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Special Section

General Section

Ph.D Abstracts

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Toward ecological literacy: A permaculture approach to junior secondary science

Unpublished Ph.D thesis, Faculty of Education, The University of Waikato

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Environmental, economic, and social trends suggest the need for more sustainable ways of thinking and patterns of behaviour. Such a shift would require humanity to function at high levels of ecological literacy, which relies on a certain amount of scientific literacy. However, troubling evidence indicates an international pattern of student disengagement with science at the secondary level. Evidence also suggests that it is difficult to integrate environmental or sustainability education at this level, both within New Zealand and elsewhere. This research was aimed at examining the use of a novel approach, using permaculture, in junior secondary science (Years 9 and 10) to enhance students' ecological and scientific literacy as well as their attitudes toward studying science in school.

Permaculture is an ecological design system based on science and ethics. A permaculture approach to science education involves eco-design thinking as well as the use of local permaculture properties and practitioners and the science behind common permaculture practices. The approach is also meant to be relevant and engaging and to promote systems thinking. This study involved the design and delivery of an intervention based on permaculture principles to one Year 10 science class in New Zealand.

Research took the form of a naturalistic, interpretive, mixed methods case study, which included the use of questionnaires, interviews and observations. Data collection focused on the impacts of a permaculture approach on the teaching and learning of science, on students' ecological literacy, and on students' attitudes toward learning science in school. Pre- and post-intervention questionnaires probed students' opinions on the environment, science and learning science in school, and tested their sustainable thinking and systems thinking with concept mapping and SOLO Taxonomy exercises. Classroom observations took place over the course of 12 weeks, on average three days per week, totalling 31 days. Before and after some classroom visits I had informal conversations with the teacher, along with three formal interviews before, during and after the intervention. Three focus groups of students were interviewed immediately following the intervention.

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Findings show that a permaculture approach to junior secondary science can impact positively on students' understanding of science and sustainability, and may impact on their attitudes toward studying science in school. It also appeared to impact positively on the science teacher's attitude toward including sustainability in his teaching practice, and on his own sustainability learning. Regarding both students and teachers, a permaculture approach appears to have been effective to cultivate attitudes and trellis learning.

The teacher and the students responded favourably to many aspects of the intervention, including the overall focus on the environment, the field trips, and some classroom learning activities. The teacher reported appreciating the way the intervention contextualized science with real world examples. Most students reported appreciating the experiential aspects of the intervention, as well as the relevance that a permaculture approach to science education provided. Findings indicate that advances in ecological and scientific literacy varied among students. Some students appeared to improve their use of science and sustainability vocabulary; to become more aware of select socio-scientific issues; and, to better recognise scientific and ecological limits and possibilities. Some students also showed advances in sustainable thinking and systems thinking. Although many students expressed concern about issues such as pollution, wildlife, and genetic engineering—and prioritized protecting the environment over making money—there appeared to be a disconnect between these feelings and a sense of personal responsibility to act. Most students reported enjoying learning science with a focus on the environment, with one cohort indicating much greater enjoyment of the permaculture approach than their usual level of enjoyment of learning science in school.

Trends in environmental degradation, population growth, energy inflation, and economic stagnation—especially pronounced since the beginning of this inquiry in 2008—indicate that the world of the future will require ecologically literate citizens who can design and create truly sustainable systems for all human endeavours. Cultivating such citizens and trellising their science and sustainability learning has implications for science education. This thesis identifies an innovative approach for junior secondary science in New Zealand that provides a way towards a more sustainable future.