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Chemistry Gamification: Students teaching students through gaming

As courses transition to Blended Learning and Online the potential to integrate learning and teaching games into the curriculum or to provide bridging support, such as providing a Chemistry basics pathway, will enable students to choose how they wish to learn. Gamification of University topics to support online and blended learning will also provide an innovative approach to learning and teaching, supporting student success and retention. Drawing from the education gaming literature, Jane McGonigal (2012) suggests gamers are expert problem solvers and collaborators, skills required across all disciplines at University level. Kiili (2005) also suggests that although gameplay is important, attention needs to be paid 'to the creation of an engaging storyline'. However, game play for a chemistry pathway can take on all forms of media.

The combined novel 'Arsenic Days' and workbook were successful in the 1990s, engaging students to learn basic chemistry elements, which suggests that their conversion to an online game for chemistry learning should be as successful. Games with predictable behaviours, as in chemistry, that are hands on and interactive influence their popularity (Emery & Enger, 1972).

Learning the basics in chemistry can be daunting for students coming into university degrees that require this understanding, while assuming the learned requirement from high school. "Chemistry is devoted to the study of matter – the stuff you can hold, throw, feel, weigh, smell, touch and taste." (Healy, 2014). The first stage of learning chemistry is to become familiar with its language. For example: some bits of matter (reactants) will combine together to form new bits of matter (products). Once grasped "You can see/comprehend why matter behaves as it does when you create new forms, which potentially can find use in health, technology and the environment." (Healy, 2014). Finally the chemistry students should be able to comprehend the "three basic questions of chemistry, 'What is it?' 'What does it do?' and 'Why does it do it?" (Healy, 2014). While this seems simple enough the challenge is exacerbated by having to learn new symbols, equations and micro chemistry that is initially difficult to grasp.

Juxtaposed is multi-media and programming students desire to learn and then apply gaming theory and education gaming development, however there are limited industry opportunities to apply these theories. To solve these dual problems ICT and Multi-Media students were given the task to convert the Chemistry Workbook into a game using an open (creative commons) platform that could be distributed and reused by students and academics as a learning tool, or chemistry refresher. This paper explores the approaches, experiences and lessons learned by students and academics undertaking this duel learning and teaching approaches, offering insights into gaming from both sides of the game, the student learner and the student teacher. Dissemination of these games will be via a variety of media, housed in the cloud, on PC's or available as an executable file that can be made available to download, by prospective Chemistry students intending to enrol in university science courses, but who have not completed Chemistry in high school .

The results demonstrate learning and teaching approaches that provide real world learning for students, identifying the importance of courses required in degrees and gaps in the students learning that these course address. Furthermore, these 'student as the teacher' approaches to learning and teaching provide opportunities for academics to facilitate learning and teaching that extends the flipped classroom to an advanced social and cognitive constructivist learning approach using games as the learning and teaching platform.

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2 THOUGHTS ON "CHEMISTRY GAMIFICATION: STUDENTS TEACHING STUDENTS THROUGH GAMING"

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