LEARNING IN LAMS:
LESSON FROM A STUDENT TEACHER EXPLORING GENE ETHICS

by **Carina Dennis**
University of Technology,
Sydney, Australia
cdennis31 @ gmail.com

Abstract

Due to its complex and microscopic nature, genetics is a difficult subject for many learners to conceptually grasp. Graphics, animation and video material can be extremely helpful to their understanding. A wealth of educational online content about genetics has been created over the past decade in the wake of the human genome being sequenced. However, these digital resources are distributed across disparate sites and it requires a high level of content and pedagogical knowledge to orchestrate the progression and choice of material available to the learner, as well as technical expertise to bundle the resources in a meaningful and accessible format. A contextualised learning sequence, called 'Gene Medicine', has been designed in LAMS by the author, a student teacher who has a doctorate in human genetics, and who has undertaken a career change to teach science to secondary students. This paper reflects an ongoing professional learning experience as the author integrates her high-content expertise and developing pedagogical knowledge within the LAMS digital environment.

Keywords: LAMS, contextualised learning design, genetics, ethics.

Introduction

This paper reports on the professional learning experience of a student teacher designing a contextualised learning sequence, called 'Gene Medicine'. Existing LAMS learning templates were re-used and adapted to suit the specific content - genetics - and particular tasks, with an emphasis on ethical discussion. The paper reflects a 'work in progress', providing a snapshot of the author's learning journey to arrive at her first LAMS lesson design, as well as future plans to broaden the scope of the project by maximising on content knowledge, expertise and professional networks.

The lesson design aggregates and arranges resources in a way that facilitates a learner's understanding of genetic variation and human disease. The learning design is intended for senior secondary students studying Biology, where the content of the lesson sequence addresses specific curriculum points (Board of Studies New South Wales, 2002).

However, the content can readily be adapted to different groups based on their learning abilities, or even for public education purposes.

The learning design is intended for sequential learning sessions: one individual session and two class, or group-based, sessions. There are three parts to the sequence, which are delineated by 'gates' at the end of each part (see Figure 1). The gates can be used to synchronise participants as different parts have been adapted to different learning environments: some are tailored for independent work whereas others are intended for group work. The details of each part, including the pedagogical design, are outlined and discussed below.

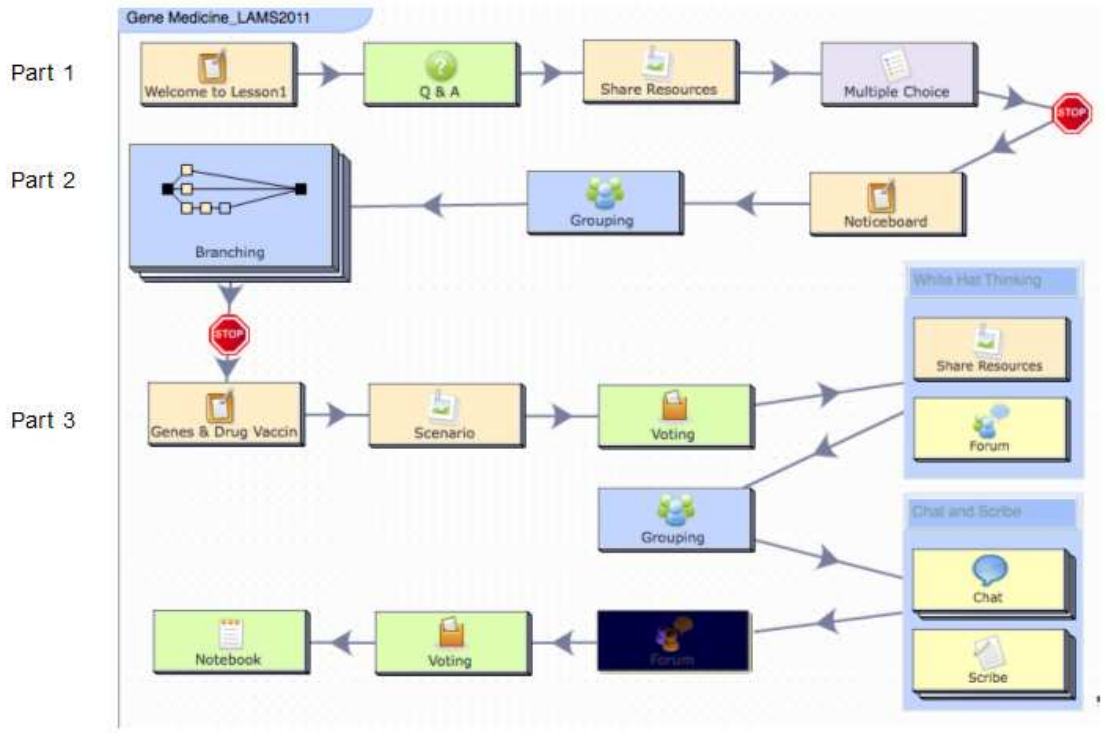

Figure 1: 'Gene Medicine': LAMS contextualised learning design

The Design

Part 1: Introductory sequence

The first part of the 'Gene Medicine' learning design (Figure 1, first line) embodies 'The 5E Instructional Model': Engage, Explore, Explain, Elaborate and Evaluate (Bybee et al., 2006). It begins with a video to engage learners in the topic by connecting it to their lives and the real-world, which underpins current pedagogical practice (Tytler, 2003). Learners then complete a Q&A to identify preconceived ideas and misconceptions about human genetic

variation and genetic testing. This sequence re-uses a LAMS template 'Identifying Misconceptions' (LAMS, n.d.). The main body of this part is a shared resource containing several videos and animations which 'explore, explain, and elaborate' the concept of genetic variation. Finally, a multiple-choice questionnaire 'evaluates' whether the learner has a grasp of the key ideas.

While a simple multiple-choice questionnaire was utilised in the pilot study, it is recommended that a two-tier multiple-choice instrument be used to assess the students' knowledge and scientific reasoning in genetics (Tsui & Treagust, 2010) and this would be developed for future revisions of the digital lesson. It would also be appropriate to consider integrating a question-design tool that encourages the development of the students' cognitive skills, similar to that proposed by Papadakis, Kordaki & Ghiglione (2010).

This first part could be conducted as individual private 'homework' (requiring approximately 20 minutes), as a prelude to topic immersion in Part 2 during the following session. The role of the teacher/facilitator in this part is one of silent monitor, to assess the students' existing knowledge and misconceptions. This will shape the discussions later in the learning sequence, which will involve forums and greater teacher facilitation and moderation.

Part 2: Exploratory sequence

Learners are empowered by choice and independent decision-making, potentially contributing to higher levels of intrinsic motivation (Malone & Lepper, 1983). For that reason, in Part 2 of the design (Figure 1, second line) learners are given the choice of three interactive activities that address distinct concepts around genetic variation and its influence on medicine design and disease susceptibility. Students select one learning activity and they are also able to do more if they wish. Learner choices control the direction and timing of movement through the sequence.

The author utilized her high-level of content knowledge and expertise to source and vet activities from a range of online content providers, predominantly educational outreach units of medical and scientific research institutions. The chosen activities were incorporated because of their potential appeal to different learners. For instance, 'Pus-poppin' frogs' (Genetic Science Learning Center, 2011a) is an animated game-playing activity that may appeal to individuals attracted to the 'gross factor'. The option involving a pedigree detective searching for the genetic culprits of nicotine addiction (Genetic Science Learning Center, 2011b) may appeal to learners interested in the humanistic side of genetics and how families inherit genetic vulnerabilities. The other option, on developing an asthma drug (Biological

Sciences Curriculum Study, 1999), may appeal to learners interested in the practical application of genetics to drug design and the business end of the pharmaceutical industry.

This part of the learning sequence would be conducted as an online homework task. Alternatively, it could be used in a classroom setting with students working at terminals individually, or in groups on an interactive white board. The educator/facilitator would not direct student learning, but rather provide on- hand assistance, if required. For two of the three activity options learners work independently. In the third option, on developing an asthma drug, students work together via a chat room to collectively submit a report. This provides an additional layer of choice, i.e. individual versus group-based learning.

Part 3: Ethical sequence

Because genetics is linked to human health and existing societal anxiety about its implications, it is worthwhile covering the ethical dimensions with senior students. Students can explore the ethical, societal and legal implications surrounding personalized genetic medicine in an online environment which can offer more structured, inclusive and considered discussion than traditional face-to-face discussion, thus strengthening the learning process (Cameron, 2009a).

Part 3 of the learning design (Figure 1, third and fourth lines) utilises an existing LAMS design based on de Bono's 'Six Thinking Hats' strategy for group thinking (de Bono, 1985; LAMS, n.d.). It explores a futuristic scenario about whether a person with an illicit drug addiction should be vaccinated against the drug. In this sequence the facilitator moderates an online forum around the various societal, ethical and legal issues, culminating in a discussion of whether people should be genetically tested for addictive tendencies and whether they should be vaccinated against the drug(s).

Learners are first presented with the scenario and essential background. They are then asked to 'Vote' (using the LAMS function) on whether a person with an illicit drug addiction should be vaccinated against the drug. After submitting their vote they can view how the rest of the group votes. Learners progress to the 'Six Thinking Hats' exercise for small-group thinking, then to a moderated larger group/class forum to discuss the topic, as well as extended social, ethical and legal issues. Finally, learners are asked to vote again. They are given the class results and can reflect on how their own and their peers' opinions vary after the learning sequence.

It is envisaged that this section would blend online with group-based classroom interactions. While the topic could readily be covered in a face-to-face classroom

environment, there are some advantages to incorporating an online component. Firstly, it enables learners to readily discuss, explore and share information with peers in order to gain the knowledge they feel they need (White-Hat thinking). Secondly, it enables learners who feel less comfortable speaking out in a classroom environment to express their views online (Cameron, 2009a). Within the digital environment, learners are given choices to express their ideas within the online LAMS forum, as well as via links to external digital discussion boards; for example, a forum in the class Wiki, blog or an embedded Voicethread, to maximise the scope of the interactive learning environment.

The educator's role would be to initially interact with learners as the scenario is introduced, fielding questions and prompting directions, but would then step back as students direct their own research and group-based learning. Finally, the teacher actively moderates the forum and encourages input from learners across the class - both face-to-face and online.

Pilot study

This contextualised learning sequence is 'a work in progress' and this paper reports on the preliminary results of a pilot study of user experience. The pilot study was conducted with two independent groups of participants: five Year 9 students and nine educators (7 pre-service, 1 in service, 1 undergraduate educator). All of the users participated remotely, completing Part 1 and Part 2 in their own time and then synchronously logging on for Part 3. Data sources included participants' responses within the LAMS lesson environment, feedback surveys and focus-group interviews.

Survey feedback and participant response

The LAMS Survey function was attached to the end of the lesson sequence, which encouraged feedback as it was presented to participants immediately and automatically on completion of the lesson. The survey function provided helpful compilation and analysis of responses, and will be integrated into all future contextualised lesson designs in order to routinely obtain feedback from learner cohorts.

A summary of the survey feedback is as follows:

- All participants reported the lesson to be enjoyable (14/14). All of the secondary students (5/5) and almost half of the educators (4/9) reported that it made them think differently about genetics.

- For both groups the navigation and usability of parts 1 and 2 were straightforward. However, one user expressed concerns about accessing a learning object that required downloading a program from an external source:

I was nervous about installing an unknown file on my computer and running it....If I had not known you personally, I would have erred on the side of it probably being a virus/harmful program. Educator

This has prompted the author to consider more carefully not only the content but also the source of external learning objects when developing future contextualised lesson sequences.

- The learning objectives need to be explicitly stated at the start of the lesson, with a visual map or other signposts to help the user know what the end point is. Participants also reported that they would have liked information on what would happen to their input during the lesson - for example, the report prepared during the Chat/Scribe activity. Future lesson sequences would need to indicate to participants who would view their contributions and how the material would be used.

- The Chat & Forum activities in Part 3 of the learning sequence was nominated as the most interesting part of the learning sequence (4/5 secondary students and 5/9 educators). However, this section was also reported by users to be difficult to use and navigate:

The group discussions (chat and forum) were the most interesting because of all the different thoughts and opinions that were shared. But they were not the most enjoyable because it is a bit of a slow method of communication. Educator

The chat/scribe thing was a bit confusing to navigate. I wasn't sure what the different roles were and how much we were supposed to write. Same for the forum - I didn't know when it was supposed to stop. Year 9 Student

[The lesson] needs a little more guidance in terms of what the end point is, especially for the forum. I think most of it would be best done in class, so that when students are wondering whether they're doing it right they can be reassured without fuss. Having said that, once students were used to LAMS-based lessons, they'd be less likely to need that kind of reassurance. Educator

Focus Group

A focus group, comprised of five of the nine educators, was held the day after they had completed the lesson sequence. The educators in the focus group were all pre-service teachers from the Key Learning Areas (KLAs) of Science, Maths and English. They provided a number of suggestions for improving the lesson, mostly pertaining to the online discussion around the ethical dilemma, and summarised as follows:

- After the ethical question was introduced, there should be a set of noticeboards to provide perspectives on 'the case for' and 'the case against'. This could form the basis for a subsequent debate using the Chat or Forum function. One participant reported their experience of the forum was "we were all shouting in unison" so it would be useful to randomly assign users to one side or the other. A lesson sequence similar to that of WebDilemma (Cameron, 2010) could be beneficial and the author plans to re-use this LAMS template in future contextualised lesson sequences, as discussed below.
- The material used to present different 'for' and 'against' perspectives on an ethical question could include a rich diversity of media, such as newspaper articles, oral recordings and video interviews of patients, families, doctors, etc.
- Participants reported that moving immediately from the Chat/Scribe activity into the Forum discussion required "too much intense discussion". It was suggested that the two functions be separated by a Noticeboard, whereby the participants read or watch content that consolidates earlier ideas.
- Participants reported that they thought the use of the '6 Thinking Hats Method' LAMS template (LAMS, n.d.) was appropriate and useful in the context of the ethical dilemma presented. However participants reported that they found it confusing to keep track of everyone's different comments wearing different hats, and the 'Scribes' found it even more difficult:

The thinking hats thing was a bit complex to scribe. 5 people all expressing opinions was a little hard to keep track of. *Educator*

- Several participants suggested that one thinking 'hat' be dealt with at a time. To design a lesson sequence incorporating this suggestion the author anticipates this would require linking four Chat activities for each of the thinking 'hats' (red, yellow, black, green). This could have the additional benefit of sharing the 'Scribe' role amongst participants.

- Participants suggested using a role-playing activity for contributing comments in the Chat/Scribe task according to an assigned role, e.g. patient. Role-playing is an effective method for exploring different perspectives of ethical dilemmas and the author plans to consider using the LAMS Role-Playing template (Cameron, 2010) in future contextualised lesson sequences.

Moderating and time management of online discussions

The Chat and Forum functions were nominated as the most interesting components of the lesson sequence. However participants reported, both in the feedback survey and the focus group, that they experienced difficulties in the group discussions (Chat and Forum). Some were unsure about how much time they should spend posting comments and some were confused about navigation, particularly in the Chat activity. In future, when embedding Forums within LAMS sequences, the author would outline a more defined role of a moderator/teacher to guide the discussion, provide real-time feedback, encourage contributions from all individuals, and assist with time management of the activity.

The participants all conducted the lesson remotely from separate locations. The author found this challenging in the pilot study and in future the users would initially participate in the Chat/Scribe and Forum activities within a classroom setting so that the online discussion can be integrated with face-to- face feedback. This would be less critical once the educator becomes more skilled at moderating online discussions and the participants more familiar with lesson sequences that incorporate the LAMS Chat and Forum functions.

The online monitoring function of LAMS was very helpful in assessing the progression of individual students in the lesson sequence, as well as the movement of groups through the branched activities. The cohort of educators was automatically split into two groups when entering the Chat activity and it was observed that one group moved through the task much faster than the second group. This meant that the participants entered the Forum in two separate groups, rather than as a single unit, which defeated the intent of having a whole ‘class’ discussion. In future the author would modify the lesson sequence to include a mechanism for synchronising the groups (perhaps using a Noticeboard and Stop gate) so they enter the forum at a similar time. Alternatively, the forum could be run asynchronously for a defined period (for example, over a few hours/days) so that all participants could post and respond to comments in their own time. There are advantages to both synchronous and asynchronous online discussions and it is beneficial to utilise either or a mixture of the two within a single learning sequence (Cameron, 2009).

Response to ethical dilemma

The ethical question posed to participants was whether a judge should be allowed to require that a drug-addict be vaccinated against their drug of choice. Participants were invited to vote at the beginning and end of the lesson sequence in Part 3. All of the secondary students (100%) voted "Yes" at both the beginning and end of the learning sequence. Of the nine educators who participated, four (44%) voted "Yes" before and three (33%) voted "Yes" at the end of the lesson sequence, with only one changing their position. The differences in response between the age groups is consistent with psychological studies that report adolescents have different patterns of moral reasoning, as conceived by Piaget (1932) and extended by Kohlberg (1973). LAMS provides an efficient and effective vehicle for accumulating and analysing the responses on ethical dilemmas from different cohorts of learners. With more pedagogical scaffolding, such as the implementation of 'structured controversies' as discussed below, it could encourage greater student engagement and deeper learning by requiring learners to consider both sides of the argument.

Discussion

LAMS provides an ideal vehicle for an educator with appropriate technological, pedagogical and content knowledge (TPACK; Mishra & Koehler, 2009) to construct a knowledge scaffold around the topic of human genetic variation for the learner to build on. Furthermore, there is value in learning about a digital lesson management system such as LAMS during teacher training, as it enables pre-service teachers to readily apply a digital context to their recently accrued knowledge framework for different pedagogical methodologies such as 'The 5E Instructional method' and de Bono's 'Six Thinking Hats' strategy. The value of familiarising student teachers with LAMS at the pre-service level has been documented in several studies (Campbell & Cameron, 2009; Kearney & Young, 2007).

LAMS templates can readily be adapted to other learning material and tasks (McAndrew, Goodyear & Dalziel, 2006) and this informed the design of the contextualised learning sequence described in this paper. The ethical part of the lesson sequence is flexible and could be bolted on to other modules that explore social implications. Alternatively, the content could be entirely replaced and a different scenario overlaid on top of this lesson structure, for example the use of nuclear power.

Many aspects of biology are controversial and LAMS enables the digital exploration of ethical topics in science. In future work the author plans to use existing LAMS learning

designs, for example 'WebDilemmas' (Cameron, 2010), to design digital lessons around ethical issues in biology, such as cloning and genetically modified foods. There is also value in designing lessons to encourage the 'learner-as-designer', asking students to use LAMS to construct their own learning activity sequence on a controversial topic in biology.

The positive response to the LAMS Chat/Forum online discussion has inspired the author to include and extend these functions in future lesson sequences, although with significant modifications based on feedback from the pilot study. Classroom conversations enhance the learning process and online discussions have the additional benefits of overcoming students' reluctance to contribute in class, avoiding the conversation being dominated by a few individuals, thus enabling disagreement without excessive emotional or personality conflicts (Cameron, 2009a). The use of the LAMS Chat and Forum has been reported to raise students' level of engagement with compulsory class texts (Cameron, 2009a).

While online collaborative tools can help students in their learning activities, there are significant challenges. Students' participation in online discussion tasks has been reported to be generally low (Goodyear & Ellis, 2007). Furthermore, Mann (2008) reported that online collaborative tools can be "misused in a destructive way" due to the inclination of junior high school students to use them for casual chatting and socialising, rather than learning. While LAMS provides an appropriate monitoring facility to modulate this behaviour, nonetheless participants in this pilot study expressed significant frustrations and uncertainties with the online discussion, with regards to expectations of their contribution and time management. Future studies will be aimed at more clearly structuring and scaffolding the role of the educator in these discussions, in terms of online engagement in the Chat discussion and moderation of the forum.

One mechanism for encouraging student engagement in online discussions is to embed assessment tasks (formative and/or summative). Given that LAMS online Chat and Forum retain all previous history, students' contribution to the online discussion can readily be assessed, as demonstrated by Cameron (2009b). However, it would be necessary to allow students to practice online discussion (either synchronous or asynchronous) prior to using it as an assessment tool, and to familiarise the students with the rubric for such an assessment by outlining the learning objectives, marking criteria and expectations around quality/standard (Cameron, 2009b; Jackson, 2010; Nandi, Chang and Balbo, 2009).

Although setting assessment may motivate a student to participate, Goodyear and Ellis (2007) noted: "The teacher may espouse the intrinsic virtues of discussion, but if the

assessment regime rewards signs rather than substance of engagement in discussion, the students will learn that token participation is more cost-effective than deep engagement". Dobozy (2009) drew similar conclusions from a pilot study of pre- service primary school and kindergarten teachers and concluded that "it is counter productive to 'make students collaborate' through the simple attachment of assignment points to tasks, because it rewards compliance rather than learning".

Future studies will look at the use of the pedagogical tool known as 'structured controversy', first described by Johnson & Johnson (1979), to help students learn the value of working collaboratively online to discuss social problems. Structured controversy is reported to lead to greater understanding and retention of material, and enhanced ability to generalise about the principles learned (Johnson & Johnson, 1988). According to Watters (1995), "the benefits of such collaborative pedagogies, in contrast to competitive ones, are well-documented: increases in learning, self-esteem, self-confidence, and interdependence".

Practically, this can involve choosing a controversial issue related to the course, prepare pro and con arguments based on guided research, debate the issue in class or online, and engage in small-group discussions to discover common values and solutions (Watters, 1995). However, the method can involve a large investment of classroom time (Herreid, 1996) and the challenge is to construct digital lessons around structured controversies, while also orchestrating the learning sequence in a succinct, effective and engaging way in an online environment.

Conclusions

Genetics has increasingly permeated many aspects of modern life, including medicine and health matters, family history and ancestry, as well as DNA profiling and issues of personal privacy. While there is considerable e-learning material on the topic of human genetic variation, many resources are poorly integrated and require considerable effort and knowledge on the part of the teacher to assemble them into a meaningful learning scenario.

Sharing of templates and contextualised lesson sequences within the LAMS community provides a useful resource for teachers without the time and expertise to create their own and will expand the range of learning tools available in the digital classroom. Using LAMS as a vehicle to support 7-12 science students' rigorous thinking will be an ongoing part of the author's professional learning experience as a pre-service teacher and after qualification. Future studies will focus on developing learning sequences in light of feedback from the pilot study and a review of the literature on collaborative online pedagogies.

References

Biological Sciences Curriculum Study (1999). Human Genetic Variation: Molecular Medicine Comes of Age. Retrieved from http://science.education.nih.gov/supplements/nih1/genetic/guide/activity3-1.htm

Board of Studies New South Wales (2002). *Stage 6 Syllabus Biology*. Sydney: Board of Studies NSW. Syllabus links: 9.3 Blueprint of Life and 9.7 Genetics: The Code Broken?

Bybee, R.W., Taylor, J.A., Gardner, A., Van Scotter, P., Carlson Powell, J., Westbrook, A. & Landes, N. (2006). The BSCS 5E Instructional Model: Origins and Effectiveness. Colorado Springs: BSCS.

Cameron, L. (2009a). Using LAMS Chat and Forum to Promote Quality Conversations. *Teaching English with Technology - Special Issue on LAMS and Learning Design volume 2*, 9(3), 18-26.

Cameron, L. (2009b). Assessing online discussions and forums. In *Proceedings of the 2009 European LAMS & Learning Design Conference: Opening up Learning Design*. Sydney, December, 2009. http://lams2009.lamsfoundation.org/pdfs/04b.pdf

Cameron, L. (2010). WebDilemmas and RolePlaying. Retrieved from http://implementinglearningdesigns.lamsfoundation.org/page6/page11/page11.html and http://implementinglearningdesigns.lamsfoundation.org/page6/page9/page9.html

Campbell, C. & Cameron, L. (2009). Using Learning Activity Management Systems (LAMS) with pre-service secondary teachers: An authentic task. In *Same places, different spaces. Proceedings ASCILITE Auckland 2009.* http://www.ascilite.org.au/conferences/auckland09/procs/campbell-c.pdf

Dalziel, J. (2003). Implementing learning design: the learning activity management system (LAMS). *ASCILITE 2003, Adelaide 1-10 December 2003.* http://www.melcoe.mq.edu.au/documents/ASCILITE2003%20Dalziel%20Final.pdf

de Bono, E. (1985). *Six Thinking Hats: An Essential Approach to Business Management*. London: Little, Brown, & Company.

Dobozy, E. (2008). The use and usefulness of non-assessed online learning: Tracking students' behaviour on LAMS. In *L. Cameron & J. Dalziel (Eds), Proceedings of the 3rd International LAMS & Learning Design Conference 2008: Perspectives on Learning Design, 5 December 2008* (pp. 59-69), Sydney: LAMS Foundation. Retrieved from http://lams2008sydney.lamsfoundation.org/papers.htm

Genetic Science Learning Center (2011a). Pus-Poppin' Frogs. Learn.Genetics. Retrieved from http://learn.genetics.utah.edu/content/health/pharma/frogs/

Genetic Science Learning Center (2011b). PI: Pedigree Investigator, On the Case of Nicotine Addiction. Learn.Genetics. Retrieved from http://learn.genetics.utah.edu/content/addiction/genetics/pi.html

Goodyear, P. & Ellis, R. (2007). Students' interpretations of learning tasks: Implications for educational design. In *ICT: Providing choices for learners and learning. Proceedings ASCILITE Singapore 2007.* http://www.ascilite.org.au/conferences/singapore07/procs/goodyear.pdf

Herreid, C.F. (1996). Structured controversy: A case study strategy. DNA fingerprinting in the courts. *Journal of College Science Teaching*, 26(2), 95-101.

International Human Genome Sequencing Consortium (2001). Initial sequencing and analysis of the human genome. *Nature* 409 (6822), 860–921.

Jackson, K. (2010). What value assessment rubrics in shaping students' engagement in asynchronous online discussions? In C. H. Steel, M. J. Keppel, P. Gerbic & S. Housego (eds.), *Curriculum, Technology & Transformation for an Unknown Future. Proceedings ASCILITE Sydney 2010* (pp. 454-458). http://ascilite.org.au/conferences/sydney10/procs/crisp-symposium.pdf

Johnson, D. W., & Johnson, R. (1979). Conflict in the classroom: Controversy and learning. *Review of Educational Research*, 49, 51-61.

Johnson, D. W., & Johnson, R. T. (1988). Critical thinking through controversy. *Educational Leadership*, 45(8), 58-64.

Kearney, M. & Young, K. (2007). Pre-service teachers' perceptions of LAMS as a teaching tool. In *ICT: Providing choices for learners and learning. Proceedings ASCILITE Singapore 2007.* http://www.ascilite.org.au/conferences/singapore07/procs/kearney.pdf

Kohlberg, L. (1973). The claim to moral adequacy of a highest stage of moral judgment. *Journal of Philosophy*, 70 (18), 630–646.

LAMS (n.d). Identifying Misconceptions. Retrieved from http://lessonlams.com/lams/pedagogicalPlanner.do?method=openSequenceNode&edit=false&uid=6.

LAMS (n.d). Six Thinking Hats. Retrieved from http://lessonlams.com/lams/pedagogicalPlanner.do?method=openSequenceNode&edit=false&uid=37.

Malone, M. R. & Lepper, M. R. (1983). Making learning fun. In R. E. Snow & J. F. Marshall (eds.), *Aptitude, Learning, and Instruction: Cognitive and Affective Process analyses* (Vol. 3, pp. 223-253). Hillsdale, NJ: Lawrence Erlbaum Associates.

Mann, S. (2008). The problems of online collaboration for junior high school students: Can the Learning Activity Management System (LAMS) benefit students to learn via online learning? In L. Cameron & J. Dalziel (eds.), *Proceedings of the 3rd International LAMS & Learning Design Conference 2008: Perspectives on Learning Design.* (p.p. 81-86). 5 December 2008, Sydney: LAMS Foundation. http://lams2008sydney.lamsfoundation.org/papers.htm

McAndrew, P., Goodyear, P., & Dalziel, J. (2006). Patterns, designs and activities: unifying descriptions of learning structures. *International Journal of Learning Technology*, 2 (2-3), 216-242.

Mishra, P. & Koehler, M. J. (2009). Too cool for school? No way! *Learning & Leading with Technology*, 36 (7), 14-18.

Nandi, D., Chang, S. and Balbo, S. (2009). A conceptual framework for assessing interaction quality in online discussion forums. In *Same places, different spaces. Proceedings ASCILITE Auckland 2009.* http://www.ascilite.org.au/conferences/auckland09/procs/nandi.pdf

Piaget, J. (1932). *The Moral Judgment of the Child*. London: Kegan Paul, Trench, Trubner and Co.

Tsui, C.-Y., & Treagust, D. F. (2010). Evaluating secondary students' scientific reasoning in genetics using a two-tier diagnostic instrument. *International Journal of Science Education*, 32(8), 1073-1098.

Tytler, R. (2003). A window for a purpose: Developing a framework for describing effective science teaching and learning. *Research in Science Education*, 30(3), 273-298.

Watters, B.L. (1995) Attacking ideas, not people: Using structured controversy in the college classroom. *Teaching Excellence*, 7(7). Retrieved from http://www.podnetwork.org/publications/teachingexcellence/95-96/V7,%20N7%20Watters.pdf

Acknowledgements

The author acknowledges the thoughtful feedback of Jacinta Barlow, Ariane Blanch, Bethan Gregory, Manar Hussein, Matthew Kearney, Gregory Krix, Tracey Millar, Erica Newby, Yvette Poshoglian, Cherri Ryan and Gaganpreet Sandhu in the preparation of this paper.

Please cite as: Dennis, C. (2012). Learning in LAMS: Lesson from a student teacher exploring gene ethics. In C. Alexander, J. Dalziel, J. Krajka & E. Dobozy (Eds.), *Teaching English with Technology, Special Edition on LAMS and Learning Design volume 3,* 12(2), 74-87, http://www.tewtjournal.org.