Adolescent females' assessment of and learning gains from researcher developed mouse genetics multimedia simulation (MouseGen): A mixed methods analysis.

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Statement of Originality

The thesis contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. I give consent to the final version of my thesis being made available worldwide when deposited in the University's Digital Repository, subject to the provisions of the Copyright Act 1968.

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SYNOPSIS

This thesis grew out of a personal interest in genetics and an admiration for the ground breaking research by Gregor Mendel in establishing the foundations of the Science of Genetics. As a high school science teacher I have been interested in how to best support adolescent students' to learn the experimental methodologies and the hypothesis of monohybrid genetics, and how to improve their acquisition of the concepts and skills required for an understanding of fundamental Mendelian inheritance.

Thirty years ago I collected a number of mouse mutants from pet shops and research institutions and set about ensuring that they were pure breeding for particular traits that students find appealing. Since this time I have used live mice in the teaching of high school genetics and have recorded students' questions, answers and reflections. I have come to understand that for many students the study of high school genetics is not intuitive but conceptually and linguistically difficult. However, I have found that providing an experience of genetics using real mouse crosses to be an effective way to proceed in teaching this problematic science topic.

This approach to teaching genetics has its constraints and for my thesis I used Microsoft PowerPoint to create a technology-based multimedia learning environment called "MouseGen", which simulates cross breeding experiments with live mice. MouseGen contains video clips, photographs, animations, audio and annotated photographic diagrams (Multiple External Representations) and allows numerous students to access a learning experience that had previously been only provided for a single class at a time. I created coloured half disks (MER's) to represent the different alleles of a gene to assist students learn the abstract concepts of genetics. I have taken seven years to develop and trial this multimedia program and have sought feedback from students and teachers throughout the process.

The underlying pedagogical philosophy that I adopted when designing the MouseGen program was a constructivist framework of learning and multimedia development that places the learner at the centre of the process. I selected a pedagogical form of constructivism that encourages students to be set tasks that are appropriate to their cognitive and linguistic capacities, that requires them to be active participants in their own learning, to work together, and to reflect upon and talk about their learning (Morris & Adamson, 2010).

The overarching research question for this thesis was whether a Microsoft PowerPoint resource, utilizing multiple external representations to product limits and designed according to constructivist principles, will significantly improve student conceptual development within an area of science that has been historically challenging for them.

I developed a number of test instruments to assess students' acquisition of genetic concepts and skills and to determine their perceptions of the usefulness of MouseGen in learning fundamental genetics. This research adopted a mixed methods approach with both qualitative and quantitative data collection. I am pleased to note that these assessments show that participants rated the MouseGen software very highly and their performance in the post test was significantly improved from the pre-test.

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I would like to thank my wife Julie and children for being so tolerant as I collected a breeding colony of mice and then used them to create the MouseGen program. I then spent the next seven years developing the software, collecting and analysing data and writing the thesis.