additionally, this form of assessment has the capacity to act as a framework to facilitate engagement and build graduate attributes, such as problem solving, critical thinking and team work, which may in turn simulate deep learning and innovation (Monday & Barker 2005).

Multimedia or digital storytelling, when coupled with entry level technologies such as those used to create a stopmotion animation, whilst grounded in contemporary digital pedagogy has the potential to promote students' digital literacy (Anderson, 2008; Clark, 2010). Furthermore, this form of assessment has the capacity to act as a framework to facilitate engagement and build graduate attributes such as a problem solving, critical thinking and team work, which may in turn simulate deep learning and innovation.

Today more than ever before, tertiary students are engaging with the internet and other forms of digital media in their everyday lives. The results of this analysis confirm previous reports that students regularly engage with email, mobile phones, computers to produce assignments (Word and PowerPoint) and digital music and images however, many of them report having much less experience editing a video or music files and creating a web pages (Kennedy et al., 2008). Despite relatively limited experience in the development of digital media, tertiary level students are increasingly utilising digital animations and visual explanations of theoretical concepts to assist their learning (Lee, Paik, & Joo, 2012). By engaging in a digital story telling based assessment task, students both the second year MSc and fourth year Pharm generally believed they were able to develop graduate attributes of critical thinking, problems solving, team work and time management, as well as communication skills. However, the fourth year students undertaking the 4 week intensive course, were more likely to be anxious about the task and concerned about the both the time to complete the task and their perceived lack of technical skills. This was particularly evident for the International students.

Whilst we acknowledge that this was a relatively small study and the students undertook different assessment tasks that were evaluated over different time periods, there are several lessons that can be learned for educators considering the implementation of a digital story telling assessment task. Firstly, one must be mindful that the regular use of hardware does not necessarily translate into skilled use of software, with International students likely to self report being less skilled than Domestic students. Secondly, students were more likely to feel anxious and apprehensive if they considered themselves to have low levels of technical computing ability, irrespective of prior experience with editing audio or video. Additionally, anxious and apprehensive students were also likely to be worried about the time to produce the multimedia product, and this was not influenced by whether the production occurred in the classroom with the support of lecturing staff in a 2-hour allocated session or conducted independently outside the classroom. One of the possible explanations for this was the concern over access to suitable software, even though it was provided as standard on Macintosh and Windows University based computers. Finally, the provision of digital

editing software as standard on University based Macintosh and Windows based computers, links to copyright free music and pictures through the 'Creative Commons' website and instructions on how to use digital editing software on course home pages will not guarantee the students will be able to find the information or will use the information. It may be pertinent, particularly when working with International students, to set a small introductory tutorial task, where under the guidance of teaching staff, the students were required to access and use multimedia software, copyright free music and graphics to prepare a 10 sec animation/ multimedia product as a 'trial run' to allay any fears and reassure students of the ease in obtaining a successful product.

Significant change is taking place across the national and international workplace landscape with technological advances dramatically shaping the workplace environment as greater emphasis is placed on innovation, adaptation and digital literacy (Davies et al., 2011). The capacity for students to develop these skills as part of their undergraduate education will be fundamental to the success of our graduates negotiating the realities of the future world of work. The results of this work suggest that for students at varying levels of educational experience and from differing disciplines within the Health and Pharmaceutical sciences, digital story telling offers an effective tool to development new media literacy and foster future relevant graduate capabilities.

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