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Student-Produced Podcasts as an Assessment Tool: An Example from Geomorphology

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Q1 **ABSTRACT** *The emergence of user-friendly technologies has made podcasting an accessible learning tool in undergraduate teaching. In a geomorphology course, student-produced podcasts were used as part of the assessment in 2008–2010. Student groups constructed radio shows aimed at a general audience to interpret and communicate geomorphological data within the context of relevant social and environmental issues. Questionnaire results suggest that the novel format engaged students, and promoted group working, IT, language and oral communication skills, and a deeper understanding of the context of geomorphic data. For teachers, podcasting technology offers efficient teaching of oral communication, with opportunities for distance and self-directed learning.*

KEY WORDS: E-learning, podcasting, group work, computer-based assessment

Introduction

The term ‘podcast’ derives literally from a combination of Apple’s *iPod* and *broadcasting*, but its accepted meaning is a radio show or any audio-based object such as narrative, lecture, individual or group presentation that is made available through the World Wide Web (Morales & Moses, 2006). Meng (2005) distinguishes between the traditional, audio podcast and the enhanced podcast, or ‘vodcast’ which may contain audio and video materials, together with other multimedia information. Evans (2008) describes podcasting as a form of m-learning or e-learning on the move (Jarvis & Dickie, 2010), in which a mobile device, such as an iPod, MP3 player, PDA or a laptop, is used to listen to or watch an audio or video broadcast. The immediate educational benefit of podcasting technology is the ease with which digital content can be immediately and cheaply disseminated to large audiences on e-learning platforms, University intranet or via a Really Simple Syndication (RSS) channel from a website (see Kemp *et al.* 2009). Its use in teaching has mostly been limited to audio and video recording of lectures to make them available to students electronically (Read, 2005; Thomas, 2006) or instructional, as in, for example, student guides to library use (Jowitt, 2008). There is an emerging use of participatory video and audio, including podcasting, in the field of cultural production and research

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(Sharp, 2006), but the technology potentially has a wider range of applications to geography and the social sciences, and its broader benefits to undergraduate student learning are beginning to be explored (e.g. Lee *et al.* 2008; Salmon & Edirisingha, 2008).

Nowadays, lecturers are faced with rapid technological change and the present student cohort prefers learning through group activity and teamwork, and through experiential activities and the use of technology (Oblinger & Oblinger, 2005; Presky, 2009). Changing student expectations, needs and demands (Goudie, 2002), and issues such as widening participation, employability and quality enhancement, has led higher education institutions to promote blended modes of delivery based on the use of technologies, including podcasting, and associated advances in pedagogical theory (Dale & Povey, 2008). Use of podcasting varies widely and may be tutor driven, service driven, marketing driven or technically driven (Harris & Park, 2008); the absence of a learner-driven category is worth noting. More specifically within geography, uses and applications of podcasting include provision of assessment feedback (France & Wheeler, 2007; France, 2008), lecture delivery (Winterbottom, 2007) and production of practical materials to support laboratory and field work (Mount & Chambers, 2008; Jarvis & Dickie, 2010). They have also been used to support walks (Downward, 2008; France & Wakefield, 2011) and are considered to be particularly beneficial as a revision aid (Evans, 2008) and in highlighting university resources (Berk *et al.* 2007).

Jarvis & Dickie (2010) argued that innovations such as podcasting that improve support of enquiry-based and independent learning must be flexible and adaptive to a variety of pedagogic contexts. They used tutor-produced podcasts as a 'pedagogic bridging strategy', linking and extending technical skills support with research-focused fieldwork. They were not attempting to replace traditional pedagogies but to augment them in a flexible manner. This approach was supported by Fernandez *et al.* (2009) who argued that podcasting is a powerful tool to complement traditional resources but not a substitute for them. Podcasts can offer flexibility in teaching and learning to support a diverse student population through their university experience (Salmon & Nie, 2008).

The benefits of podcasting to student learning have been widely acknowledged in the literature. For example, podcasts can be effective for provoking reflective thought (Fisher & Baird, 2006) and provide a forum for collaborative learning and student knowledge creation (Lee *et al.* 2008). Jarvis & Dickie (2010) argued that the use of podcasts helps to boost student confidence and foster more effective learning. In a review of podcasting applications, Dale (2007) highlighted a number of potential benefits including the ability to meet a range of learning styles and developed key skills such as critical thinking and reflection. Similarly, Cooper *et al.* (2009) discussed the role of podcasting in encouraging mobility of the learning experience, whereas Abt & Barry (2007) explored its benefits compared with written modes of communication. In her study of English language teacher training, Thompson (2007) refers to podcasting as the ultimate learning experience and authentic assessment.

There are few published studies on the use of podcasting to encourage active learning in higher education (Lee *et al.* 2008; Salmon & Edirisingha, 2008). Abt & Barry (2007) identified development of podcasts by students themselves as an under-researched field, indicating that previous research has noted the need to explore student use of podcast creation and its link to assessment. Jarvis & Dickie (2010, p. 176) acknowledged the potential of student-produced podcasts to trigger a deeper mode of learning; for example, when required to explain geographical methods. The authentic, real-world experience (McDowell & Sambell, 1999) derived from student-produced podcasts was stressed by

Gorra *et al.* (2009) in a study in which students were required to produce a written press release and a short video interview, suitable for an Internet podcast or a television news interview. Lee *et al.* (2008) argued that students should not only participate in activity and acquire skills but also produce shared outcomes and advance the intellectual capital of the group. Dale & Povey (2008) also stressed the benefits of student-generated podcasts for developing deeper learning and more effective employability skills compared with more traditional forms of assessment such as the essay.

This paper explores the practical as well as the pedagogic potential of student podcasting in a second-year undergraduate field and practical project in drainage-basin geomorphology. It arose from observations of science students over a number of years who were able to engage with geomorphological practical work, but were less good at interpreting, making arguments from and drawing connections between different kinds of data. In addition, students typically demonstrated a poor understanding of the scientific and social context of geomorphology studies. Our objectives for the exercise were to (1) engage and motivate students through the use of technology that connects with their daily lives and interests, (2) develop competence in modern Web-based technologies, (3) develop student creativity in ways different to more traditional forms of assessment, (4) develop understanding of different uses of geomorphic information and (5) develop students' ability to communicate science effectively to a wide range of audiences.

The Exercise

The podcasting exercise, completed in 2008 and 2010, formed part of the summative assessment for a year-long second-year undergraduate course in drainage-basin geomorphology at Northumbria University, which students undertake as part of Geography (B.Sc.), Environmental Management or Geography and Sports Studies Honours programmes. In 2008, the cohort comprised 40 students (29 male and 11 female), which rose to 61 students (37 male and 24 female) in 2010. All students were aged 19–23; more than 95 per cent were of white, British or Irish origin. The project 'Geomorphological mapping of West Allen at Blackett Bridge: gravel-bed river response to metal mining activity' is treated as a group assessment, with typically 5–6 students per group (selected by the lecturer), to facilitate data collection and analysis in the field and laboratory, as well as to promote group learning. While learning basic techniques in fluvial geomorphology, students assess channel stability and dynamics on a floodplain that was transformed by 19th century heavy-metal mining in northern English Pennines (Macklin & Aspinall, 1986). Over c.100 years, the stable, single channel evolved into a multi-channelled river reworking a floodplain over-burdened with Pb- and Zn-rich fine sediment. In the field, students measure channel sections, planform morphology and hydraulic parameters that they later plot in practical sessions.

The module learning outcomes (LO) related specifically to this exercise were that students would demonstrate the ability to

- (1) employ and criticize a range of standard field techniques used in the study of fluvial geomorphology
- (2) demonstrate effective mapping and presentation skills
- (3) explain results in the context of published research at this location and equivalent localities and

- (4) communicate the results of field and laboratory analysis to a broad audience in the context of important social and economic issues.

Students were asked to produce a 10-min podcast that communicated their findings in the manner of a radio interview in which their important results were explained in simple language and their broader significance explored within the context of important social and environmental issues. In a preparatory lecture, students received guidance on the three stages of podcasting production (Table 1), from drafting the script and storyboard (pre-production), addressing technical requirements, recording and editing (production) and creating the transcript, credits and availability (post-production). To aid the creative process, students were played short podcasts downloaded from Web-based science programmes, and were asked to offer some critical analysis of the content and structure. *Audacity* 1.2.6 for Windows and PC was used for digitally recording and editing sound (Audacity Developer Team, 2008). This had the advantage of being freeware, distributed under a GNU General Public Licence (Creative Commons, 2002). The programme was easily downloaded from the World Wide Web and proved to be small enough for students to use for editing purposes on their home computers. A small, external digital microphone was installed for voice recordings and a selection of digital music tracks was made available for musical interludes and introductions. Instruction was provided in 20-min sessions to small groups using the software and microphone, and students were supervised through some of the recording and editing stages until the students developed familiarity with the recording equipment. Podcasts were produced collectively and uploaded onto the respective module e-learning platform 'Blackboard' for other students and staff to access.

Assessment was based on the group-produced podcast (MPEG-2 Audio Layer 3 or mp3 file; 55 per cent), a written transcript of the recording (10 per cent) and supporting figures from the fieldwork (35 per cent) constructed in two subsequent practical sessions. These

Table 1. The three stages of podcast production, simplified from Kemp *et al.* (2009)

165	Stage 1—pre-production <ul style="list-style-type: none"> • Brainstorm about possible content ideas for the podcast. Discuss details such as: What is the purpose of the podcast? Who is the intended audience? What topics/themes should be covered? • What is a logical structure for the script? Who will work on each portion? • Draft the podcast script and storyboard (around 1000 words, with six questions for a 10-min podcast).
170	Stage 2—production <ul style="list-style-type: none"> • Decide upon any special effects. Are you going to use music and jingles? Will it enhance the listener's experience? • Select music and sounds. Use Creative Commons music, or get permission from authors. • Design the introduction. • Hold recording sessions to produce the podcast, adjusting the written script into spoken language where needed and re-record.
175	<ul style="list-style-type: none"> • Edit and mix audio content as desired. Ensure final version close to 10 min in length.
180	Stage 3—post-production <ul style="list-style-type: none"> • Produce a brief summary or outline of the podcast (show notes) to inform potential listeners. • Produce a written transcript of the podcast. Include the title and acknowledge any music or other sources used in its production. • Download podcast in iTunes or other podcast directory software. • Submit audio file, transcript and show notes for assessment and publication on the module e-learning site.

included a geomorphic map of the present river planform, cross-section profiles and shear stress plots at a pool and riffle, and a map of clast orientations on an exposed gravel bar. The podcasting exercise replaced a more traditional group report style of assessment which had been run for the previous 3 years and which was used for comparative purposes. The adoption of a podcast format was intended specifically to focus students' minds on the interpretation of the results (LO 3) and their significance (LO 4), as well as improve their ability to articulate their conclusions to peers, tutors and an intelligent lay audience (LO 4). Assessment guidelines for the podcasts were formulated with reference to Bell (2007; Table 2). Evaluation was conducted by informal discussions with students and the teaching team, and an end-of-module questionnaire comprising closed- and open-format questions, in which students were asked to compare the podcast assessment with a traditional essay or report. Module questionnaires offer a relatively crude measure of student perceptions, and informal anecdote often provides a rich source of somewhat unusable material. Therefore, preliminary findings may, in the future, benefit from investigations using focus groups and semi-structured interviews.

Results

Logistics

Although encouraged to come to the practical session with a draft script, most groups combined the pre-production and production stage, producing most of the storyboard at the same time as recording ideas. After various problems with some groups based on uneven organization skills or commitment, group work among most students progressed smoothly. Familiarization with the recording equipment was usually quick, and students were able to run and organize their sessions with little need for technical assistance. The requirement for a written transcript to be submitted in addition to the CD proved to be a necessary security against podcast files that were submitted in unsolicited formats, and also allayed students' concerns about the sound quality of parts of the recording.

Although an interview format was suggested, students were encouraged to be creative, which resulted in a number of variations in format and in use of special effects and music. The 'radio show' format proved to be familiar to most students and offered several group members the chance to speak. In 2008, most groups used musical interludes or changes in speaker to maintain listener interest. In 2010, some groups experimented to a greater extent with the theatrical aspects of the podcast: one group staged a reconstruction of the field data collection with apparently live interviews with students, adding sound effects such as thunderstorms, bird calls and gravel crunching underfoot to add realism. Another group covered previous work on the site by staging interviews with students posing as past researchers. Less innovative groups made fewer attempts to engage listeners and tended to produce a more detailed account of the methods and results aimed towards their examiners.

Assessment

Assessed performance of the completed podcasts, transcript and associated figures was better than, or similar to, previous years. Marks ranged from 44 per cent (55 per cent in 2010) to 83 per cent (82 per cent in 2010) with a mean of 71 per cent (65 per cent in 2010) excluding non-submissions and withdrawals, compared with a mean of 64 per cent for a

Table 2. Criteria for assessing student group-produced podcasts (based on Bell, 2007)

Category	Excellent	Competent	Fair	Poor
230 Introduction	Provides relevant information and establishes a clear purpose, engaging the listener. Tells who is speaking, and where the speaker is located, topic of podcast and what the listener can expect.	Describes the topic and engages the audience as the introduction proceeds. Tells most of the following: who is speaking, topic and structure of podcast.	Somewhat engaging but provides a vague purpose. No information on who is speaking, vague on topic and structure.	Introduction absent or is vague and unclear. Speaker is not identified. No clear focus.
235 Content	Creativity and original content enhance the purpose of the podcast in an innovative way. Accurate information and succinct concepts are presented. Remains focused on the topic. Keeps to specified 10 min.	Accurate information is provided succinctly and concepts reasonably well understood. Mostly remains focused on the topic. Keeps to specified 10 min.	Some information is inaccurate or long winded. Understanding of concepts is hazy. Occasionally strays from topic. Podcast length is more than 2 min – too long or short.	Information is inaccurate. Poor understanding of concepts. Unfocused. Podcast is more than 4 min – too long or short.
240 Delivery	Well-rehearsed, smooth delivery in a conversational style. Presenter’s speech is clear and intelligible. Expression and rhythm keep the audience engaged.	Rehearsed, smooth delivery. Enunciation, expression and pace are effective throughout the podcast.	Appears unrehearsed with uneven delivery. Enunciation, expression and rhythm are sometimes distracting during the podcast.	Delivery is hesitant, and choppy or sounds like the presenter is reading. Enunciation is distant or muddled and unclear.
245 Music	Music enhances the mood, quality and understanding of the presentation.	Music provides supportive background to the podcast.	In places, music is distracting background to the podcast.	Music is distracting to presentation.
250 Technical production	Presentation is recorded in a quiet environment without background noise and distractions. Transitions are smooth and spaced correctly without noisy or ‘dead air’. Volume of voice, music and effects are excellent.	Presentation is recorded in a quiet environment with minimal background noise and distractions. Transitions are smooth with a minimal amount of ambient noise. Volume is acceptable.	Presentation is recorded in a semi-quiet environment with some background noise and distractions. Transitions are uneven with inconsistent spacing; ambient noise is present. Volume is occasionally inconsistent, and either too low or too high.	Presentation is recorded in a noisy environment with constant background noise and distractions. Transitions are abrupt and background noise needs to be filtered. Volume changes are highly distracting. Sound level is too low or too high.
255 Show notes	Show notes provide a captivating title and clear outline of the content. Music credits are included.	Show notes provide a good title. Some music credits.	Show notes provide a poor title with no music credits. May not accurately reflect the content of the podcast.	Show notes provide a poor title with no music credits. May not accurately reflect the content of the podcast.

traditional field report based on the same field exercise over the previous 3 years. These marks may be compared with mean exam marks for the same cohorts of 45 per cent in 2008 and 56 per cent in 2010, which provide a gauge of general competence, and reflect the longer tail in 2008. All groups completed the exercise by the due date, although two students did not attend the podcasting or practical components of the exercise in 2010: their contribution was regarded as unsubmitted work.

Student feedback

The end of module questionnaire received 26 responses in 2008 and 27 responses in 2010 (results for 2010 are given in brackets; Table 3). In comparison with a traditional scientific report, 71 per cent (67 per cent) of students perceived the difficulty of the podcasting exercise to be easier or about the same, and 54 per cent (44 per cent) thought it needed less or about the same amount of planning. Most students, 54 per cent (81 per cent) thought it took 6–9 h to produce. One half of all students (50 per cent, 37 per cent in 2010) thought that the exercise had improved their ability to communicate results clearly, and a similar number (50 per cent, 37 per cent in 2010) thought it had increased their confidence in giving presentations. Just over half of respondents (54 per cent, 48 per cent in 2010) thought the exercise had improved their understanding of drainage-basin geomorphology, but only 38 per cent (11 per cent) thought the exercise had improved their engagement and motivation for the subject. A large proportion (44 per cent) gave an equivocal response to this question in both 2008 and 2010. With respect to other skills, 77 per cent (56 per cent) thought the exercise had improved their abilities in using new software, 58 per cent (37 per cent) in technical aspects of computing, 96 per cent (63 per cent) in group working skills, 81 per cent (48 per cent) in oral communication, 19 per cent (22 per cent) in written communication, 77 per cent (44 per cent) in use of language and 54 per cent (33 per cent) thought their listening skills had improved. Most students (77 per cent, 59 per cent in 2010) would not have objected to making their podcasts available to others. There was no apparent difference in performance or engagement between male and female dominated groups.

In 2008, this exercise resulted in students attempting their first production of an assessed podcast. The open responses to questions about what students considered the interesting part of the exercise conveyed students' appreciation of its novelty, including comments such as "listening to [our] own voices" and "presenting my data in a different way", "coming up with a format and jokes to make it interesting". "It was good—fun and interesting to do something different." Some experienced satisfaction with learning new techniques or "the output", or "the fact that we got to communicate our results." "Learning how to do it" and "making it" were perceived as both the most interesting and most difficult aspects of the exercise by two students. When prompted to name the most difficult part of the exercise in 2008, many responses related to technical issues, including "trying to work the computer system", "coping with data" and "converting to mp3", perhaps indicating their engagement with a new method. Difficulties surrounding the creative process, "writ(ing) the spoken word", planning and producing a working or final script within the time limit received seven comments. Six students reported difficulties with time/room availability. Another student experienced problems with 'random' team members. One student found the exercise "a bit pointless, didn't learn much, better to write an essay".

In 2010, podcasting had been introduced in a pre-requisite first-year course and was part of a range of assessments this new cohort had experienced. In 2010, comments from eight

Table 3. Student questionnaire and percentage responses following podcasting exercise in 2008 and 2010 (results for 2010 are given in brackets)

320	The exercise was	harder 15(33)/easier 35(19)/about the same 38(48)
325	The amount of planning needed was	more 46(56)/less 15 (11)/about the same 38 (33)
330	How many hours were needed to complete the podcasting recording?	< 3 7(15) < 6 27(48) < 9 27(33) 9 + 38(4)
335	The exercise has improved my ability to communicate results clearly . . .	Yes 50(37) No 27(11)
340	The exercise has increased my confidence in presentations.	Yes 50(30) No 42(37)
345	The exercise has improved by engagement and motivation for the subject.	Yes 35(11) No 35(44)
350	I would prefer to always present results in a conventional essay/report	Yes 38(56) No 42(7)
355	I asked to present your podcasts to other students, would you be	in favour 31(7)/against 23(41)/don't mind 46(52)
360	I have improved my abilities in	
	... using new software	Yes 77(56) No 15(44)
	... technical aspects of computing	Yes 58(37) No 31(52)
	... group working skills	Yes 96(63) No 4(33)
	... oral communication	Yes 81(48) No 15(40)
	... written communication	Yes 19(22) No 69(63)
	... reflecting on use of language	Yes 77(44) No 23(41)
	... listening skills	Yes 54(33) No 35(44)
	... understanding drainage basins	Yes 54(48) No 38(33)
	... using new software	Yes 77(56) No 15(44)

The most interesting part of the exercise was

2008: "listening to [our] own voices" (2); "doing the podcast" (2); "using different method/format to present my data/express study" (5); "It was new—not done before"; "It was good—fun and interesting to do something different"; "trying to make a boring subject fun"; "the output"; learning how to do it/use the software (5); "coming up with a format and jokes to make it interesting"; "the fact that we got to communicate our results."

2010: "being able to use programmes I am familiar with but in a different way"; using new technology/software (6); "making and putting together the podcast with the software"; "working as a radio station"; working in different groups (3); fieldwork and data collection (5); "creating a script for the podcast"; "completing the work in a different format to an essay or report"; "the detail and findings"; recording the podcast (2); "using different sound effects"; "editing the podcast"; listening to other students' podcasts.

The most difficult part of the exercise was:

2008: learning the software (5); "converting to mp3"; "organizing it"; "working with random team mates"; "planning/writing a working script" (4); reaching/filling the time limit (3); time/room constraints (11); staff organization and support; data collection.
2010: group co-ordination/group work (3); learning the software/hardware (6); "making it into a witty podcast"; "planning the script"; "editing the podcast"; "putting the podcast together"; "writing the script and interpreting the results"; writing the script for a broad audience; "lack of knowledge about how it needed to be written"; "researching the morphological changes of the area"; assessment clashes; time constraints (3).

Any other comments/suggestions?

2008: "Seems a bit pointless, didn't learn much, better to write an essay." "Podcasting is art not science."
2010: "I feel as though podcasts have no merit or benefit over conventional essays/reports." Strongly prefer essays (3).

Note: Students were asked to base their responses on a comparison with a conventional essay or report.

students (out of 27 student responses) still related to novelty, but an equal number of comments were received on other interesting aspects of the exercise such as the group work (3), fieldwork and data collection (5). More specific comments on the podcasts included “creating a script for the podcast” and “completing the work in a different format to an essay or report”, “editing the podcast”, to creative aspects specific to the format: “working as a radio station” and “using different sound effects”. One student considered listening to other students’ podcasts to be the most interesting part of the exercise. Technical difficulties, and “learning the software” (6) remained a concern to students in 2010, but group work also created problems for three students. Seven students considered that editing, planning and researching the script were the most difficult aspects of the exercise, three of these commenting specifically about interpreting results, writing for a broad audience and creating a witty script. Assessment clashes and time constraints received four comments. One student considered that podcasts “have no merit or benefit over conventional essays/reports”.

Staff reflections and evaluation

In this trial, the exercise proved to be modestly more labour intensive than a typical laboratory-based practical. The division of students into small groups worked well for the instruction sessions, and although initially time consuming, the need for subsequent supervision was small. *Audacity’s* intuitive system of controls and editing tools was easy to explain to students, including the majority (in 2008) who had no experience of digital recording or editing. A troubleshooting guide to common problems experienced by students during recording and editing was produced after the first run and is given in Table 4. Initial recording sessions were completed in 2 h with a further 2-h session for editing and modifications. The use of a single dedicated computer and room placed some pressure on students’ availability and time, and editing was completed by some students

Table 4. Troubleshooting guide to problems encountered by students during recording and editing sessions

Problem	Solution
Converting audacity specific format files (.aup) to MP3 (.mp3) files that can be played on most media players	A Lame MP3 encoder must be downloaded from the audacity website http://audacity.sourceforge.net/ (Windows recommended downloads), and installed somewhere on the computer. The first time an attempt is made to export a file to mpg, the programme requires the location of the plug-in. Choose appropriate file for PC or Mac type.
Computer begins to run slowly during the editing stage	The recording has been constructed from too many separate tracks; 8–10 tracks is an ideal maximum depending on the speed of the computer. Tracks can be amalgamated by cutting and pasting one onto the end of another, leaving a 2–3 second gap before pasting. The gaps allow easier identification of different tracks and can be edited out later.
Recording too soft when played back	Better digital microphones are more sensitive to voice at normal speaking volumes, but the recording can be amplified through Effects: amplify from the main menus.

on their home computers. Recording files could be shared electronically and later combined allowing recording segments to be produced at different times and places, making this an adaptable technology for distance and self-directed learning. As an assessment tool, student-produced podcasts proved to be practical to run for medium-sized courses and could be easily adapted for use in large or distance-learning modules.

From the perspective of the examiner, the advantages of the podcast as an assessment form included the possibility of a second or third hearing, the ability to stop and start podcasts at will and the ability to break between podcasts for assessment and moderation. The amount of time lecturers judged they spent in examining podcasts was similar to that is normally required to assess written reports, and provided a more intimate and engaging experience than is sometimes the case for more conventional forms of assessment. During assessment of podcasts, lecturers perceived nervousness among students to be lower than in oral presentations, probably owing to their removal by one stage from the examination situation. The absence of an immediate audience of student peers or examiners may also have been detrimental to the final result, and the exercise might be improved by making podcasts available to other students, either privately or as a basis for discussion in seminars.

Discussion

Results from the student questionnaire combined with lecturers' assessment of the group podcasts suggest strongly that most students enjoyed and were motivated by the technology and novel assessment method. This view is supported by Oblinger & Oblinger (2005) and Presky (2009) who suggest a student preference for experiential and technology-led learning. The novelty of the exercise was more noticeable in 2008 than in 2010, by which time students had been exposed to an earlier podcast assessment. Student perceptions about general motivation and understanding of drainage-basin geomorphology received fewer positive and more equivocal responses. Some negative responses in 2010 may have related to difficult weather conditions in the field, which shortened many of the field exercises. As a consequence, many students may have felt that they were less able to learn the necessary field skills and methods. Responses from informal discussion with students about the exercise tended to be more positive, and compelling evidence for an increase in motivation emerged after the course in 2008, with a 60 per cent increase in the number of student choosing the third-year fluvial geomorphology module, for which this module is a pre-requisite, as a specialist option. This increase was unaffected by external factors such as significant increase in the number of student or change in specialist option choices. The fact that "we got to communicate our results" suggests that at least one student regarded podcasting as enhancing an otherwise 'academic' exercise by providing greater outlet for scientific discovery, a view supported by Dale & Povey (2008) and Gorra *et al.* (2009).

Student perceptions about improvements to their competence in modern technologies need to be interpreted with respect to prior skills. In 2010, students had already developed competence with recording and editing software and had some experience constructing a coherent audio performance. Correspondingly, positive responses to improvements in skills using software and the technical aspects of digital audio production fell from very high to just over half between the two cohorts. Despite this, between half and two-thirds of students registered an improvement in these skills on their second introduction to the technique.

In a new assessment format, in which students are invited to be inventive, evidence of student creativity may be interpreted as all effective departures from, or alterations to the

suggested format, but which continue to meet the requirements of the exercise. Creativity may also be evident in competent execution of the new (creative) format. Opportunities for creativity arose in constructing the audio script, devising techniques to engage to the listener, developing innovative modifications to the format and in the choice of non-scientific language to describe scientific concepts or methods. Dale (2007) and Lee *et al.* (2008) acknowledge the role of podcasting in developing creative, critical and reflective thinking. Both the novelty and the flexibility of the format contributed to feelings of anxiety in some students, and may have been perceived as a lack of guidance by others. At least one student found the “lack of knowledge about how it needed to be written” to be the most difficult part of the exercise. Some of the more negative comments (e.g. “podcasting is art not science”) may reflect similar feelings of insecurity. In 2008, student engagement with creative demands of the podcast was evident from experimentation with musical interludes, voices and breaks, but all groups retained the suggested format. In the second cohort, novel modifications by three groups (of eight) suggested a more advanced, or perhaps a more confident creativity that might reflect students’ increasing familiarity with podcast production and techniques (e.g. Thompson, 2007; Nie *et al.* 2008).

The success of the exercise in promoting a deeper understanding of the context and uses of geomorphic data is a difficult parameter to measure. Approximately, half of the podcasts showed evidence of background research and wider reading, which lent greater context to the interview discussion. Despite this, identification of the broader effects and significance of the results remained one of the less well-handled aspects of the podcast, and additional direction may be required to encourage students to advance conclusions or ideas. Poorer students fell back on a description of the methods, whereas better students tended to describe the history and background of the study. Despite this, combined assessed marks were similar to, or higher than, marks for a report from the same work, because students (to varying degrees) engaged with and achieved the LO and performed the task set competently or with merit.

Clear evidence emerged for students engaging with the objective to communicate science effectively. Developing students’ ability to communicate to a broad audience in the context of important social and economic issues was one of the most ambitious LO of the podcasting assessment, and assumes a general knowledge of social and economic issues and perhaps of social engagement which may be poorly or underdeveloped in many students. Both Thompson (2007) and Gorra *et al.* (2009) support this ‘authentic’ and ‘real-world’ learning experience derived from student-produced podcasts. Student responses to the questionnaire suggested that the emphasis on non-technical language and need to be selective about data and methods presented increased rather than decreased the difficulty of the exercise. Reports of difficulties in planning, writing and editing the script indicate that the project prompted a deeper consideration of its content, and are likely to have generated both positive and negative student responses.

An unexpected result from the student questionnaires and informal student discussions, and one not associated with specific LO, was students’ perception of improved group working skills. Scriptwriting, podcast recording and editing required additional group organization outside of the module teaching hours, which may have tested but also strengthened the group dynamic. Fisher & Baird (2006) argue that podcasting provides a forum for collaborative learning and student knowledge creation. Similarly, Lee *et al.* (2008) indicate that students should aim not only to participate in activities and acquire skills but also to produce shared outcomes and advance the intellectual capital of the group.

It is also possible that this reflects the number of roles available to accommodate different abilities and learning styles (*sensu* Kolb, 1985), including planning and organizing roles, storyboard production, script writing, presenting and technical roles, which may have resulted in greater satisfaction from individual group members. The benefit of podcasting in meeting the needs of a range of learning styles was also stressed by Dale (2007). Other pedagogic benefits of the technique include its appeal to auditory as well as visual learners and to those who prefer a ‘hands on’ approach. It also suited a range of learning paces because the podcast can be replayed as often as needed, and may be considered a formative exercise in which students reviewed and improved their own performance. Podcasting also offers learning opportunities attractive to students from different backgrounds and cultures, and may be particularly accessible to international or British students who wish to improve their spoken as well as written English (Thompson, 2007; Salmon & Nie, 2008). In addition, there may be lessons for employability in a fast changing external environment in which Web-based communication is increasingly important, but human presentation skills remain paramount to success (Dale & Povey, 2008).

Conclusions

The recent emergence of user-friendly tools such as *Audacity* software in the market has made student-produced podcasting an accessible learning tool with enhanced opportunities for distance and self-directed learning, combining flexible provision and efficient, cost-effective teaching of oral presentation skills. Although based on a limited number of responses, questionnaire results from two student cohorts studying drainage-basin geomorphology suggest that student-produced podcasts appear to have achieved the project objectives to enhance engagement, competence in e-technologies, creativity, science communication skills and a broader understanding of the context of geomorphology studies. The formulation and delivery of the podcast created opportunities for student creativity in ways different to more traditional forms of assessment, and provided a more intimate and engaging experience for the examiner. The need to speak to a broader audience in concise, non-technical language transformed a site-based study of geomorphic processes into an exercise in science communication, and provided an opportunity to improve students’ understanding of the scientific and social context of geomorphology studies. Tangible benefits of student-produced podcasting to higher-level learning in geography are that it engages students familiar with blogging, podcasts and *iPod* technology, and may involve an element of group work that reduces self-consciousness and results in a more relaxed delivery. The exercise developed here focused students’ minds on ways to communicate scientific results effectively and engagingly, and contributed to a range of assessment types which is more likely to overlap with different students’ learning styles and abilities. It also focused on Goudie’s (2002) call for geomorphologists to educate students in public outreach by demonstrating the direct application of geomorphology to understanding and dealing with global and regional issues, engaging students actively in the transfer of information in society, and helping them to respond to modern challenges.

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