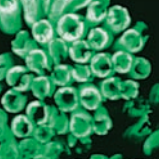

6 | Using Learner Response Systems for Ecological Fieldwork

Fieldwork is generally regarded as an essential component of most bioscience degree programmes and is held in high regard by practitioners in many disciplines (Fuller *et al.*, 2006). There is a great deal of evidence that students enjoy their experiences of fieldwork, whilst learning effectively (Fuller *et al.*, 2006). Experiencing and exploring outdoor (complex) systems and processes requires learning opportunities that cannot be wholly replicated in the classroom or laboratory. In terms of the delivery, approaches that promote active, rather than passive, learning are to be encouraged as such approaches are considered more effective, particularly with small-group approaches to problem-solving (Lonergan and Anderson, 1988).

Fieldwork is not without problems and for many reasons opportunities for fieldwork within degree programmes may be limited and can be expensive. Therefore, it is preferable to maximise the learning benefits associated with field sessions. Logistically, fieldtrips can be difficult for tutors to manage and tutors often concentrate their efforts on organising students to ensure that all required tasks are completed. This can reduce time for students to experiment and reflect. In addition, students can become very task focused, working through methods and instructions without really thinking deeply about the techniques they are employing. In short, tutors can find themselves too busy organising the fieldwork activities to engage deeply with students, test their understanding and provide meaningful feedback.

Learner response systems (LRSs)

Learner response systems are a relatively new technological addition to classrooms in UK Higher Education, although they are becoming increasingly common in many educational settings (Fies and Marshall, 2006). A LRS normally comprises a set of individual hand-held or desktop keypads that transmit student votes/responses to a central device that collates, analyses and displays results to a classroom, normally via a whiteboard system. LRSs promote learning when coupled with appropriate pedagogical methodologies (Fies and Marshall, 2006) and can significantly improve interactivity in the classroom (Siau *et al.*, 2006). One of the main reasons that tutors make use of LRSs is to increase the ease with which frequent formative assessment of students can be made (Roschelle *et al.*, 2004). With LRSs such feedback is elicited from everyone in the class (rather than just from individuals who choose to put up their hands in response to questions) and allows tutors to evaluate the understanding and address the needs of a whole class. The ActivExpression LRS has the ability to receive texts of complete sentences and numerical responses in addition to the more usual selection of options from multiple choice questions.

It seemed to us that the strengths that are often attributed to LRSs (e.g. increased interaction with learning tasks, ability to elicit responses from a whole class and consequently to provide rapid feedback) might allow us to address some of the problems associated with running field courses.

Moorland Ecology fieldtrip

The Lindow Common fieldtrip introduces key ecological techniques and data collection methods used in moorland vegetation surveys for level 5 students (2nd year undergraduate n = 34; 3 staff). The fieldtrip aims to get students to engage critically with the field environment and the ecological methods that underpin the learning objectives for a written assignment. To explore the potential of LRSs to enhance fieldwork experiences we delivered six questions whist in the field to address three components of the learning experience (Table 1).

Table 1 – LRS deployment throughout the field course

Aims	Question (format)	Delivery/Location and Tutor Use
1. Testing basic knowledge and background of moorland ecology	Q1. Which three deciduous hardwood tree species are native to the UK? (Multiple choice question) A. Ash B. Beech C. Scots pine D. Oak E. Larch Q2. Name two common moorland plant species (Free text entry)	In the car park during the introductory talk. Results allow the tutors to address errors in the students' knowledge base, both in the field and in follow-up sessions.
2. Exploring problems of the data collection techniques	Q3. Estimate percentage cover of heather *Calluna vulgaris* in the quadrat. (Numerical entry) Q4. At a distance of 10m, what is the angle between the horizontal and the top of the marked tree? (Numerical entry)	During the fieldwork and data collection activities. Results will alert the students to the inherent variability between operators in making estimations and taking measurements
3. Reflecting on prior learning	Q5. What is the missing tree biomass that does not appear in the calculation of standing biomass? (Free text entry) Q6. What two statistical tests could you apply to confirm greater biomass of purple moor grass in the heathland versus woodland sites at Lindow common? (Free text entry)	On the coach before leaving on the return journey. Results will give an indication to tutors level of reflection of the methods and ability to link to relevant prior learning at level 4 (1st year undergraduate).

The LRS was installed on a lightweight tablet laptop that could be used in a hand held fashion (i.e. the screen face up) and easily carried while in the field (Figure 1). Thirty students were each issued with a LRS handset and four students shared one between two (32 handsets in total).

Evaluation

During the fieldwork it was raining heavily with a blustery wind from the time that we left the coach until the end of the three hour trip. We adopted a simple, low tech solution of putting the laptop inside a clear plastic bag which operated perfectly using the pen mouse from outside the bags even in heavy rain (Figure 1). To protect the LRS handsets from the rain they were also placed inside protective plastic bags (Figure 2). None of the students reported that this impaired the operation of the LRS handsets. The handsets transmitted without problems when tested up to a distance of 20 metres.

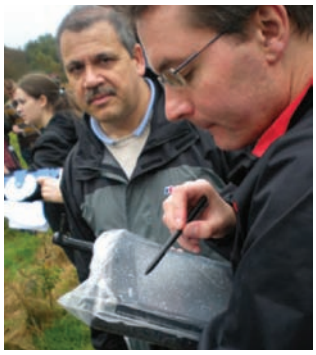

Figure 1: Tablet laptop working perfectly in heavy rainfall protected by a clear plastic bag

Figure 2: Students had no problem operating the AE pods inside protective plastic bags

We could not present the options for the multiple choice questions via a white board or other screen (as in a classroom setting) so we wrote them on A3 paper. Due to the weather, this rapidly became wet and difficult to read. For some of our simple questions this was not an issue as verbal communication was sufficient. However, presenting the options for multiple choice questions under such conditions needs further consideration.

One pleasing outcome was the enhanced reflection on operator error/variability when making basic estimations in the field. The variation in estimates of heather cover (Q3 – Table 1) for one group is shown in Figure 3. The students were genuinely surprised at the large range of estimates submitted by their peers. This generated instant discussion on approaches to standardisation for professional ecological measurements and also the nature of variation in the data used in statistical analysis. This data together with all of the data captured by the LRS was reused in follow-up session to explore these issues in more detail. When asked, the majority (85%) of the students on this field trip were in favour of LRSs being used in their teaching.

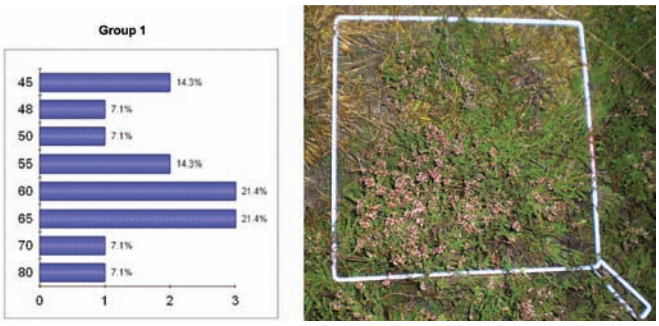

Figure 3: Output from LRS software showing the variation in students' estimations of percentage cover of heather in an example quadrat (pictured above).

We were able to deploy simple proof of principle activities that:

- tested our students' basic knowledge and background of moorland and woodland ecology. The leaders of the fieldtrip were able to respond immediately, based on the strengths and weaknesses which were identified;
- generated data sets that demonstrated, in the field, the inherent variability in making estimations and measurements (of percentage vegetation cover and angles for the calculation of tree heights respectively). This provided a relevant stimulus for discussion during the fieldtrip and in follow-up sessions; and
- encouraged students to reflect upon the methods they had used in the field and make links to prior learning and experience in statistical analysis. This allowed the tutors to respond to any misunderstandings in the follow-up sessions.

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