

# The Impact of Virtual Microscopes on Learning

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This thesis is presented for the degree of Doctor of Philosophy of Murdoch  
University

**Diana Jonas-Dwyer (BAppSc(Hons), Grad.Dip(IS), MSc)**



I declare that this thesis is my own account of my research and contains as its main content work which has not previously been submitted for a degree at any tertiary education institution.

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Diana Jonas-Dwyer

## Abstract

Universities are using new technologies for both practical aims (to reduce costs or to cater for greater student numbers without increasing teacher numbers) and/or pedagogical aims (to improve students' learning). Frequently new technologies are introduced before the impact of these technologies on learning is fully assessed.

This thesis focuses on the introduction of virtual microscopes into histology and pathology teaching in the Health Sciences at Murdoch University.

An exploratory study was conducted in 2006 in which 47 students were randomly allocated to one of two groups. In their laboratory work one group used optical microscopes (Optical Group) and the other group used virtual microscopes (Virtual Group) during one semester. At the beginning and the end of the semester, an ASSIST survey (Tait, Entwistle, & McCune, 1998) was undertaken to determine any changes in the students' learning approach. As part of the assessments in their course, students completed an Attitude Survey about their attitudes to microscopes. Students were also required to complete a log book detailing their time spent studying. The results were analysed using appropriate statistical tests, frequencies, Chi-square, correlation, ANOVA, Two-way ANOVA, and the General Linear Model. The exploratory study tested the research design and the methods for analysing the data for the main study. Some modifications were made to the Attitude Survey prior to the commencement of the main study.

In 2007, the main study was undertaken with 293 students. In addition to the ASSIST survey, the Attitude Survey, and the log books, the students were asked to participate in focus groups and interviews to build a richer picture of microscopes and learning.

The results indicated changing trends in the students' learning approaches. The Optical Group moved from surface to strategic; the Virtual Group from deep and strategic to

surface learning during the teaching period. However, there were no statistically significant differences between the groups. The use of virtual microscopes in histology and pathology laboratories therefore does not encourage deep learning any more than the use of optical microscopes. The virtual microscopes do, however, enable students to study at times and locations that are convenient to them and they are easier to use than the optical microscopes.

The students' responses to the items in the Attitude Survey were content analysed and 15 themes emerged from the data. These themes indicated that there are critical issues, such as authenticity and group work, which need to be addressed when introducing virtual microscopes into the classroom.

In identifying critical issues and ensuring there were no detrimental effects in using virtual microscopes, recommendations were developed for histology and pathology educators to assist the implementation of virtual microscopes into a university curriculum. This was done with a view to enhancing pedagogical practice and included the development of microscope skills, authenticity, linking theory with practice and group work.

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