Academic effectiveness of podcasting: A comparative study of integrated versus supplemental use of podcasting in second language classes

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A B S T R A C T

With podcasting gaining more mainstream adoption in higher education, it's critical to examine its effectiveness in improving the student learning experience. To this end, this paper examines the effectiveness of podcasts integrated into the curriculum (PIC) versus podcasts as supplemental material (PSM). Considering recent empirical work on the effectiveness of podcasting, this study collected data from students enrolled in lower level and upper level language courses. Results revealed an inconclusive relationship among PIC students' learning outcomes (as measured by their final grades). In contrast, however, our findings indicate a strong relationship between the use of PSM and students' final grades, particularly in upper level courses.

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1. Introduction

Amplified by an exponential increase in computing power and the ever-wider penetration of wireless broadband access, the convergence of telecommunications and hardware technologies is reshaping the higher education information technology landscape. Indeed, the proliferation of the so-called mobile supercomputers (Woh, Mahlke, Mudge, & Chakrabarti, 2010), capable of performing intensive computational programs such as real time speech recognition and augmented reality (Beck & Luigi, 2010) while providing high-bandwidth access to social networking sites, is transforming students' ownership and use of technology (Smith & Caruso, 2010). The increased adoption of these wireless learning devices offers significant implications for academia, particularly in managing students' expectations, in augmenting traditional face-to-face classrooms, and in enabling and/or offering non-traditional students flexible access to content. Amid this mix, as part of a variety of Web 2.0 applications (Hsueh, 2011), podcasting has gained mainstream acceptance as a supplemental and revision tool capable of engaging and improving students' academic experience. Numerous studies have lauded the effectiveness of podcasting in enhancing students' learning and academic environments. To this end, it's critical to examine these claims and to explore the pedagogical effectiveness of podcasting in improving students' learning experience.

To contribute to this understanding, this paper attempts to examine the differential effectiveness of several different instructional uses of podcasting in second language (SL) acquisition. More specifically, we examine the academic benefits of 1) integrating podcasts into the curriculum and contrast them to 2) using podcasts as a supplemental instructional material. In doing this, our goal is twofold. First, the study bridges the significant gap in large and/or longitudinal studies in the literature, a gap which has been acknowledged by several authors (Heilesen, 2010; Lee, Miller, & Newnham, 2009). Second, it contributes to the understanding of podcasting as an effective learning tool.

This paper is divided into four sections. We briefly define the concept of podcasting and review various studies on the effectiveness of podcasting, and then discuss the categorizations of podcasting. Subsequent to this, we explain the purpose of the paper and the research

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questions it explores. This is followed by a short description of the background of the study and a detailed consideration of its methodological approach (sampling, data collection, and analysis). Building on this analysis, we conclude by highlighting key findings, discussing the study's limitations, and proposing further research avenues.

2. Review of the literature: academic effectiveness of podcasting

2.1. Benefits of podcasting

Broadly defined, podcasting refers to any audio/video content delivery approach based on web syndication protocols (Really Simple Syndication (RSS) and/or Atom). Podcasting provides increased flexibility, user control, and portability, and allows for time-shifting and multitasking (Abdous, Camarena, & Facer, 2009; McGarr, 2009; Thorne & Payne, 2005). By allowing subscription and notification, this XML-based protocol shifts audio/video file handling from a static and manual mode to a dynamic and automated mode (Abdous et al., 2009).

As we are reminded by Popova and Edirisingha (2010), the use of podcasts in higher education is rooted in the tradition of using audio for teaching and learning. Citing Durbridge (1984), Popova and Edirisingha (2010) point out that *audio has the educational ability to influence cognition through clarity of instructions, while influencing emotional aspects of learning by conveying immediacy and a connection with the teacher.*

However, unlike traditional audio files hyperlinked from websites, podcasting offers a number of technical/logistical and pedagogical benefits. In terms of technical benefits, sophisticated podcasting software and hardware has simplified, streamlined, and automated the recording, uploading, and downloading processes, even as the overall audio quality of podcasts has improved. Considered a Web 2.0 tool, podcasting is integrated into various self-publishing environments such as weblogs, wikis, and other tools.

RSS syndication is at the cornerstone of podcasting publication, subscription, and delivery. In addition to providing users with a portable, flexible, and convenient way to access and to listen to audio files anytime/anywhere, podcasting is enabling learners to control playback (hence, learning) speed and/or to engage in parallel activities. Although several studies have reported that students favor listening to podcasts on their desktops, instead of benefitting from the portability and flexibility associated with subscribing to RSS feeds (Carvalho, Aguiar, & Maciel, 2009; Evans, 2008; Huntsberger & Stavitsky, 2007; Lee & Chan, 2007; Lee et al., 2009), the portability of a podcast is an important factor in its getting used by students.

From a pedagogical perspective, Heilesen (2010) points out (with reason) that podcasting is revamping one of the *"most conservative and formal of all teaching methods."* Indeed, by shifting their lectures (a predominant form in teaching) to outside-of-classroom-time, podcasting is providing faculty with opportunities to extend communication and interactive opportunities beyond the lecture experience (Gosper et al., 2008), while restructuring classroom face time (Lonn & Teasley, 2009).

Consequently, Oliver (2005) argues that podcasting contributes to student learning by augmenting student motivation and engagement. This perspective is emphasized by the findings of Fernandez, Simo, and Sallan (2009) who suggest that podcasting contributes to students' motivation. In fact, those authors note that motivation was students' most highlighted aspect of their podcasting use.

After reviewing an extensive body of scholarly literature published between 2004 and 2009 regarding the academic efficacy of podcasting, Heilesen (2010) concludes that podcasting has a "positive impact on the academic environment." According to this author, podcasting opens up opportunities for faculty to experiment with new forms of teaching while it provides students with a new tool to use to supplement their study activities. These findings are corroborated by Walls et al. (2010) who show that podcasting can enrich students' learning experience, and by Lee, McLoughlin, and Chan (2008) who argue that engaging students in producing podcasts promotes collaborative knowledge building. In the same way, Larkin (2010) suggests that recorded lectures can contribute "to support the transformative nature of real learning." Lee and Chan (2007), for their part, indicate that podcasting promotes a sense of social presence and reduces online students' feelings of isolation.

As a revision tool, there's a clear consensus in the literature that podcasting is extremely effective. Evans (2008) concludes that students perceive podcasting as a more effective revision tool than textbooks, and consider it to be more efficient than their own notes. For their part, Kemp, Myers, Campbell, and Pratt (2010) suggest that podcasts are useful test review tools capable of decreasing anxiety before an examination. Along the same lines, Lonn and Teasley (2009) report that podcast materials were largely used as revision tools used for reviewing concepts and issues presented during lectures. However, McKinney, Dyck, and Luber (2009) specify that students are likely to benefit from podcasts only by taking notes and listening several times to the podcast; hence reiterating Heilesen's (2010) idea that listening is the "most obvious benefit of podcasting."

In terms of students' outcomes, there's a lack of consensus about the effectiveness of podcasting. For instance, McKinney et al. (2009) found that students watching a lecture podcast significantly outperformed those who attended only the live classroom lecture. Vajoczki, Watt, Marquis, and Holshausen (2010) reported higher grades among their experimental group of economics students listening to vodcasts. In contrast, Lazzari (2009) found that podcasting does not have a positive effect on students' grades. In a similar vein, Kemp et al. (2010) didn't discover any positive relationship between podcast listening and students' final course grades. For their part, Lazzari and Betella (2007) reported that the use of podcasting for the purpose of supporting learning is pedagogically neutral, even though the same authors reported that students involved in designing, creating, and editing podcast lessons enhanced their learning experience in a very effective manner.

Following this critical stance, several authors have reported that podcasting is associated with low class attendance and passive learning and has limited impact on final grades. Indeed, one of the most common critiques of podcasting centers on its impact upon class attendance. For example, Traphagan, Kucsera, and Kishi (2010) report that podcasting affected class attendance negatively. However, the authors conclude that webcast viewing is associated with higher performance in courses, and hence, students' absenteeism does not have a negative effect on their performance (as measured by quizzes and final exams).

In contrast, Bongey, Cizadlo, and Kalnbach (2006) conclude that students' listening to podcasts didn't lead to a large decline in class attendance. Similarly, Larkin (2010) notes that providing online recording of lectures didn't lead to lower class attendance. To the contrary, however, Moss, O'Connor, and White (2010) report findings from several studies indicate that podcasts were used as a revision tool rather than as an alternative to live lectures. In sum, students perceive podcasting as a useful additional resource that is available to help them succeed in their courses, rather than as a substitute for more traditional methods of learning.

For their part, Palmer and Devitt (2007) point out that podcasting is associated with passive learning, since students focus on the audio facility rather than actively engaging with the lecture content. Similarly, McGarr (2009) warns that podcasts have the potential to reinforce what he calls the *"the worst aspects of the transmission model of learning."* Perhaps this perspective is rooted in the perceived passivity associated with lectures and in the limited interactivity associated with podcasting, overall.

This overview of the literature reveals a mixed message about the benefits of podcasting, which perhaps explains the scepticism of some authors about the effectiveness of podcasting, or even the readiness of students to use and benefit from podcasting (Walls et al., 2010). However, the findings reported above suggest that podcasting is a useful tool for review, and is capable of providing students with self-paced and flexible access to learning material, while complementing traditional course resources. Yet these benefits hinge on two dimensions: effective pedagogical integration and the incorporation of podcasts into students' learning and studying habits and activities.

2.2. Educational categories of podcasting

In terms of categorization, McGarr (2009) offers an interesting approach which distinguishes among three categories: substantial podcasts (used mainly as a substitute for classroom teaching), supplementary podcasting (used to provide a classroom summary or additional materials), and creative podcasts (produced by the learner).

Similarly, Carvalho et al. (2009) propose a more elaborate taxonomy of podcasts using these delineating variables: type (informative, feedback, guidelines, and authentic materials), medium (audio or video), length, author, style (formal or informal), and the purpose of each podcast. While some of these variables are merely technical, podcasts' type, style, and purpose can reveal the value of podcasting to the student learning experience.

For their part, Walls et al. (2010) remind us that instructors have used podcasting in two forms: repetitive (recording lectures, including lecture slides and demonstrations) or supplemental (providing materials such as interviews with external resources), and that podcasting includes a wide variety of other options (distance learning enrichment, facilitation of self-paced learning, remediation, and support for various categories of learners).

Harris and Park (2008) talk about an integrated, expanded, and creative adoption of podcasting, driven by four variables: teaching, service, marketing, and technology. Teaching usage is focused on improving the learning experience by augmenting teaching, facilitating students' assignments, and supplementing research publications.

2.3. Podcasting and second language studies

In spite of the scepticism which surrounds the academic effectiveness of podcasting in learning, language learning has been identified as one of the disciplines most likely to benefit from podcasting's integration and use (Evans, 2008; Kukulska-Hulme & Shield, 2008; Walls et al., 2010). This claim is substantiated by podcasting's ability to provide authentic content (content produced by native speakers of the target language, such as news feeds or radio programming). This use of authentic content has been supported by numerous studies, particularly when careful pedagogical considerations have been kept in perspective (Khaniya, 2006). According to Beres (2011), "second language teachers and researchers have lauded the potential of mobile-assisted language learning (MALL)." In this regard, Beres notes, "smart phones and MP3 players can become language learning tools, allowing students to easily and immediately access materials from a variety of sources and to engage with those materials where and when they please."

3. Purpose of the study

Prior studies, including a recent study conducted by the authors (Abdous et al., 2009), provide evidence that the pedagogically-driven implementation of podcasting technology promotes second language learning; however, few studies have examined the effectiveness on language acquisition of the different instructional uses of podcasts. Copley (2007) and Herrington and Kervin (2007) indicate that the technology is most effective when it is thoughtfully integrated into course curricula and when it offers a clear purpose and rationale for its instructional use. In the light of current literature and practice, this study attempts to examine the differential effectiveness of two different instructional uses of podcasting upon student language acquisition: (1) Podcasts integrated into the curriculum (PIC), and (2) podcasts used as supplemental material (PSM). More specifically, we examine the academic benefits of integrating podcasts into the curriculum versus using them as a supplemental/review tool by addressing the following questions:

1 How will the use of podcasting (PIC vs. PSM) in a foreign language course predict students' final grade?
2 How will the level (upper level vs. lower level) of a foreign language course predict students' final grade?

The originality of our study is twofold: while previous podcasting studies relied almost exclusively on one-semester-based data (Heilesen, 2010), our study collected data over several semesters. Although it can't be considered a longitudinal study per se, our study offers a continuous look at the effectiveness of podcasting across various language courses, and involves a fairly large sample, when compared to most studies. Indeed, Kemp et al. (2010) recognize that studies spanning more than one semester's duration would likely offer more generalizable results. Hence, we aim to move podcasting research from research via immediate impressions – to reuse the expression of Heilesen (2010) – to more credible documentation of the effects of podcasting on teaching and learning.

4. Method

4.1. Background of study

This study was conducted in a mid-sized public four-year Research University in the mid-Atlantic region of the United States. Funded originally by a small Faculty Innovator Grant, this project was later supported by a grant from the National Endowment for the Humanities

(NEH). The NEH grant allowed more faculty members in the Foreign Language Department to develop podcasts and to use them for a variety of instructional purposes in different language courses between Fall 2007 and Fall 2010. Courses selected for the project range from lower-level language learning (beginning 101/102 and intermediate 201/202 sequential series) to upper-level language learning (311/312 advanced series and the 400 advanced series) in grammar, phonetics, literatures, and English.

As detailed in Tables 1 and 2, the academic podcasts vary from course to course, and include lectures, guest lectures, student-centered projects, student–student and student-instructor oral interviews with or without feedback, interviews with native speakers, pre-recorded lectures for class, dictations, group discussions, student presentations, student vodcasts, and distance learning.

4.2. Participants

Participants were recruited from 27 foreign language and literature courses held between Fall 2007 through the Fall 2010. These participants ($N = 337$) completed a survey which had been developed to tap into the information regarding a language class, student's academic performance, study habits, time devoted to studying and to completing assignments, access to various technological gadgets, and perceived usefulness and effects of the podcasts on language skill development (Abdous et al., 2009). The study also collected student demographic data such as gender, age group, computer skills, device ownership, and study habits.

The majority of the participants who responded to the survey were female (216, 64.09%), 19–25 years old (245, 72.70%), and studying in the College of Arts & Letters (241, 71.51%). More of their demographic information is listed in Table 3.

Participants were asked to respond, on a five-point Likert scale (1: very little; 5: a great deal), to five survey items regarding their comfort levels using various technological applications. The mean total score was 18.49 and the standard deviation of the total scores was 4.70, regardless of the podcasting method used. Accordingly, the average comfort level score for technological applications was 3.70 on a 1–5 Likert scale. As to the comfort level of technological applications between different podcasting groups, the mean total scores were 19.63 ($n = 141$) in the PIC courses and 17.65 ($n = 191$) in the PSM courses. Therefore, the participants in the PIC courses seemed to have more confidence when using various technologies. Those technological applications included using the internet or library search engine for research, using a hand-held PC or laptop to take class notes, using PC software to complete class assignments, downloading course material to the PC/iPod/MP3 player, and completing interactive lessons using wireless access.

As to their ownership of different technology gadgets, 330 (98.21%) of the students owned personal computers, 57 (16.96%) owned hand-held computers or PDAs, and 249 (74.11%) owned iPods/MP3 players (See Table 4). The aforementioned ownership composition remained similar across those two podcasting use groups (i.e., PIC vs. PSM).

Table 1
Pedagogically Integrated Podcasts (PIC).

Semester	Number of courses	Podcasting activity	Activity description
Fall/Spring 2010	4	1. Pre-recorded lecture 2. Student presentations 3. Group discussion 4. Guest Lectures	1. Text dialogs 2. Student recordings of final projects 3. Instructor-student group discussion of the material 4. Special guest lecture by faculty experts on the topic
Fall/Spring 2009	3	1. Lecture 2. Group discussion 3. Student presentations 4. Pre-recorded lecture	1. Instructor's recorded lecture of course content for specific assignments and dates; corrections and pronunciation 2. Instructor-student group discussion of the material 3. Student presentations during class 4. Instructor-student group discussion of the material
Fall/Spring 2008	4	1. Student recordings 2. Lecture 3. Group discussion 4. Student presentations 5. Guest Lectures	1. Student recordings in the Language Learning Center (LLC), including: paired interviews and interviews with a native speaker. Feedback/corrections provided by instructor 2. Instructor's recorded lecture of course content 3. Instructor-student group discussion of the material 4. Student presentations of author and text in preparation for class discussion and lecture (5–10 min) 5. Special guest lectures by faculty experts on the topic and/or language/region (20–30 min)
Fall/Spring 2007	6	1. Lecture 2. Student presentations 3. Dictations 4. Group discussion 5. Guest Lectures 6. Student oral exam interviews 7. Student paired interviews 8. Roundtable discussions	1. Instructor's recorded lecture outlining the author, text, and cultural content 2. Student presentations of author and text in preparation for class discussion and lectures 3. Graded in-class dictations by instructor for student out-of-class review and corrections 4. Discussion by students and instructor of the literary text 5. Special guest lectures by faculty experts on the topic and/or language/region (20–30 min) 6. Instructor-student oral interviews with feedback and corrections provided at the end of recording 7. Student–student interviews with instructor voiceover feedback and commentary for grade. Recordings used for peer review critique. 8. Small student group discussions of required weekly reading material
Total	17		

Table 2
Podcasts as Supplemental Material (PSM).

Semester	Number of Courses	Student Enrollment	Podcasting Activity	Activity Description
Fall/Spring 2010	2	31	1. Lecture	1. Instructor's recorded lecture of course content
Fall/Spring 2009	11	161	1. Lecture	1. Instructor's recorded lecture of course content
Fall/Spring 2008	10	150	1. Lecture	1. Instructor's recorded lecture of course content
			2. Guest Lectures	2. Special guest lectures by faculty experts
Fall/Spring 2007	4	66	1. Lecture	1. Instructor's recorded lecture of course content
			2. Group discussion	2. Discussion of texts and critical texts with student participation
			3. Distance learning	3. Recording was used for a distance learning student enrolled in the course
Total	27	408		

*Academic podcasting courses include: Chinese, French, German, Italian, Japanese, Spanish, FLET, IS; beginning to advanced language, literature, and culture; undergraduate and graduate.

The participants were also asked to supply information regarding the effects of podcasting on their study habits and time spent weekly on readings and assignments (see Table 5). In general, a higher percentage of students in the PIC courses perceived more positive effects of podcasting on various aspects of their studying. For instance, 33.57%, 35.57%, and 32.38% of students in the PIC courses perceived "much" to "a great deal" of positive effects of podcasting on the ease of learning material, on completing assignments, and on getting feedback from teachers respectively, relative to 22.68%, 23.12%, and 11.35% of their counterparts in the PSM courses. On the other hand, a much higher percentage of students in the PSM courses (73.51%) perceived the positive effects of podcasting on the ease of getting feedback from teachers as "little" or "very little" than did the students in the PIC courses (46.76%). The students' reported time spent on reading per week did not differ much between the PIC courses and the PSM courses. However, students in the PSM courses reported spending less time on assignments each week than their peers in the PIC courses. More specifically, more than half of them (54.45%) spent less than 2.5 h on assignments each week, while 55.63% of students in the PIC groups spent more than 2.5 h on assignments.

4.3. Students' learning habits

Our results indicate that a higher percentage of students (40.45%) were often or sometimes listening to podcast material on their desktops or laptops instead of on their mobile devices or MP3 players. Among students who owned iPods or MP3 players, only 28.48% reported to "often use" or "sometimes use" those devices to listen to course materials.

These findings are consistent with previous studies showing the same learning habits among other groups of students (Abdous et al., 2009; Lonn & Teasley, 2009). As mentioned by Lee et al. (2009), this learning habit is likely explained by several factors, including lack of technical knowledge among students and teachers and pre-established habits in accessing web-based information. In this sense, Walls et al. (2010) remind us that students have the tendency to use their portable devices for entertainment, while using their desktop for educationally-related material.

Table 3
Participant demographics by use of podcasting (N = 337).

	Use of podcasting					
	Integrated (PIC)		Supplementary (PSM)		Total	
	n	%	n	%	n	%
Gender						
Female	95	66.43	121	62.69	216	64.09
Male	48	33.57	72	37.31	120	35.61
Missing					1	0.30
Age						
≤ 18	12	8.39	6	3.11	18	5.34
19–20	38	26.57	51	26.43	89	26.41
21–25	66	46.16	90	46.63	156	46.29
26–29	10	6.99	20	10.36	30	8.90
≥ 30	17	11.89	26	13.47	43	12.76
Missing					1	0.30
College						
Arts & Letters	99	69.23	142	74.35	241	71.51
Business & Public Admin	16	11.19	27	14.14	43	12.76
Education	8	5.59	6	3.14	14	4.15
Engineering	3	2.10	4	2.09	7	2.08
Sciences	12	8.39	8	4.19	20	5.93
Health Sciences	3	2.10	0	.00	3	0.90
Other	2	1.40	4	2.09	6	1.80
Missing					3	0.90

Table 4
Descriptive statistics of ownership of technological gadgets by use of podcasting excluding missing scores.

Variable	Use of podcasting					
	Integrated (PIC)		Supplementary (PSM)		Total	
	n	%	n	%	N	%
Personal Computer						
Yes	141	97.92	189	97.93	330	97.92
No	3	2.08	4	2.07	7	2.08
Handheld Computer/PDA						
Yes	26	18.06	31	16.06	57	16.91
No	118	81.94	162	83.94	280	83.09
iPod/MP3						
Yes	102	70.83	147	76.17	249	73.89
No	42	29.17	46	23.83	88	26.11

4.4. Operationalization and measurement of research variables

4.4.1. Use of podcasting

There were two different types of podcasting used in various foreign language courses: (1) Podcasts integrated into the curriculum (PIC), and (2) podcasts used as supplemental material (PSM). In the PIC courses, faculty members strategically integrated podcasting into a variety of instructional activities, such as student projects and exams, student presentations, student interviews, lectures, dictations, roundtable discussions, and guest lectures. On the other hand, in the PSM courses, faculty only utilized podcasting for recording their lectures so that students could review them after the class. In both types of courses (i.e., PIC & PSM), the instructors were provided with the latest recording hardware, software, and technical support to facilitate the use of podcasting. All podcasts were uploaded to iTunes so that students could access, browse, search, subscribe, and synchronize their classes' podcast lists. Technical support for the use of podcasts was also offered to students and to faculty.

4.4.2. Level of course

Participating foreign language classes consisted of lower level and upper level language courses. Lower level courses included the beginning 101/102 and intermediate 201/202 sequential series language courses. Upper level courses were the 311/312 advanced series and the 400 advanced series in grammar, phonetics, and language literature.

4.4.3. Final grades

The participants' final grades were supplied to the study by the University Registrar. The final grades were categorized into three groups in actual data analysis: (1) A to A−, (2) B+ to B−, and (3) C+ or lower.

5. Data analysis

In the current study, data analyses were performed using SPSS 17.0. Descriptive statistics of frequencies and percentages were computed for the outcome variable, final grade. Furthermore, the alpha levels were set at the 0.05 level for all significant tests in this study.

Table 5
Descriptive statistics of the effect of podcasting on study habits and weekly time spent on reading and assignments by use of podcasting excluding missing scores.

Variable	Use of podcasting					
	Integrated (PIC)		Supplementary (PSM)		Total	
	n	%	n	%	N	%
Easier to learn material						
Little/Very little	67	47.86	104	55.91	171	52.45
Moderate amount	26	18.57	40	21.51	66	20.25
Much/Great deal	47	33.57	42	22.58	89	27.30
Easier to complete assignment						
Little/Very little	70	50.00	111	59.68	181	55.52
Moderate amount	23	16.43	32	17.20	55	16.87
Much/Great deal	47	33.57	43	23.12	90	27.61
Easier to get feedback from teachers						
Little/Very little	65	46.76	136	73.51	201	62.04
Moderate amount	29	20.86	28	15.14	57	17.59
Much/Great deal	45	32.38	21	11.35	66	20.37
Time on reading						
0–2 h per week	49	34.27	70	36.65	119	35.63
2.5–4 h per week	56	39.16	67	35.08	123	36.83
> 4 h per week	38	26.57	54	28.27	92	27.55
Time on assignment						
0–2 h per week	63	44.37	104	54.45	167	50.15
2.5–4 h per week	50	35.21	43	22.51	93	27.93
> 4 h per week	29	20.42	44	23.04	73	21.92

Due to the limited number of categories and ordinal nature of final grades, ordinal logistic regression analysis (Norusis, 2008; O'Connell, 2006) was implemented to examine the predictive relationships between (1) the use of podcasting and the final grade, and (2) the level of course and the final grade. More specifically, a cumulative odds model was fitted to the data. The use of ordinal logistic regression, which is closely related to logistic regression, helped to avoid the statistical consequences from the violation of assumptions in linear regression, such as normality of errors and linearity in the parameters (King, 2008).

In the ordinal logistic regression model, the highest-grade group (i.e., the A to A− group) served as the first group to form the cumulative odds at two descending cut-offs: (1) A−, and (2) B−. As a result, the odds of obtaining (1) a grade of A− or higher (relative to all other lower grades), and (2) a grade of B- or higher (relative to all other lower grades) could be estimated. The probabilities of falling into three possible categories of final grade (i.e., 1: A to A−; 2: B+ to B−; 3: C+ or lower) could also be derived from those odds. In the ordinal logistic regression model, with use of podcasting as the predictor, the PSM group served as the reference group. On the other hand, the upper level course group served as the reference group in the ordinal logistic regression model with level of the course as the predictor.

The overall predictive utilities of those two predictors respectively (i.e., the use of podcasting and the level of the course) for students' final grades were assessed by testing the improvement of the model fit relative to the null model with the χ^2 likelihood ratio test of the differences between the deviances in the null model and the model under study (O'Connell, 2006). The parallel lines assumption was checked with the χ^2 likelihood ratio test (Norusis, 2008) to assess whether the relationship between the predictor and final grade remained the same across those two cut-offs. Two different pseudo R^2, Cox and Snell R^2 and Nagelkerke R^2, were computed to assess the overall model fit (O'Connell). The larger the pseudo R^2 was, the better the model fit.

6. Results

6.1. Descriptive statistics of research variables

The descriptive statistics of the final grades by use of podcasting and level of course were listed in Table 6. Overall, around 47% of the participants got A or A- grades. Within each podcasting use group (i.e., PSM & PIC), a higher percentage of students in the PSM group (52.85%) obtained A or A- grades relative to the percentage of students in the PIC group (38.19%). As to the level of course (i.e., upper level vs. lower level), a higher percentage of students in the upper level courses obtained A or A- grades (50.19%) relative to the percentage of students in the lower level courses (33.78%).

6.2. Predictive relationship between use of podcasting and final grade

In the ordinal logistic regression model, with use of podcasting as the predictor (see Table 7), the results of the χ^2 likelihood ratio test supported a predictive relationship between use of podcasting and final grade, χ^2 (1, $N = 337$) = 9.63, $p < 0.05$. Accordingly, the probabilities of obtaining various final grades would change across two podcasting use groups. In addition, the results did not indicate the violation of the parallel lines assumption, χ^2 (1, $N = 337$) = 0.38, $p > 0.05$. Therefore, the relationship between the use of podcasting and the students' final grades remained constant across two cut-offs in final grade and could be estimated by the single regression coefficient for use of podcasting (Norusis, 2008).

The logistic regression coefficient (i.e., the location coefficient) for the use of podcasting was 0.65 and suggested that the odds of students' getting higher course final grades, relative to all other lower course final grades at various cut-off values, were higher for students in the PSM group than for their counterparts in the PIC group (Norusis, 2008). The Cox and Snell R^2 and the Nagelkerke R^2 were 0.03 and 0.03 respectively and indicated a modest predictive relationship.

Two cut-offs were set for the ordinal criterion variable, final grade, to examine how the odds and the probability of obtaining higher final grades would change across two podcasting groups (O'Connell, 2006). The odds of obtaining higher final grades at two cut-offs were the ratios of the probabilities of: (1) A and A− to all lower grades, and (2) A through B- to all lower grades. For students in the PSM group, the predicted probabilities of obtaining A to A−, or B+ to B−, or C+ & lower were 53.29%, 32.95%, and 13.76%, respectively. As for the students in the PIC group, the predicted probabilities of obtaining A to A−, or B+ to B−, or C+ & lower were 37.41%, 39.25%, and 23.34% respectively. Overall, the students in the PSM group were more likely to obtain better grades in various foreign language courses.

6.3. Predictive relationship between level of course and final grade

While using the level of course as the predictor (see Table 8), the predictive relationship between the level of course and the final grade was supported by the χ^2 likelihood ratio test results, χ^2 (1, $N = 337$) = 7.21, $p < 0.05$. As a result, the probabilities of obtaining various final grades would depend on the course level of various foreign language courses. Furthermore, the violation of the parallel lines assumption was not suggested by the results, χ^2 (1, $N = 337$) = 0.03, $p > 0.05$. Accordingly, the relationship between the level of course and the final grade across two cut-offs could be estimated by the single regression coefficient (Norusis, 2008).

Table 6
Descriptive statistics of final grade by use of podcasting and level of course ($N = 337$).

| | Use of podcasting | | | | Level of course | | | | Total | |
| | Integrated | | Supplementary | | Lower level | | Upper level | | | |
	n	%	n	%	n	%	n	%	n	%
Final grade										
A to A−	55	38.19	102	52.85	25	33.78	132	50.19	157	46.59
B+ to B−	54	37.50	66	34.20	30	40.54	90	34.22	120	35.61
C+ or lower	35	24.31	25	12.95	19	25.68	41	15.59	60	17.80

Table 7
Ordinal logistic model with use of podcasting as the predictor for final grade ($N = 337$).

Parameter	Estimate
Location	
Use of Podcasting	0.65*
Threshold	
Grade = A to A−	0.13
Grade = B+ to B−	1.84*

Overall model evaluation	χ^2	df	Cox and Snell R^2	Nagelkerke R^2
Likelihood ratio test	9.63*	1		
Goodness-of-fit index			0.03	0.03

*$p < .05$.

The logistic regression coefficient (i.e., the location coefficient) for use of podcasting was 0.66 and suggested that the odds of students' getting higher course final grades were higher for students in the upper level courses relative to their counterparts in the lower level courses (Norusis, 2008). The Cox and Snell R^2 and the Nagelkerke R^2 were 0.02 and 0.02 respectively and indicated a modest predictive relationship.

The odds of obtaining higher final grades at two cut-offs were the ratios of the probabilities of: (1) A and A− to all lower grades, and (2) A through B- to all lower grades. For students attending the upper level courses, the predicted probabilities of obtaining A to A−, or B+ to B−, or C+ & lower were 50.11%, 34.44%, and 15.45% respectively. As to the students attending the lower level courses, the predicted probabilities of obtaining A to A−, or B+ to B−, or C+ & lower were 34.17%, 39.71%, and 26.11% respectively. Generally, the students in the upper level foreign language courses were more likely to obtain better grades.

7. Discussion

Drawing on our previous study results (Abdous et al., 2009), our research aim was to examine the effectiveness of PIC versus PSM in second language learning courses. Unlike our previous results, our findings suggest a relationship between podcasting use and final grade that is inconsistent with the theoretical expectation. The different uses of podcasting (i.e., PIC vs. PSM) seem to result in different learning outcomes (as measured by final grades in foreign language courses). More specifically, students in the PSM courses are more likely to obtain better final grades in comparison with their counterparts in the PIC courses.

Regression analysis revealed that the use of podcasting was a useful predictor for learning outcomes, as measured by students' final grades. One possible explanation is that PIC wasn't integrated in a similar manner across the various courses sampled. Although several studies suggest that pedagogically-driven implementation of podcasting technology is likely to promote second language learning, podcasts' integration must engage learners in tasks that demonstrate authentic language or simulate authentic tasks.

In contrast, this study highlights that use of podcasts as a supplemental course material remains an effective revision tool, one likely to promote SL learning. Regression analysis revealed that a conclusive relationship with PSM was a useful predictor for high learning outcomes, as measured by students' final grades.

This idea that emerges from our analysis can be interpreted, on the one hand, as reinforcement for the consensus shown in the literature that podcasting is an effective revision tool. Our results clearly indicate that students using PSM obtained high grades. On the other hand, these results could be interpreted to show another non-conclusive relationship between PIC and students' grades. Again, this conclusion is likely explained by the variety of integration scenarios used by faculty (guest lectures, student-centered projects, oral interviews, dictations, group discussions, student presentation).

The second question examined the relationship between podcasting use in lower level SL courses versus podcasting use in upper-level courses. Data reveals that upper level students listening to podcasts obtained higher grades in comparison to lower level students. Although this finding isn't echoed in previous studies, it could be interpreted that upper level SL students are benefitting from podcasting because of

Table 8
Ordinal logistic model with level of COURSE as the predictor for final grade ($N = 337$).

Parameter	Estimate
Location	
Level of course	0.66*
Threshold	
Grade = A to A−	0.004
Grade = B+ to B−	1.70*

Overall model evaluation	χ^2	df	Cox and Snell R^2	Nagelkerke R^2
Likelihood ratio test	7.21*	1		
Goodness-of-fit index			0.02	0.02

*$p < 0.05$.

their advanced SL proficiency. However, against this conclusion, it could be argued that lower level students should have equally benefited from podcasting as a revision tool.

Recalling McKinney et al. (2009) and Vajoczki et al. (2010)'s conclusions, we can argue that our findings support previous studies. However, our expectation that PIC would outweigh PSM was not supported.

8. Limitations of the study

Like most comparative studies, it is common practice to interpret results in light of potential limitations. First, the study was quasi-experimental, since random selection and an assignment of participants to groups were not possible. The sample was selected based on the survey response, which creates a self-selection bias that may have affected the results. Second, for the PIC, the researchers did not participate in the design, implementation, or utilization of podcast files. Various instructors used the PIC in various ways, hence the variety observed (Table 1). Third, there are limitations inherent in using final grades and satisfaction levels as the measurement of the outcomes of courses delivered by various course delivery methods (DMs). Fourth, our data was self-reported and it's well known that self-reported data often carry a certain dose of subjectivity. To this end, we were unable to obtain server log files to triangulate the reported frequency of access data with server log files. Finally, the lack of a control group in our study was perhaps its most important limitation. It would have helped to determine if the observed results are truly related to the use of PSM or PIC.

In spite of these limitations, this study contributes to the podcasting literature by confirming some of the known assumptions and by questioning some of the existing assumptions. Undoubtedly, this project warrants further examination and exploration of the myriad ways in which targeted and systematic integration of podcasting can enhance students' learning experiences.

9. Conclusion

In this paper, we examined the effectiveness of podcasting used either as a supplemental or as an integrated course material. Although our findings reveal an inconclusive relationship between PIC and students' final grades, our study reinforces previous findings. As a revision tool, podcasting has the potential to improve students' learning. To maximize the untapped potential of various Web 2.0 applications, including podcasting, future research should focus on the effective integration of learner-generated podcasts.

Because of the unique capabilities and features of podcasting, it is critical to expand its use beyond its disappointing association – to reuse the expression of Middleton (2009) – with mere transmission of teachers' knowledge through the distribution of recorded lectures, into a catalyst which can promote active student engagement and learning.

Keeping in perspective that learning is partially a knowledge creation process, we argue, with Lazzari (2009), McGarr (2009), and McLoughlin and Lee (2007), that further research should involve designing and producing learner-generated/centered podcasts. To this end, we agree with Beres (2011), that we should refocus the podcasting debate on student learning, aligning their understanding of effective learning strategies with our teaching practices. We anticipate that this alignment is likely to enable faculty to rethink their teaching practices while enhancing students' learning experiences and establishing podcasting as an effective and viable tool for improving the learning experience.

References

Abdous, M., Camarena, M., & Facer, B. R. (2009). MALL technology: use of academic podcasting in the foreign language classroom. *ReCALL, 20*(1), 1–20.
Beck, S. F., & Luigi, A. C. (2010). *Dynamic reconfigurable architectures and transparent optimization techniques*. Dordrecht: Springer.
Beres, D. (2011). Mobile-assisted language learning from the student perspective: encouraging effective language learning strategies outside of the classroom. In B. Facer, & M. Abdous & (Eds.), *Academic podcasting and mobile assisted language learning* (pp. 93–110). Hershey, PA: IGI Global.
Bongey, B., Cizadlo, G., & Kalnbach, L. (2006). Explorations in course-casting: podcasts in higher education. *Campus-Wide Information Systems, 23*(5), 350–367.
Carvalho, A., Aguiar, C., & Maciel, R. (2009). A taxonomy of podcasts and its application to higher education. In *ALT-C 2009 " "In dreams begins responsibili*ty" - choice, evidence and change, 8–10 September 2009, Manchester". Retreived from. http://repository.alt.ac.uk/638/.
Copley, J. (2007). Audio and video podcasts for lectures for campus-based students production and evaluation of student use. *Innovations in Education and Teaching International, 44*(4), 387–399.
Durbridge, N. (1984). *Media in course design, No. 9, audio cassettes. The role of technology in distance education*. Kent, UK: Croom Helm.
Evans, C. (2008). The effectiveness of m-learning in the form of podcast revision lectures in higher education. *Computers & Education, 50*(2), 491–498.
Fernandez, V., Simo, P., & Sallan, J. M. (2009). Podcasting: A new technological tool to facilitate good practice in higher education. *Computers & Education, 53*(2), 385–392.
Gosper, M., Green, D., McNeill, M., Phillips, R., Preston, G., & Woo, K. (2008). *The impact of web-based lecture technologies on current and future practices in learning and teaching*. Sydney: Australian Learning and Teaching Council. Retrieved from http://www.cpd.mq.edu.au/teaching/wblt/research/report.html.
Harris, H., & Park, S. (2008). Educational usages of podcasting. *British Journal of Educational Technology, 39*(3), 548–551.
Heilesen, S. B. (2010). What is the academic efficacy of podcasting? *Computers & Education, 55*(3), 1063–1068.
Herrington, J., & Kervin, L. (2007). Authentic learning supported by technology: 10 suggestions and cases of integration in classroom. *Education Media International, 44*(3), 219–236.
Hsueh, S.-L. (2011). Challenges of adopting Web 2.0 and Mobile 2.0 for language learning. In B. Facer, & M. Abdous (Eds.), *Academic podcasting and mobile assisted language learning* (pp. 70–91). Hershey, PA: IGI Global.
Huntsberger, M., & Stavitsky, A. (2007). The new "podagogy": incorporating podcasting into journalism education. *Journalism & Mass Communication Educator, 61*(4), 397–410.
Kemp, P. K., Myers, C. E., Campbell, M. R., & Pratt, A. P. (2010). Student perceptions and the effectiveness of podcasting in an Associate Degree Nursing program. *Teaching and Learning in Nursing, 5*(3), 111–114.
Khaniya, T. (2006). Use of authentic materials in EFL classrooms. *Journal of NELTA, 11*(1–2), 17–23.
King, J. E. (2008). Binary logistic regression. In J. W. Osborne (Ed.), *Best practices in quantitative methods* (pp. 358–384). Thousand Oaks, CA: Sage Publications.
Kukulska-Hulme, A., & Shield, L. (2008). An overview of mobile assisted language learning: from content delivery to supported collaboration and interaction. *ReCALL, 20*(03), 271–289.
Larkin, H. E. (2010). But they won't come to lectures …" The impact of audio recorded lectures on student experience and attendance. *Australasian Journal of Educational Technology, 26*(2), 238–249.
Lazzari, M. (2009). Creative use of podcasting in higher education and its effect on competitive agency. *Computers & Education, 52*(1), 27–34.
Lazzari, M., & Betella, A. (2007). Towards guidelines on educational podcasting quality: problems arising from a real world experience. In M. Smith, & G. Salvendy (Eds.), *Human interface and the management of information. Interacting in information environments, Vol. 4558* (pp. 404–412). Berlin/Heidelberg: Springer.
Lee, M. J. W., & Chan, A. (2007). Reducing the effects of isolation and promoting inclusivity for distance learners through podcasting. *Online Submission, 8*, 85–105.
Lee, M. J. W., McLoughlin, C., & Chan, A. (2008). Talk the talk: learner-generated podcasts as catalysts for knowledge creation. *British Journal of Educational Technology, 39*(3), 501–521.

Lee, M. J. W., Miller, C., & Newnham, L. (2009). Podcasting syndication services and university students: why don't they subscribe? *The Internet and Higher Education, 12*(1), 53–59.

Lonn, S., & Teasley, S. D. (2009). Podcasting in higher education: what are the implications for teaching and learning? *The Internet & Higher Education, 12*(2), 88–92.

McGarr, O. (2009). A review of podcasting in higher education: its influence on the traditional lecture. *Australasian Journal of Educational Technology, 25*(3), 309–321.

McKinney, D., Dyck, J. L., & Luber, E. S. (2009). iTunes University and the classroom: can podcasts replace professors? *Computers & Education, 52*(3), 617–623.

McLoughlin, C., & Lee, M. J. (2007). Listen and learn: a systematic review of the evidence that podcasting supports learning in higher education. In C. Montgomerie, & E. J. Seale (Eds.), *World conference on educational multimedia, hypermedia and telecommunications (EDMEDIA) 2007* (pp. 1669–1677). Vancouver: Canada.

Middleton, A. (2009). Beyond podcasting: creative approaches to designing educational audio. *ALT-J: Research in Learning Technology, 17*(2), 143–155.

Moss, N. D., O'Connor, E. L., & White, K. M. (2010). Psychosocial predictors of the use of enhanced podcasting in student learning. *Computers in Human Behavior, 26*(3), 302–309.

Norusis, M. (2008). *SPSS statistics 17.0 advanced statistical procedures companion*. Upper Saddle River, NJ: Prentice Hall.

O'Connell, A. (2006). *Logistic regression models for ordinal response variables*. Thousand Oaks, CA: Sage Publications.

Oliver, B. (2005). Mobile blogging, 'Skyping' and podcasting: Targeting undergraduates' communication skills in transnational learning contexts. *Microlearning, 107*(4), 587–600.

Palmer, E. J., & Devitt, P. G. (2007). A method for creating interactive content for the iPod, and its potential use as a learning tool: technical advances. *BMC Medical Education, 7*(32), Retrieved from http://www.biomedcentral.com/1472-6920/7/32.

Popova, A., & Edirisingha, P. (2010). How can podcasts support engaging students in learning activities? *Procedia - Social and Behavioral Sciences, 2*(2), 5034–5038.

Smith, S. D., & Caruso, J. B. (2010). *The ECAR study of undergraduate students and information technology, 2010 — Key findings*. Boulder, CO: EDUCAUSE Center for Applied Research. Retrieved from http://www.educause.edu/Resources/ECARStudyofUndergraduateStuden/217333.

Traphagan, T., Kucsera, J. V., & Kishi, K. (2010). Impact of class lecture webcasting on attendance and learning. *Educational Technology Research & Development, 58*(1), 19–37.

Thorne, S. L., & Payne, J. S. (2005). Evolutionary trajectories, internet-mediated expression, and language education. *CALICO Journal, 22*(3), 371–397.

Vajoczki, S., Watt, S., Marquis, N., & Holshausen, K. (2010). Podcasts: are they an effective tool to enhance student learning? A case study. *Journal of Educational Multimedia and Hypermedia, 19*(3), 349–362.

Walls, S. M., Kucsera, J. V., Walker, J. D., Acee, T. W., McVaugh, N. K., & Robinson, D. H. (2010). Podcasting in education: are students as ready and eager as we think they are? *Computers & Education, 54*(2), 371–378.

Woh, M., Mahlke, S., Mudge, T., & Chakrabarti, C. (2010). Mobile supercomputers for the next-generation cell phone computer. *Computer, 43*(1), 81–85.