

# Podcasting in the classroom: involving students in creating podcasted lessons

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## ABSTRACT

This paper describes an academic experience of podcasting, which involved a group of students of a course on multimedia communication and human-computer interaction both as users of the university's podcasting service, and as creators of podcasted lessons. The evaluation of the effect on student performance and data from student satisfaction surveys provide encouraging results.

## Categories and Subject Descriptors

K.3.1 [Computer uses in education] Collaborative learning, Distance learning

K.3.2 [Computer and information science education] Computer science education

H.5.1 [Multimedia Information Systems] Audio input/output

H.3.4 [Systems and Software] World Wide Web

K.8.1 [Application packages] Freeware/shareware

## General Terms

Design, Experimentation, Human Factors.

## Keywords

Podcasting, elearning, distance education, multimedia communication, cooperative learning, Pluriversiradio, Podcast Generator, open source.

## 1. INTRODUCTION

This paper presents an experience of educational podcasting set up at the University of Bergamo (Italy) for extending and improving its elearning environment, and illustrates an example of application of such environment to a course of multimedia communication, which involved the students both as users of the podcasting service and as creators by themselves of podcasted or podcastable lessons.

From that experiment we derive some reflections upon the value of such approach to teaching and learning. These reflections are based on the results of the examinations at the end of the course

and their comparison with the results of the previous years; on the quantitative elaboration of the results of standard customer satisfaction reports filled in by the students; and on the interpretation, based on the grounded theory, of qualitative data recorded by interviewing the students.

## 2. EDUCATIONAL PODCASTING

The use of podcasting for educational purposes is a rather new idea and opportunity for higher education and its potential is still to be exploited: several universities have set up podcasting services (among them Michigan, Duke, and Stanford), but the literature is still poor of examples, case studies and evaluations [10, 14, 20].

Despite the current lack of quantitative data about the effects of podcasting on education, many educators consider podcasting as an exciting learning paradigm of impressive pedagogical potential [2, 3, 5]: limited technical skills and efforts are enough to produce course lectures, interviews, workshops reports, which can be used to meet individual's learning or teaching needs [9]; students can be involved in producing, editing and delivering podcasts by themselves as a part of their assignments, developing in such a way collaborative and social networking activities [4, 7]. Moreover, learning through listening is greatly appreciated by those students whose learning style is mainly auditory [12], whilst visual learners benefit from seeing videos from which they can catch teacher's expressions and body language.

## 3. FROM ELEARNING TO PODCASTING

Since 1999 the University of Bergamo has enabled its students to access learning facilities through several elearning services: an elearning platform for asynchronous activities, tools for synchronous lessons, web procedures for distributing materials and managing all the bureaucratic aspects of the university life.

Such efforts are appreciated by the students for two main reasons:

1. first of all, as rather usual in Italy, there is a high number of part-time students, who are very keen on any distance learning facility, which enables them not to commute to the university;
2. on the other hand, the number of students enrolled at the University of Bergamo doubled over the last five years, and this enormous increase caused some structural problems, which could be more easily faced by means of elearning services: for instance, the Linguistic Laboratory has been virtually extended by

developing on the elearning platform a large set of lessons incorporating the digital version of the audio and video materials already available at the laboratory (several hundreds of lessons for 24 different courses are available on the elearning site of the Faculty of Foreign Languages and Literatures).

On the ground of this experience with audio files and the aforementioned positive feelings about podcasting, we decided to try the podcasting as an educational tool. Therefore, in 2005 we designed and implemented *Podcast Generator* (PG), a free, open source library for building and managing podcasting services (<http://podcastgen.sourceforge.net>) and from there we built Pluriversiradio, a podcasting service for the students of the University of Bergamo, freely accessible via web (<http://www.pluriversiradio.it>) or through a feed aggregator (<http://www.pluriversiradio.it/feed.xml>) [13].

Podcast generator is a PHP script released under GPL, that lets users upload media files via a web form and automatically creates rss 2.0 podcast feeds, which are fully compatible with Juice and iTunes. Moreover, Podcast Generator acts as a content management system, able to manage a web site that hosts one or more *podcast channels*, that is thematic subsets of the documents of a podcasting service, such as, for instance, all the recordings on a specific subject, or related to a single course.

Podcast Generator comprises three main modules:

1. a database to store multimedia files and the catalog of such recordings; the catalog has been originally based on csv files, to be easily installed on any web server by inexperienced users, and then distributed also in MySQL; it provides each podcast with a record with title, author, short description, long description, image, categories, iTunes keywords, metadescriptions to facilitate future “intelligent” search agents;
2. a module for loading podcasts into the database; it validates all the data, loads them into the database, loads the podcast into the multimedia archive, and updates the RSS feed of the podcasting service;
3. a CMS (Content Management System) to manage a web site for the distribution of the multimedia materials (so that recordings can be downloaded either through podcast catchers or via web).

Using the first beta release of PG, in March 2006 we created *Pluriversiradio*, a web site to collect podcasts and to provide web surfers with the proper feeds for getting files from their podcast aggregators. The contents of this site are strictly related to courses, seminars and conferences held at the University of Bergamo.

Despite born as a small size experimental project, Pluriversiradio was subsequently hosted by the *Interdepartmental Center for elearning* of our university, and our software library is currently used by at least 500 podcasting portals in Italy and abroad. For instance, the Dutch foundation *Kennisnet Ict op School*<sup>1</sup> has

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<sup>1</sup> The foundation Kennisnet Ict op School is a public Dutch ICT support organisation established by and for education that manages the interests of the Dutch education sector and offers ICT related knowledge and delivers public educational services and products to renew and innovate education (<http://www.kennisnetictopschool.nl/international/>)

recently used PG for publishing a screencast series about podcasting with open source and promoted the use of PG in schools: for this purpose they have also developed a video podcast the explain the (really easy) installation procedure of Podcast Generator (<http://files.ictopschool.net/podos/mp4/09.mp4>).

#### 4. PODCASTED LESSONS FROM CREATIVE STUDENTS

Pluriversiradio has been used during the second semester of the academic year 2005-2006 for two undergraduate courses on multimedia communication and human computer interaction at the Faculty of Arts and Philosophy of the University of Bergamo; after that first experiment, other colleagues began recording podcasts for their students.

The second of the multimedia communication courses that used Pluriversiradio (Laboratory of multimedia communication) aimed at introducing students to the foundations of the human computer interfaces, to basic elements of graphics and to the management of audio files.

Podcasting was used first of all for recording syntheses of the theoretical lessons and for distributing them to the students: this is for us an invaluable help, because in Italy there is a large part of students who rarely attend the lessons (distal users), and hence such students exploit the podcasts as a source of distance learning. Moreover, even those students who sporadically attend the lessons (proximal users) exploit the podcasts for integrating their knowledge; and those who regularly attend the lessons (central users) use the podcasting as a source of summaries or deepening.

As soon as the students became rather skilled with audio files management (using the free software Audacity for recording and editing sounds), we started an experiment with the full time students who were involved in developing their own podcasts.<sup>2</sup>

The experiment was based on three assignments:

1. for the first exercise each student was given two files: one was the recording of an interview on multimedia themes<sup>3</sup> (questions and answers), the second one provided a new set of answers to the same questions; each student had to cut the new answers from the second file and paste them into the first one to substitute the original answers;
2. for the second exercise the students had to provide their own answers to the original questions, record them using a digital recorder connected to a personal computer, and paste them into the file of the interview; the students could choose to answer by expressing their own feeling about the topic, or by pretending to be either enthusiastic or skeptical of the technology;
3. for the third exercise the students, working in pair, had to prepare a lesson to be podcasted about one of the themes of the theoretical course: they were given some constraints (duration, sampling rate, bit rate), but were rather free to face the topic and to choose their favorite format: some of them arranged a formal lesson, others (a group of three students) simulated a moderated radio

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<sup>2</sup> Eighteen students were involved in the experiment.

<sup>3</sup> The author of this paper had been interviewed by a radio station and co-produced the interview to successively use it for educational purposes.

debate, others a desperate phone call between two friends the night before the exam.

The students were supported by the course instructors to solve technical problems and were able to interact with each other through a forum provided by the university's elearning platform, where they were able to post questions and answers and exchange experiences.

## 5. RESULTS AND REMARKS

Exam results are one out of several criteria commonly used in evaluating student performance, and in reference to this experiment they serve as a readily available measure: student performance was evaluated by comparing exam grades over the past three academic years, using overall grade average. The goal was to determine first of all if there were any significant differences in student performance this year, and subsequently if there were significant differences between the students involved in the experimentation and the other ones. Any difference found in the results should be ascribed to the introduction of podcasting, since the other variables, such as textbooks, lecturer and instructors, environment and students' profile did not significantly change from previous academic years.

Table 1 shows a comparison of the average grades of the students who passed the exam of "Laboratory of multimedia communication" over the last three academic years (Italian university grades range from 18 to 30): figures highlight that the results of the current year are significantly better than the previous ones.

**Table 1. Average grades (min 18 – max 30)**

	2003-2004	2004-2005	2005-2006
<b>Av. Grades (<math>\mu</math>)</b>	28.09	28.06	28.68
<b># of students</b>	66	98	28
<b>Std dev.</b>	1.68	1.78	1.68

In order to analyze these data, we evaluated the effect size (Cohen's  $d$ ) according to group mean differences; we obtained a  $d$  value of 0.35 (checking 2005-2006 against 2004-2005): according to Cohen [6], it corresponds to a small effect (on a scale 0.00-null, 0.20-small, 0.50-medium, 0.80-large); according to Slavin [17], this effect should be considered educationally significant (since it is greater than 0.25).

On the other hand, the application of the ANOVA method [1] on the same data did not provide enough evidence for supporting the idea that the variations are due to differences between the educational methods: by using the three groups of students, we got a calculated  $F$  value of 1.47, whilst the critical value of  $F$  for  $\alpha=0.05$ , which can be obtained from the  $F$  table, to reject the null hypothesis ( $H_0 : \mu_{2004} = \mu_{2005} = \mu_{2006}$ ) would be about 3.05.

Therefore, despite the sample effect looks promising, some caution is warranted in interpreting the effect size by itself, because the effect could have been the result of chance, even if it looks practically meaningful [8].

At this point we did split the results in two, as shown in Table 2, by separating the grades of full time students, who took part to the experiment, and part time students: these figures show that full time students usually perform better than part time, but also that

whilst the latter provided this year results similar to those of the past years, the former have seen a considerable increase.

**Table 2. Average grades (min 18 – max 30): full time vs. part time students**

	2003-2004	2004-2005	2005-2006
<b>Full time students</b>	28.4	28.7	29.4
<b># of students</b>	36	41	16
<b>Std dev.</b>	1.23	1.14	1.21
<b>Part time students</b>	27.7	27.6	27.7

This successful performance is even more significant since grades for this exam are usually rather high, because of the characteristics of the enrollment (students select the course deliberately and it is the final step of their curriculum on publishing) and there is limited room for improvement, which induces a sort of ceiling effect.

The statistical analysis performed with reference to full time students provided an effect size of 0.6 (2006 vs. 2005) and 0.85 (2006 vs. 2004); the ANOVA method generated an  $F$  value of 4.39, whilst the critical value would be 3.1: these findings would support the hypothesis that there was a significant improvement of grades due to the new educational method applied during the last academic year.

The results of Table 2 seem to support two opposite ideas:

1. the grades of the part time students provide evidence for claiming that the use of podcasting for distributing course materials did not affect the results: this might be interpreted as a failure of the podcasting itself, or could simply suggest that, despite the large number of visitors to the lecturer's site (more than 100,000 unique visitors a year), part time students did not look at the list of files recorded by their colleagues and ignored those integrative documents; on this subject it must be noted that the syllabus of any course of the faculty had to be published prior the beginning of the academic year, in July 2005, whilst the development of the podcasting service began some months later, the course started in February 2006, and the decision of using podcasts was taken in March – at that point, in order not to violate the formative pact formulated through the syllabus, the listing of the required textbooks and materials could not be modified and the podcasts were simply considered as additional (not compulsory) bibliographic materials; moreover, they probably were not enough evident within the lecturer's site, nor the podcasting portal was already known to the part time students;
2. on the other hand, the grades of the full time students suggest that their involvement in creating podcasted lessons enhanced their learning experience in a very effective manner [18]; by figures and observation we can say that podcasting design, recording, and editing spurred the development of reflective learning skills, stimulated students to go deep into the questions they had to face, and fostered positive collaborative behaviors.

It could be argued that positive results depend on the number of students enrolled in the course, which dramatically decreased, for organizational reasons, from 2005 to 2006 and that, according to Glass and Smith [11], reduced class size would be expected to produce increased academic achievement and the major benefits from reduced class size are obtained as the size is reduced below 20 pupils. Besides noting that there is no general agreement on this subject [16], we have to point out that when the number of students was higher, they were split into two groups and therefore the student / instructor ratio was approximately the same.

Eventually, it could be also argued that the results were influenced by some kind of Hawthorne effect, that is an increase in student performances produced by the psychological stimulus of being singled out, made to feel important and part of something new; or by a form of Rosenthal effect, or teacher expectancy effect, that is an increase simply because students are expected to do better. In that respect, we have to stress that also the students of the previous academic years experienced something completely new for them and their curricula, that is the practical development of multimedia applications; moreover, students were not aware of being tested, because the idea of reflecting on the course experience was suggested after its conclusion by the first good results of the exams, which were beyond any expectation; and finally, the introduction of podcasting had not been felt in advance by the lecturer and the other instructors as an improvement suitable to generate impressive effects, and therefore students have not been affected by any beneficial nor detrimental influence.

Although student performance is a significant gauge of the outcome and suitability of a course, student satisfaction surveys are important for casting light on students' feeling and derive some hypotheses for the continued success of an educational program.

Therefore we analyzed data from the standard student satisfaction surveys that are part of the institutional audit process of the University of Bergamo. Students were asked several questions and their answers could range from 0 (strongly disagree) to 10 (strongly agree). For the purpose of this case study, only a subset of the questions is shown (those related to structural, logistic or bureaucratic topics were discarded).

**Table 3. Scores for the course of Laboratory of multimedia communication over the last three years (min 0 – max 10)**

	2003-2004	2004-2005	2005-2006
opportunities to meet faculty	8.9	8.7	10.0
cultural stimuli from faculty	8.5	7.4	9.7
qual. of teaching: faculty	8.3	7.9	9.1
qual. of teaching: instructors	8.3	8.3	8.9
usefulness of laboratory work	8.6	8.2	9.2
qual. of classroom/lab facilities	9.1	7.6	9.9
interest for course contents	8.4	7.9	9.3
overall quality	8.6	7.6	9.4
cultural enrichment	8.5	7.5	9.1
overall satisfaction	8.4	7.8	9.4

Table 3 shows the “satisfaction scores” for the course over the last three years: the improvement is rather clear. Note that there is a known correlation between the “overall satisfaction” and the other issues (correlation above 0.9); this correlation could explain why the same classrooms and laboratories can be evaluated so differently from one year to an other, even if the increased score could be attributable to the use of audio devices for podcasting; note that the influence applies also to the feeling of “cultural enrichment”, that usually is difficult to be affected by computer science courses in a faculty of humanities.

Eventually, the amazing evaluation of the “opportunities to meet faculty” can be explained by the combined positive effect of the availability of an online discussion forum, of the podcasted lessons and of the sense of community [15] fostered by the cooperation with other students, faculty and instructors to build the set of podcasted lessons.

Similar considerations arise from the analysis of Table 4, that compares the scores of the three courses taught by the author in the academic year 2005-2006 and checks them against the mean and maximum value (for each topic of the quality assessment) over the whole set of courses of the Faculty of Arts and Philosophy.

The results, which move the “Laboratory of multimedia communication” to the top of the ranking, can be explained by the new structure of the course, which was not chosen for the other two courses.

**Table 4. Scores for the courses on computer science compared with mean and maximum scores over the whole Faculty of Arts and Philosophy (min 0 – max 10)**

LEGENDA:

- 101: Foundations of computer science;
- MC1: Introduction to multimedia communication;
- MC2: Laboratory of multimedia communication;**
- I s: first semester; II s: second semester

	101 (I s)	MC 1 (II s)	MC 2 (II s)	mean I s	max I s	mean II s	max II s
opportunities to meet faculty	9.1	9.0	<b>10.0</b>	8.3	9.6	8.2	<b>10.0</b>
cultural stimuli from faculty	8.1	8.1	<b>9.7</b>	7.5	9.3	7.5	<b>9.7</b>
qual. of teaching: faculty	8.5	8.1	<b>9.1</b>	7.7	9.3	7.8	9.2
qual. of teaching: instructors	n.a.	8.2	<b>8.9</b>	6.9	8.1	7.2	<b>8.9</b>
usefulness of laboratory work	n.a.	9.2	<b>9.2</b>	7.2	8.5	7.5	<b>9.2</b>
qual. of classroom/lab facilities	7.1	8.6	<b>9.9</b>	6.7	9.3	7.1	<b>9.9</b>
interest for course contents	7.4	7.7	<b>9.3</b>	7.8	9.4	7.8	<b>9.3</b>
overall quality	7.9	8.1	<b>9.4</b>	7.5	9.0	7.5	<b>9.4</b>
cultural enrichment	7.7	8.1	<b>9.1</b>	7.7	9.4	7.7	9.3
overall satisfaction	8.2	8.2	<b>9.4</b>	7.7	9.3	7.7	<b>9.4</b>

An important issue is that students declared that the course required limited effort: this shows that the improvement of the performance was not detrimental in terms of overwork and has not subtracted time to other activities and courses.

Finally, some form of qualitative analysis, based on the grounded theory [19], was conducted on transcriptions of colloquia with students and on their open answers to the student satisfaction questionnaire. The preliminary results (some interviews are still to be scheduled) emphasize the impact of the creative use of podcasting on the perceived quality of the course, but also on the ability of the students to assess their own understanding of the topics of the course and to deepen their competence beyond the walls of the classroom.

## 6. CONCLUSIONS

An experience of creative use of podcasting in higher education has been shown.

Quantitative and qualitative analysis of exam results and satisfaction surveys highlight that the involvement of students in producing podcasts for a course on multimedia communication had positive effects.

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