

PROJECT REPORT

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Title: An inquiry-based pedagogy to support the development of environmental science honours students' literacies at Rhodes University
Theme: Supporting postgraduate research development

Aims and objectives

The aim of the research was to investigate how an inquiry-based pedagogy supported the development of students' literacies. The objectives of the study were to: (a) assess the literacies and learning experiences of Environmental Science Honours students; (b) assess the depth of students' reflective comments on different aspects of the academic literacies model, and (c) develop principles for using inquiry-based learning to develop students' academic literacies.

Processes/Methods

The design-based research approach was used (Herrington and Reeves, 2011). Within this overall approach, mixed methods (Bryman, 2012) were used to collect qualitative and quantitative data on students' literacy and learning experiences in 2018 and 2019.

I transformed the curriculum of my Environmental Science Honours module on Achieving Land Degradation Neutrality by using the inquiry-based learning model (Justice *et al.* 2007). The module is optional and taught over six weeks. Six students chose my module in both 2018 (Cohort A) and 2019 (Cohort B). Both cohorts were given key readings on the concept of land degradation and restoration. We discussed these in class in both years.

Overgrazing is one of the key drivers of land degradation. Rotational grazing is a strategy that can be used to reduce overgrazing (Briske, 2017; Hawkins, 2017) whereas restoration is a practice that is employed to improve the condition of degraded land (Cowie *et al.* 2018). Cohort A students were given an authentic task to investigate local farmers' current grazing management practices and their perceptions and attitudes towards group herding of livestock to reduce overgrazing in Macubeni communal area in the Eastern Cape. Students designed questionnaires, conducted interviews and wrote up their findings in the format of a

manuscript for submission to the journal *Land Degradation and Development*. An external examiner and I examined the students' manuscripts as if we were the reviewers for the journal.

Cohort B students conducted research on the efficacy of different methods of restoring degraded land in Macubeni communal land in March 2019. The students submitted their summative research report in the format of a journal paper on 21 June 2019.

I studied both cohorts' literacies and experiences of the module. The study was informed by three theoretical frameworks. These were the academic literacies (Lea and Street, 2006), reflection on practice and reflection in practice (Schon, 1983) and situated/authentic learning and legitimate peripheral participation in a community of practice (Herrington and Oliver, 2000; Lave and Wenger, 1991) conceptual frameworks.

I drew on Schon's (1983) reflective conceptual framework to study students' learning experiences. Students were required to write reflective reports on all stages of the research process. The stages included the formulation of the research questions, designing questionnaires, data collection in the field, data analysis and the writing up of the different sections of the research paper. I scored the depth of students' reflective writing using Moon's (2007) criteria. A statement was scored 1 if it was descriptive and only considered one point of view. A score of 2 was given if a statement was descriptive with limited amount of reflection. A score of 3 was given if a statement showed some analysis and self-questioning. The deepest reflections showing critical self-questioning and ability to see others' point of view were given a score of 4.

Students designed the research questionnaire drawing on key literature on grazing management and the social-ecological systems conceptual framework (Ostrom, 2009) for managing natural resources. Students worked in pairs to design questionnaires for livestock herders, livestock owners, and traditional leaders. Students commented on each other's draft questionnaires to provide formative feedback. Students' learning experiences were recorded in reflective journals (Jasper, 2005). I also gave students formative feedback when they were writing each of the sections of their research reports. It was optional for Cohort A students to submit their draft research reports to me for formative feedback. In contrast,

Cohort B students were required to submit their draft research reports to me for formative feedback.

Students' academic literacies (Lea and Street 2006) were assessed through written exercises on the six components of a research paper. I used the skills and socialisation approach to literacy by teaching students how to structure their reports and how to follow author guidelines (Jacobs 2013). Students were required to follow the author guidelines for the international journals *Land Degradation and Development* for Cohort A and *Ecological Restoration* for Cohort B. The external examiner and I (internal examiner) acted as the journals' referees when we marked the students' research reports for summative assessment. Cohort A and I are in the process of submitting their research manuscript for publication.

The research reports that both cohorts of students submitted replaced the traditional three-hour examination that students in previous years wrote as part of their summative assessment. An external examiner and I (internal examiner) reviewed the students' reports for suitability for publication in the journals *Land Degradation and Development* and *Ecological Restoration*. Both of us have vast experience in reviewing articles for scientific journals.

Outcomes

Influence of an inquiry-based approach on students' literacies

All students demonstrated satisfactory to very good research and writing skills. The inquiry-based pedagogical model (Justice *et al.*, 2007) enabled students to construct knowledge for an authentic environmental problem (overgrazing of rangelands in a communal area). For Cohort A, the external examiner and I agreed that two students' research reports were first class and suitable for publication with minor revisions. One student's research report was good although it would require major revision before it could be submitted for publication in the journal *Land Degradation and Development*. The remaining three students' reports were satisfactory but would require major revision and re-submission for review. This provides evidence of my students' enculturation into a community of practice (Lave and Wenger, 1991, McDonald and Cater-Steel, 2017). The research reports for Cohort B are being assessed. They were submitted last week (21 June 2019).

Cohort A students are writing a paper together for publication. One student from Cohort A published a paper in April 2019 in an international journal. This is evidence that the writing skills she learnt in my module might have enabled her to conduct individual research and publish her paper - I was her supervisor and co-author. The student has since been offered a place to study for an MSc degree at Oxford University.

Depth of students' reflection

Reflective writing promotes deep learning (Biggs and Tang, 2011; Moon, 2007; McKinney and Sen 2012). The two top Cohort A students showed deep reflective writing characterized by critical self-questioning and ability to see others' points of view. The remaining four students' reflective writing ranged from descriptive with limited amount of reflection to showing some analysis and self-questioning. The reflective writings of Cohort B students are being analysed.

Draft principles for using inquiry-based learning to support students' literacies

The draft principles for using inquiry-based learning to support students' literacies include: (1) focus on knowledge construction; (2) provide authentic tasks; (3) foster reflective practice; (4) students should investigate a single open-ended problem; (5) support collaborative knowledge construction, and (6) give students adequate time to work on a task. The principles draw on constructivism and reflection in practice and on practice (Schon, 1983; Biggs and Tang, 2011).

References

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