Using student generated podcasts to foster reflection and metacognition

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ABSTRACT

A group of volunteer students who had previously completed a first year undergraduate information technology subject were tasked with producing audio supplementary material for new students undertaking the subject, to be disseminated through podcasting. The production process, from inception and scriptwriting through to the final recording, was driven by the student-producers, with minimal intervention from the lecturer. A combination of focus group interviewing and content analysis was used to study the levels of reflection and metacognition that occurred as a result of their participation in the podcasting exercise. The findings suggest that placing students in the roles of producers of educational podcasts encourages them to engage in metacognitive thinking about learning, as they create podcast episodes for beginning students.

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INTRODUCTION

Technology is increasingly being harnessed to improve the quality of learning in science subjects at the university level. This article sets out, by incorporating notions drawn from constructivist and adult learning theory, a foundation for the design of technology supported activities for the acquisition of metacognitive thinking skills. The capacity to reflect and be aware of one's self as a learner is one of the generic skills now being promoted at the tertiary level, yet for many learners it is an assumed skill rather than one that is consciously taught. In addition, there are few instances of instructional design guidelines for developing learning environments to support these skills for effective learning.

In order to foster the processes of metacognitive skills explicitly in students, we first investigated areas where cognitive support was needed. The aim was to strengthen the metacognitive and reflective skills of students to assist them in adopting strategies and reflective processes that enabled them to define, plan and self-monitor their thinking and learning during the creation of podcasts. In a tertiary level ICT subject, both content knowledge and a repertoire of generic skills must be fostered. A further aim was to produce design strategies for scaffolding metacognitive skills in the context of students using podcasting technology creatively.

WHY WE NEED A NEW APPROACH TO TEACHING METACOGNITIVE SKILLS

A number of contemporary designs for technology supported learning environments require student self-direction and high-level metacognitive control (Hollingworth & McLoughlin, 2005). Exploratory and open-ended learning environments enable students to generate knowledge and engage in critical thinking. Similarly, project-based approaches assume that students are able to generate questions and produce a final product that represents knowledge integration. Many students, however, lack essential metacognitive skills and a repertoire of learning strategies to enable them to maximise their learning in environments where self-direction is expected (Davidson & Sternberg, 1998). Table 1 shows how various contemporary learning designs assume metacognitive knowledge.

Example	Learning scenarios	Metacognitive skill needed
Anchored instruction	Narratives, stories, real life anchors	Capacity to define problems and abstract from cases
Open-ended learning environment	Multiple scenarios and viewpoints	Self-direction and self management
Project-based learning	Collaborative, task based learning environments	Management of information, self and others
Problem-based learning	Presentation of cases and events that present potential problems	Capacity to identify the problem and select resources to solve it

Table 1: Metacognitive Requirements of Contemporary Student-Centred Learning Environments

These learning environments, though highly successful, assume that students are goal driven and self-directed. Yet, these expectations bring with them a range of assumptions, primarily that students possess metacognitive skills to enable them to cope with self-directed learning. Other research has shown that the processing demands of these environments are problematic and need to be investigated. One of the issues of most concern is that of the learning paradox
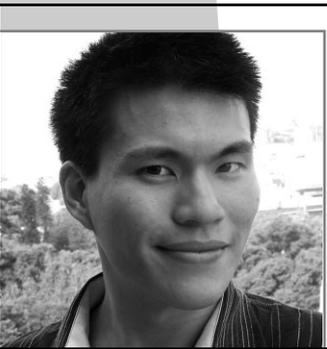
noted by Schanck and Cleave (1995), 'How can students learn by doing what they do, when they do not know how to do what they have to do to learn?' It is well established that in order to learn effectively, a repertoire of learning strategies and the capacity to manage one's own learning are fundamental (Boekaerts, Pintrich & Zeidner, 2000; De Corte, Verschaffel & Op 't Eynde, 2000). It is this set of skills that we refer to as metacognition.

THE ROLE OF METACOGNITION IN LEARNING

Metacognition is a learner's knowledge about his or her processes of cognition and the ability to control and monitor those processes as a function of the feedback the learner receives via outcomes of learning (cf. Metcalfe & Shimamura, 1994; Schraw 1998b). Metacognitive knowledge refers to what the learner understands and believes about a subject matter or a task, and the judgments he or she makes in allocating cognitive resources as a result of that knowledge. Metacognitive control refers to the strategies the learner uses to achieve specific learning goals, like planning and organising, allocating attention to relevant and irrelevant factors, looking for relationships and patterns, monitoring comprehension, identifying and testing procedures, evaluating outcomes, and reflecting on learning (cf. Jacobs & Paris, 1987). Schraw (1998a) explains that attentional resources, existing cognitive strategies and awareness of breakdowns in comprehension, are all enhanced by training in metacognitive knowledge and skills. While there are examples of successful metacognitive instruction in the literature, the most effective ones involve providing the learner with both knowledge of cognitive processes and strategies, as well as experience or practice in using them. Simply providing knowledge without experience or vice versa does not seem to be sufficient for the development of metacognitive control (Volet, 1991). It is also essential that learners have an opportunity to evaluate the outcome of their efforts, to reflect and self-assess their own approaches to learning.

Four categories of metacognitive knowledge are recognised as important and affect task performance and achievement of distance learners (White, 1999). These are as follows:

■ *Self knowledge:* Self knowledge entails the individual's capacity to recognise his/her strengths and weaknesses and weaknesses and to evaluate him/herself;

■ *Task knowledge:* This involves understanding the demands of tasks and what they require;

■ *Strategic knowledge:* This refers to the learner's knowledge of the usefulness of strategies available for achieving learning goals;

■ *Knowledge of plans and goals:* This refers to the learner's capacity to set and maintain goals and to record what he/she intends to do through his/her learning.

PODCASTING ACTIVITIES TO PROVIDE METACOGNITIVE SUPPORT

What is Podcasting?

Podcasting allows audio content from user selected feeds to be automatically downloaded to one's computer as it becomes available, then later transferred to an iPod or other portable player for listening at a convenient time and place. By having a computer that is continuously online so that bandwidth-intensive content can be 'dripped in' and made available when

ready, the 'click and wait' situation common in streaming (playing media as it downloads) can be eliminated (Curry, 2004).

Equipment capable of playing podcasts encompasses a myriad of portable devices, including but not limited to MP3 players, handheld computers, laptop computers and tablet PCs, as well as many modern mobile phones and personal digital assistants (PDAs). This holds much potential for mobile learning, although users without access to such devices can simply listen to the content on their PCs.

Podcasting is based on Really Simple Syndication (RSS). RSS-enabled web sites generate a feed of Extensible Markup Language (XML) data summarising the content of the site. This XML is maintained either manually – a process that is simpler than authoring (X)HTML for a web page – or more commonly, generated on-the-fly by software on the web server. For example, many weblog and content management systems automatically syndicate RSS. Client-side programs called aggregators periodically poll subscribed feeds for updates and deliver new content directly to the user's desktop. RSS content can be filtered and aggregated from multiple feeds.

Podcasting-capable aggregators or 'podcatchers' are used to download podcasts. They are configured to do so by supplying them with the URL of the relevant RSS feed. The podcatcher monitors the feed for RSS 2.0 (RSS Advisory Board, 2005) "enclosure" elements, which are similar to the following:

<enclosure length="45735" type= "audio/mpeg" url="http://athene.riv.csu.edu.au/~malee/podcast/itc125/enclosu res/itc125_5Jun05.mp3" />

The enclosure element contains a 'url' attribute that provides the absolute or relative location of the MP3 file, as well as 'length' and 'type' attributes that indicate the file size in bytes and MIME type respectively. The 'audio/mpeg' MIME type used for specifying MP3 files.

Educational Podcasting at Charles Sturt University

The authors believe that given the large uptake of portable music players and the increasingly socially acceptable nature of these devices, the use of a series of short audio clips, delivered in a timely fashion through podcasting, can help alleviate students' pre-class anxiety and allay their concerns about issues such as assessment (Chan & Lee, 2005). To this end, a small group of second year students who had previously completed an undergraduate information technology subject, ITC125 Information Superhighway, at Charles Sturt University's Wagga Wagga campus were recruited to serve as volunteer producers and presenters of podcasts targeted at new students undertaking the subject.

It was decided that the podcasts be structured as a series of weekly, three to five minute talkback radio-style 'shows', with two or more student-presenters holding discussions on pertinent issues related to the subject and its content in a relaxed, informal style. Subject matter experts were occasionally brought in as 'guests' to offer additional insight. This approach is in contrast to many existing educational podcasting applications, which focus on mere dissemination of instructor-generated material such as lectures.

Although the aim of the project is ultimately to investigate the impact of the podcasts on the listeners, the authors also set out to investigate the benefits of the exercise for the student-producers, which forms the basis of the present article. Table 2 outlines the rationale, research questions, data collected and methods used.

Student generated podcasts

	Context	Analysis
Rationale	• Are students able to manage their own learning? • Do podcasts support learning and metacognition?	• Is there evidence of student self-reflection? • Do students demonstrate self knowledge, strategic knowledge, task knowledge and knowledge of plans and goals?
Data	• Student generated podcasting scripts	• Records of student generated scripts • Student feedback • Focus groups
Methods	• Interviews • Transcripts • Focus groups	• Content analysis of transcripts

Table 2: Features of the Methodology Adopted

Context and Participants

The five members of the ITC125 student-producers team were recruited from a cohort of 32 students who had completed the subject in the previous semester. They included three males and two females, aged 18 to 20, who were enrolled in the Bachelor of Information Technology and Bachelor of Business/Bachelor of Information Technology degree courses.

These students expressed an interest in participating, following an announcement by the lecturer in class. The aims of the project were stated to be twofold: firstly, to create audio supplementary material targeted at alleviating ITC125 students' preconceptions and anxiety, both in relation to the subject content as well as other course-related issues, for dissemination through podcasting; and secondly, to develop a variety of skills in the student-producers themselves. Since ITC125 is an introduction to Internet and web technology which includes coverage of topics such as Internet standards and protocols, XHTML web authoring and online multimedia, involvement in the podcasting project as student-producers seems a logical follow-on for interested students who have successfully completed the subject. It was made clear from the outset that the student-podcasters' participation in the project was voluntary and non-assessable.

The group initially met on a weekly basis, which was reduced to a frequency of once a fortnight as the semester progressed and their own study workload increased. The meetings were structured though relaxed, lasting for approximately one and a half hours each. The student-producers were not provided with any formal training, but rather were introduced to the script writing, editing and presentation process by means of examples. They gradually developed competence in the various facets of the process through undergoing a number of practice runs, with decreasing levels of 'hand-holding', as well as through their interactions with one another.

Procedure for the Creation of the Podcasts

The student-producers were proactive and self-regulated in their work. They brainstormed, discussed and debated ideas for the podcast scripts during their meetings, with minimal intervention from the lecturer. One member of the team was responsible for documenting ideas for later follow-up. One or two members typically took 'ownership' of a particular script idea by agreeing to undertake the necessary research and produce a draft script. Draft scripts were circulated to provide opportunity for input from all members.

Of the script ideas generated, several were abandoned midway through the production process due to a variety of implementation-related difficulties; others were produced but never aired as a result of a unanimous decision from the team members. For example, a script idea on how to perform XHTML coding was abandoned because of the difficulty in explaining this technical topic without accompanying visual aids; two episodes entitled 'Searching and not finding' and 'Fun searching with search engines' were taken through to final production but never 'aired' as the team was dissatisfied with the quality of the end product and its presentation. Table 3 shows the six episodes approved for distribution to the student audience.

No.	Title
1	'Introduction to the subject'
2	'Oops...I missed my first lecture'
3	'Textbooks'
4	'What is XHTML'
5	'Right to copy or copyright? – Part 1'
6	'Right to copy of copyright? – Part 2'

Table 3: List of Podcast Episodes Produced and Approved for Distribution

Like the script writing and editing process, the casting of roles for the presentation of each podcast episode was a democratic, team-based effort. For example, through their experiences, a team decision was made that in general, a female presenter or host should be used to interview a male guest, and vice-versa, so as to ensure sufficient contrast so that listeners are able to easily distinguish between the two voices. The team was familiar with one another's strengths and weaknesses, and through their participation in the many recording sessions, each was able to develop his/her own unique podcast 'persona'. Once again, the lecturer provided minimal input but was on hand to offer general guidance and assistance on request.

The team typically conducted informal rehearsals prior to each podcast recording, during which the script was tested and appropriate modifications made. Minor changes to wording and even swapping of roles often occurred as a result of this testing, as did variations in seating and equipment configurations. For the earlier episodes the rehearsals were also especially helpful as a confidence building exercise for the presenters.

During a recording session, scripts were often subject to impromptu variation and improvisation at the discretion of the presenters, who tried to avoid simply reading the scripts verbatim so as to provide a more relaxed, natural feel.

Following the recording, the podcasts were distributed to the student audience. The podcast episodes were distributed at a rate of approximately one per fortnight, timed in such a way as to coincide with topics that were being covered in class. Members of the student audience had the option of either downloading the MP3 files manually via hyperlinks on the online subject outline, or configuring their podcatchers to periodically check for new files and download them automatically.

DATA COLLECTION PROCEDURES

In order to assess the level of reflective and metacognitive thinking that occurred in the scripting and podcasting process, focus group discussion was selected as the data collection method to elicit the views and experiences of the student-producers. Focus group discussions are particularly suited for obtaining in-depth perspectives and reflections on a single topic, and have the added benefit of allowing participants to feed off one another's thoughts and ideas to fuel the discussion, unlike one-on-one interviews.

A list of questions was developed for the focus group session (Table 4). These questions were not intended to be followed to the letter, but instead were to be used as a guide. The participants were provided with the questions one day before the session.

- *written reports,* in which they record their thinking in response to standardised questions following a task;

- *self-estimates,* in which they estimate their performance on a task prior to or after completing it.

The approach adopted in this study was to analyse transcripts of the focus group discussions (retrospective verbal reports) for metacognitive processes and indicators (see Table 3). This is a form of content analysis. Content analysis originated in communications research (Neuendorf, 2002) and is a 'generic name for a variety of means of textual analyses that involve comparing, contrasting and categorising a corpus of data…including now both numeric and interpretive means' (Schwandt, 2001). One of its most popular recent applications has been to online discussions, which have proved to be an easily accessible source of data for content analysis. In a review of various evaluation methodologies, Mason (1991) argues for content analysis to be established as a key approach in investigating the value of computer mediated communication for learning, because no other suitable methodologies have been developed in

No.	Question	Metacognitive element
1	What are the major incentives /sources of motivation driving your interest in the project, especially given the fact that your participation is not rewarded through formal academic credit?	Self knowledge, self monitoring, understanding one's own motivation for involvement in the tasks
2	How did being involved in the scriptwriting, editing and presentation of the podcasts to support the topics in the unit of study benefit you? What did you learn from a subject content point of view? How about other generic knowledge and skills?	Task knowledge: Understanding the demands of the task and how engagement with tasks develops personal skills and knowledge
3	What lessons have you learnt from the project that might form the basis of advice / recommendations for educators and groups of student-producers pursuing similar projects?	Strategic knowledge: ability to see how strategies used in podcasting might benefit others
4	Do you have any further suggestions on how to make this a really good experience for all those involved (producers, lecturers, listeners)?	Knowledge of plans and goals; capacity to plan and project ideas, assess benefits for self and others and refine the task itself

Table 4: Focus Group Questions Designed to Investigate Metacognitive Components

ANALYSIS OF DATA

Measuring metacognitive processes is difficult and many of the instruments developed to measure it have suffered from criticisms about their validity. The vast majority of current metacognitive measures are self-reports. These include:

- *retrospective verbal reports*, in which individuals recall what they were thinking while they were doing a task;

- *concurrent verbal reports,* in which they record their thinking while it is occurring;

either the positivist or interpretive paradigms. It can also be argued that content analysis of transcripts can improve practice by providing feedback on the educational merits of dialogue between students (McLoughlin & Luca, 1999). Content analysis should be distinguished from other forms of message analysis (Neuendorf, 2002) like discourse analysis, which adopts a more structural emphasis in studying text and talk within social contexts.

Approaches to content analysis within the educational computing domain can be both quantitative and qualitative. Early research in the area tended to take a numeric focus and was mostly concerned with investigating participation in online discussion. Qualitative approaches to content analysis are now well established and have recently been reviewed by Rourke, Anderson, Garrison and Archer (2001), with a sample of 19 different content analysis studies. Most of the content analysis frameworks focus on manifest (present and observable) content, and different researchers can interpret this in different ways. However, in the development of content analysis frameworks, there is a common practice of stating or describing a latent factor and then determining indicators of that latent factor, which are identified as manifest content of the transcript. An alternative view in relation to latent content is expressed by Potter and Levine-Donnerstein (1999) who consider subjectivity when dealing with latent content to be 'unavoidable' (p. 265) and claim it merely increases the importance of establishing interrater reliability checks on coding.

RESULTS AND DISCUSSION

A summary of the results is found in Table 5.

Metacognitive variable	Subcomponents	Number of Message Units	%
Self knowledge	• Self-evaluation • Awareness of effort needed • Awareness of learning achieved	4	16.67
Task knowledge	• Task demands • Degree of task success • Strategies applied to task	4	16.67
Strategic knowledge	• Self management • Resource management • Peer group learning/support	8	33.33
Knowledge of plans and goals	• Plans established • Scheduling • Persistence	8	33.3
	Total:	24	100.0

Table 5: Metacognitive Features Displayed in the Focus Group Discussions

A total of 24 message units relating to metacognition were found in the focus group discussion transcripts, where students reflected on learning processes, skills developed, control and awareness of their learning strategies. Each major category had a number of subcategories, or related metacognitive skills (based on the research of White, 1999: Table 2).

Self Knowledge

Students demonstrated awareness of the learning outcomes they had achieved by engaging in the podcasting task, the capacity to self-evaluate their own skills and prior knowledge, as well as the ability to assess the amount of effort needed to acquire the skills of editing, scriptwriting and production. An example taken from the transcript is as follows:

"...Being critical of other peoples' work and them being critical of me, so it's like pretty much a learning experience from other people my age"

Task Knowledge

Understanding learning is a complex task, and students showed the capacity to understand the demands of the task though it was often novel for most of them. In addition, they were able to estimate the degree to which tasks were successfully completed, and the types of strategies they should apply to ensure task completion. For example:

"With some aspects of scriptwriting, it's different from when you type up words on a screen. And then when you actually have to deliver it, it might not sound right so you have to change, not just the words, but the way you express your point of view."

Strategic Knowledge

This constituted metaknowledge displayed by students of their own learning strategies, and self regulation of thinking using cognitive and other resources, together with the capacity to enlist the support of peers and others in the learning process. For example:

"You've got to learn how to communicate with other people and understand them and you've got to learn how to get that across…"

Knowledge of Plans and Goals

In this category, metacognitive knowledge consisted of the meta-components of planning the task, scheduling time and resources and showing persistence in the face of difficulty and task demands:

"I had to be motivated to actually go up to different individuals and ask them all these questions"

"I'm thinking of making time to do these podcasts between the lectures and study we had to do. Of course scheduling would have to be the main solution to something like this."

In response to questions asked about what lessons were learnt as a result of their participation in the project, participants displayed high levels of metacognitive skill in being able to identify areas where they had skills deficits, i.e. developing oral presentation skills, scheduling, script reading and editing. Overall, these results show that student involvement and engagement in the production of content for podcasts was a positive learning experience. The analysis of focus group discussions demonstrated that students reflected on the podcasting activity, displayed self-regulated learning and developed regulatory strategies and increased knowledge of task demands.

Student generated podcasts

CONCLUSION

In an examination of the literature reviewed earlier, it was found that metacognition is teachable and that it is responsive to interventions that are well planned and skilfully implemented. The authors believe that placing a group of more experienced students in charge of producing and presenting a series of educational podcasts targeted at new or novice students is a beneficial exercise for the student-producers that exhibits many possible scaffolds for metacognitive enhancement and reflection. An overarching focus of this research is that if students' metacognition is improved, their learning is also improved. The student-producers appear to be highly committed and motivated to producing high quality learning outcomes for their audience, and their comments are indicative of the reflective power of the podcasting experience. The creation of learning environments and tasks to support and develop metacognitive skills remains an enduring challenge for educators and designers, and the authors will continue to explore the possibilities of podcasting to enhance and develop this essential skill.

Approaches to content analysis within the educational computing domain can be both quantitive and qualitative

BIOGRAPHY

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student generated podcasts

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