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Psychosocial predictors of the use of enhanced podcasting in student learning

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## Abstract

The current study examined the influence of psychosocial constructs, from a theory of planned behavior (TPB) perspective, to predict university students' ( $N = 159$ ) use of a newly offered on-line learning tool, enhanced podcasts. Pre-semester, students completed questionnaires assessing the TPB predictors (attitude, subjective norm, perceived behavioral control) related to intended enhanced podcast use until the middle of semester. Mid-semester, students completed similar items relating to podcast use until the end of semester. Self-report measures of podcast use were obtained at the middle and end of semester. At both time points, students' attitudes predicted their intentions and, at the initial time point, subjective norm also predicted intended podcast use. An examination of the beliefs underlying attitudes, the only construct to predict intentions at both time points, revealed differences between those students higher, rather than lower on intentions to use the podcasts, especially for the perceived educational benefits of podcast use later in the semester. Intentions to use enhanced podcasting only predicted self-reported use in the second half of the semester. Overall, this study identified some of the determinants which should be considered by those aiming to encourage student use of novel on-line educational tools.

Keywords: podcast; e-learning; theory of planned behavior; higher education

## Psychosocial predictors of the use of enhanced podcasting in student learning.

Recently, the use of podcasts as a flexible study tool has emerged as a convenient method for students, especially in tertiary institutions, to download lecture content (Cebeci & Tekdal, 2006; Edirisingha & Salmon, 2007; Moss, 2006). Providing students with a simple subscription interface, podcasts allow the easy revision of lecture material in an audio format, apparently preferred by current students to traditional reading material (Cebeci & Tekdal, 2006). As a client base, students appear to have readily taken to podcasts with large proportions of classes reported to have used these resources when provided. Estimates using subjective measurement methods indicate approximately 32% to 58% (Cebeci & Tekdal, 2006) of the class listening to the podcasts and objective measurement methods indicate approximately 16% to 43% (Moss, 2007) of the class listening.

Podcasts have a number of benefits readily identifiable for the student base for which they are created. The simple subscription model uses an interface that is not only user friendly, but due to the popularity of the programs used, is not unknown to a large proportion of users. Little technical skill is required on the student's behalf to obtain and use the podcasts, and the files can easily be transferred to portable media players (such as iPods and mobile phones) for more transportable revision purposes. Previous research has revealed no differences between mature-age and direct from school students regarding perceived ease of use of the technology (Lorimer & Hillard, 2009). Further, the file size of the podcast itself provides little restriction for use or access, compared to the typical file size of a music audio file. Importantly, students report positive benefits concerning their ability to choose when and where they wish to review the lecture material, in a sense, "time shifting" the lecture to a period of greatest convenience to them (Edirisingha & Salmon, 2007; Moss, 2007). Enhanced podcasts, an extension of the traditional technology, enrich this experience further. By allowing the images used within the lecture itself (i.e., the "PowerPoint" slides) to be transmitted in a synchronized form along with the audio content of the presentation, the lecture is reproduced in a form much closer to that originally

delivered to students. Further, each “PowerPoint” image creates a “Chapter”, which students can use to quickly access the material the student wishes to revise. This “point of need” access improves the usability of enhanced podcasts over the standard form, for which relevant material must be searched.

Previous research into web-based e-lecture tools have confirmed that there may be some educational advantages of podcast use compared to traditional lectures, including higher exam results (McKinney, Dyck, Luber, 2009). Research of similar computer-based lectures has also found that students allocated to an ‘e-lecture’ condition using similar technology to podcasts scored higher on comprehension questions than those restricted to traditional lectures (Stephenson, Brown, & Griffin, 2006). Even when only used in addition to traditional lectures, there has been some evidence for improved exam scores for students who viewed and listened to the e-lectures for at least 100 minutes during semester compared to those who used the technology for less than 100 minutes (Cramer, Collins, Snider, & Fawcett, 2007). Given the demonstrated educational benefits of using podcasts and similar technology, it is important to examine predictors of student use and how to best implement these tools in an educational setting.

Although there is some research suggesting the educational benefits of e-lecture technologies, little is known about how students are currently using podcasts for their study across a semester or course. Moss (2007) demonstrated that students appear to increase their downloading of the podcast files themselves as a function not of the content of the lectures, but of the timing of the lectures (i.e., the weeks in which they occur), indicating that students use the podcasts as a supplement for “busy” semester weeks. Unsurprisingly, the greatest increase in downloading occurred before each of the examination periods.

Despite some predictions that students would use podcasts as an alternative to lectures and while multi-tasking, previous studies of student use of podcasts report that between 71% (Williams & Fardon, 2007) and 94% (Copley, 2007) of students prefer to use recorded lecture

technologies as a revision tool and not as a replacement for a lecture. About half (47%; Willams & Fardon, 2007) of students indicated that they had used recordings to overcome timetable clashes, and 43% had used recordings because of work and family commitments. Additionally, some studies report that the majority of students (approximately 80%) do not multitask while listening to podcasts and prefer to use PCs to review the material rather than portable audio devices (Evans, 2008; Huntsberger & Stavitsky, 2007; Lee & Chan, 2007). As few as 13% of students have reported using podcasts while completing other activities (Copley, 2007).

Although a large number of students are availing themselves of this on-line technology, little information exists as to why some students use podcasts, and others do not use podcasts as part of their study. Students appear to hold positive opinions of podcasting and other electronic lecture technologies with previous studies suggesting that 73.1% to 89% of students agree or strongly agree that electronic forms of lectures enhance learning (; McKinney & Page, 2009) and 92.4% agree or strongly agree that their other instructors should adopt some form of electronic lecture (Cramer et al., 2007). Although the general level of peer support for student use of podcasting and similar technologies has not been widely examined, 58.7% of students in one study reported that they felt socially isolated learning via computer-based learning tools (Stephenson, et al., 2008). Additionally, students' perceptions of their own ability to access and use podcasts may contribute to levels of use; in a recent qualitative study, a sample of nursing students identified technological difficulties, hardware limitations, and internet speed as key concerns related to using podcasts and similar technology (Forbes & Hickey, 2008).

Given that previous research has identified positive attitudes towards podcasting among students and educational benefits but also some concerns about factors limiting access to the technology, it may be helpful to examine these psychosocial constructs in more detail. Additionally, previous authors (e.g., Lazzari, 2008) have suggested that, while there are a number of studies examining student acceptance or perceptions of podcasting (e.g., Evans, 2008; von Kronscky, Ivins, & Gribble, 2009), there is a paucity of podcasting case studies which moves beyond simply

measuring student acceptance and very few studies have utilized established theoretical frameworks to guide this research (Mc Garr, 2009). This research also seeks to contribute to the sparse but needed literature into the use of podcasting in the educational context. This study will contribute to the existing literature by employing a well validated behavioral decision-making model that incorporates both people's attitudes towards performing a behavior and a consideration of one's control over behavioral performance, the theory of planned behavior, and attempt to determine the psychological predictors of podcast use by students across an academic semester.

### *Theory of planned behavior*

The Theory of Planned Behavior (TPB) proposes that the most proximal determinant of behavior is intention. In this model, intention is predicted by three constructs: attitudes, subjective norms, and perceived behavioral control (Ajzen, 1991; see Figure 1). Attitudes are the positive or negative evaluations held by an individual about performing a particular behavior. Subjective norms refer to the perceived pressure from important others to perform or not perform an action. Perceived behavioral control (PBC) refers to one's perceived ease of performing a behavior, taking into account their personal resources (abilities, skills and knowledge) and situational variables (obstacles and opportunities) and is also hypothesized to predict behavior directly (Ajzen & Madden, 1986).

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Insert Figure 1 about here

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The constructs of attitudes, subjective norms, and PBC are thought to be informed by underlying beliefs. The beliefs underlying attitudes refer to the likelihood of positive and negative consequences occurring as a result of performing the behavior under consideration (behavioral beliefs) weighted by evaluations of each of the outcomes (i.e., how good or bad they

are; outcome evaluations). The extent to which other people would want the person to engage in a behavior (normative belief) underlies subjective norm and is weighted by the individual's motivation to comply with each of these referents (motivation to comply). The beliefs underlying PBC concern the resources and opportunities available to perform a behavior (control beliefs), and these are weighted by the expected impact these factors would have if they were to occur/ be present (perceived power).

The TPB has been used successfully by many researchers to predict a variety of behaviors. A meta-analysis of 185 tests of the TPB provided significant support for the model (Armitage & Conner, 2001a). Intention was found to account for 27% of the variance in behavior, with a further 2% of variance attributable to PBC. Furthermore, attitudes, subjective norms, and PBC explained 39% of the variance in intention. In addition to the TPB model's proposed effects for the direct determinants of intentions and behavior, researchers have utilized the proposed belief basis of the model to identify the behavioral, normative, and control beliefs that distinguish between those intending and not intending to perform the behavior under investigation (Fishbein & Stasson, 1990). This approach has been used previously to understand the beliefs underlying a variety of behaviors (Armitage & Conner, 2001b; Greenslade & White, 2002; Hyde & White, 2007).

For computer-based activities, such as online shopping, the TPB has demonstrated some success in the prediction of both people's intentions (Hansen, Jensen, & Solgaard, 2004) and behavior (George, 2004). Recently, Lin (2006) employed the TPB to examine people's intentions to participate in on-line communities. From a TPB perspective, Lin found that both attitude and subjective norm influenced virtual community members' intentions to participate in their on-line communities. Deviating from the traditional measurement of the belief-basis of the TPB (albeit with some conceptual overlap), Lin also proposed some additional determinants of the TPB predictor variables and found support for both perceived usefulness and perceived trust as predictors of people's attitudes and facilitating conditions predicting PBC. Further, recent

commentary of podcasting uptake in higher education has suggested the TPB as an appropriate model of uptake intention and behavior (Usluel & Mazman, 2009) although there are no published studies thus far testing the utility of the TPB in predicting student uptake of podcasting.

*Aim of study and hypotheses*

The aim of the present study, then, was to contribute to the paucity of research exploring the important psychosocial predictors of student uptake of enhanced podcasting using an established theory of behavioral prediction, the TPB. The specific behavior of interest was downloading and listening to a series of enhanced podcasts (of lectures) which were offered as a resource for students enrolled in an introductory university unit (subject). In relation to the TPB, the following hypotheses were examined:

*Hypothesis 1:* Intention to download and listen to enhanced podcasts would be influenced by students' attitudes towards performing this behavior, subjective norm, and PBC.

*Hypothesis 2:* Intention to download and listen to enhanced podcasts and PBC would predict self-reported use (downloading and listening to the enhanced podcasts).

In addition to these hypotheses, the present study aimed to explore the beliefs underlying attitudes, subjective norm, and perceived behavioral control proposed by the TPB to distinguish between individuals higher or lower on the measure of intentions. Specifically, for the constructs that emerge as significant direct predictors of behavioral intentions, the study assessed which of the underlying beliefs for these constructs would differentiate between people with higher and lower scores on the measure of intention. Although belief-based measures are traditionally assessed by a multiplicative combination of belief (i.e., behavioral, normative, and control beliefs) and evaluative items (i.e., outcome evaluations, motivation to comply, and perceived power), the present study only assessed the belief items. Examining the belief items only were chosen due to space constraints; however, it has been argued also that the traditional evaluative items are not essential for belief measurement (Ajzen, 1991). Previous studies examining class intention and behavior have only used two time points (i.e., before and after the whole academic

semester); in the present study, three time points were used to investigate if the factors determining intention and behavior change as a result of students' experiences with the on-line technology throughout the semester.

#### Materials and method

Prior to conducting the study, ethical clearance was applied for and granted from the University's Human Research Ethics Committee (reference number 0700000646). The only inclusion criterion was that students were enrolled in an introductory psychology subject at the host institute, a major Australian university. Participants were invited by email (and in person at lectures by a researcher who was not part of the teaching staff) to complete a questionnaire at 3 time points across the 13-week academic semester: prior to the semester's commencement (Time 1), at the middle of the semester (Time 2), and at the end of the lecture period (Time 3; see Figure 2). At both Time 2 and Time 3, participants were asked to indicate their use of the enhanced podcasts since completion of the previous questionnaire. The online questionnaires were hosted by the subject's Blackboard site using the online testing function. A researcher not involved in student assessment for the subject linked the responses using the Blackboard stored identification details for each student. A total of 159 university students (43 males, 116 females; age  $M = 20.23$  years,  $SD = 3.80$  years) completed questionnaires at the first data collection point of the study (i.e., prior to the semester's commencement). Of the Time 1 participants, 82.4% completed the questionnaire at Time 2 and 75.5% indicated their level of podcast use at Time 3. At all data collection time-points, the researcher/on-line instructions explained the purpose of the questionnaire, that students' involvement was voluntary and that all responses were confidential. Some participants received partial course credit for their involvement.

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Insert Figure 2 about here

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*Theory of Planned Behavior Measures*

To maximize congruence between the prediction and criterion variables, the variables were measured at the same level of specificity in terms of target, context, action and time (Ajzen & Fishbein, 1970). The TPB items were constructed in line with recommendations (Ajzen, 2006) and were scored on a 7-point Likert scale, except for attitude, which was scored on a series of 7-point semantic-differential scales. Some items were negatively worded to reduce response bias and were subsequently recoded for analyses so that all items were worded in the same (positive) direction. Prior to the commencement of the semester, the TPB questions referred to the target behavior as “downloading and watching/listening to the podcast for every lecture in this unit for the first half of semester”. At the middle of the semester, the TPB questions referred to “downloading and watching/listening to the podcast for every lecture in this unit for the second half of semester”.

In TPB studies, the recommendation is that an initial pilot study is conducted to elicit the modal salient beliefs (behavioral, normative, and control) about performing the behavior under investigation amongst a representative sample of the target population (Ajzen, 1991). As participants had not yet commenced their university studies prior to the Time 1 questionnaire distribution, the beliefs underlying attitudes, subjective norm, and perceived behavioral control were generated based on qualitative feedback of an initial trial of enhanced podcasting in a subject held the previous semester (Moss, 2007). The qualitative feedback, then, informed the item construction of behavioral beliefs (the main advantages and disadvantages of podcast use), normative beliefs (the people and groups that would most likely approve or disapprove of their use), and control beliefs (the foreseeable barriers to podcast use).

*Intention.* At Time 1 and Time 2, three items in the questionnaire assessed the strength of participant’s intention to use enhanced podcasting. The items were: “I plan to download and watch/listen to the podcast for every lecture in this unit for the first half of semester”; “I intend to download and watch/listen to the podcast for every lecture in this unit for the first half of

semester”, and “It is likely that I will download and watch/listen to the podcast for every lecture in this unit for the first half of semester”, all scored on scales from *strongly disagree* [1] to *strongly agree* [7]. The measures of intention were reliable, with alpha coefficients of .904, and .943 for Time 1, and Time 2, respectively).

*Attitude.* Attitude towards enhanced podcast use were assessed using four items at Time 1 and Time 2. The four items were: “For me, downloading and watching/listening to the podcast for every lecture in this unit for the first half of semester would be: *unpleasant* [1] to *pleasant* [7]; *good* [1] to *bad* [7]; *effective* [1] to *ineffective* [7]; *unfavorable* [1] to *favorable* [7]”. The measures of attitude were reliable, with alpha coefficients of .880 and .872 for Time 1 and Time 2, respectively).

To assess the behavioral beliefs underlying attitudes, participants responded on a series of 7-point Likert-type scales to items 1 (*extremely unlikely*) to 7 (*extremely likely*) to the question “How likely is it that the following will occur as a result of downloading and listening to the podcast for every lecture in this unit for the first half of semester?”. Participants were asked to provide a response for each of the following beliefs: improve my overall grade for this unit; improve my understanding of the material presented in this unit; increase the flexibility and convenience of how I study; affect my download quotas; find the podcasts unhelpful; increase the effort I put into my study.

*Subjective norm.* The measure of subjective norm was obtained using two items at Time 1 and Time 2. The two items were: “Most people who are important to me would approve of me downloading and watching/listening to the podcast for every lecture in this unit for the first half of semester” and “Those people who are important to me would want me to download and watch/listen to the podcast for every lecture in this unit for the first half of semester”, both scored on scales from *strongly disagree* [1] to *strongly agree* [7].

To assess the normative beliefs underling subjective norm, participants were asked “How likely is it that the following people would think that you should download and listen to the

*podcast for every lecture in this unit for the first half of semester?”*. A 7-point scale from 1 (*extremely unlikely*) to 7 (*extremely likely*) was used. The participants were asked to respond to the following: other students in the unit; the teaching staff for this unit; your family; your friends.

*Perceived behavioral control (PBC)*. Perceived behavioral control was assessed using two items at Time 1 and Time 2: “I have complete control over whether I download and watch/listen to the podcast for every lecture in this unit for the first half of semester” and “I am confident that I could download and watch/listen to the podcast for every lecture in this unit for the first half of semester”, both scored from *strongly disagree* [1] to *strongly agree* [7].

The control items asked: “*How likely is it that the following factors will prevent you downloading and listening to the podcast for every lecture in this unit for the first half of semester?”*. Participants were asked to use the 7-point scale from 1 (*extremely unlikely*) to 7 (*extremely likely*). Time, access to the unit Blackboard site, lack of motivation, and lack of knowledge were the barriers used in this section of the questionnaire.

*Podcast Use*. At Time 2 and Time 3, participants reported their use of the enhanced podcasts by answering the following question at each time point, respectively: “From the beginning of semester, how many of the podcasts for this unit have you downloaded and watched/ listened to?” and “Since the mid-semester break, how many of the podcasts for this unit have you downloaded and watched/ listened to?”, both scored: [1] *none*, [2] *less than half*, [3] *about half*, [4] *more than half*, and [5] *all*.

## Results

Table 1 shows the bivariate correlations, means, standard deviations and reliabilities among the variables at each data collection time point. On average, students used enhanced podcasting 3.99 ( $SD = 3.66$ ) times across the semester. Multiple regression analyses assessed the influence of the TPB predictors of students’ intentions (attitude, subjective norm and PBC) both for (1) intention to use podcasts from the beginning to the middle of semester (between Time 1 and Time 2) and (2) intention to use podcasts from the middle to the end of semester (between

Time 2 and Time 3). The TPB predictors (intentions and PBC in the first step, attitudes and subjective norm in the second step as the latter two constructs are not expected to influence behavior directly) were then used to examine students' podcast use between Time 1 and Time 2; and between Time 2 and Time 3.

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Insert Table 1 about here

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*Prediction of intentions to use podcasts.* As shown in Table 2, the TPB predictor variables, as a block, significantly predicted students' intention to use podcasts in the period between Time 1 and Time 2,  $F(3, 155) = 34.94, p < .01$ , explaining 40.3% of the variance. Attitude and subjective norm were the significant predictors,  $t(158) = 7.60, p < .001$  and  $t(158) = 2.10, p = .04$ , respectively. The TPB predictor variables also significantly predicted students' intention to use podcasts between Time 2 and Time 3,  $F(3, 126) = 46.63, p < .001$ , accounting for 52.6% of the variance. Attitude was the only significant predictor of students' intentions between Time 2 and Time 3,  $t(129) = 8.11, p < .001$ .

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Insert Table 2 about here

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*Prediction of podcast use.* The analyses predicting students' podcast use involved the entry of 2 steps of variables. Intention and PBC were entered on the first step and attitude and subjective norm were entered on the second step. As shown in Table 3, in the period between Time 1 and Time 2, the first step of the analysis (intention and PBC) was significant,  $F(2, 129) = 4.48, p = .01$ , explaining 6.5% of the variance. Intention was the only significant predictor at this step,  $\beta = .206, p = .023$ . Attitude and subjective norm were introduced in the second step, which did not significantly add to the model,  $\Delta R^2 = .03, \Delta F(2, 127) = 1.9, p = .148$ . The overall model

was significant,  $R^2 = .09$ ,  $F(4, 127) = 3.24$ ,  $p = .014$  and predicted 9.3% of the variance in student use of podcasts. At the final step of the model, there were no significant predictors of students' podcast use for the first half of the semester.

Across the period between Time 2 and Time 3, the first step of the analysis (intention and PBC) was significant,  $F(2, 113) = 27.26$ ,  $p < .001$ , explaining 32.5% of the variance (see Table 3). Intention was the only significant predictor at this step,  $\beta = .56$ ,  $p < .001$ . Attitude and subjective norm were introduced in the second step, which significantly added to the model,  $\Delta R^2 = .04$ ,  $\Delta F(2, 111) = 3.48$ ,  $p = .034$ . The overall model was significant,  $R^2 = .37$ ,  $F(4, 111) = 15.97$ ,  $p < .001$  and predicted 36.5% of the variance in student use of podcasts. At the final step of the model, intention was the only significant predictor of students' podcast use,  $\beta = .38$ ,  $p = .001$ .

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Insert Table 3 about here

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*Belief-based analyses.* To better understand why some participants indicated that they intended to download and listen to the podcasts and why some participants did not, a series of ANOVAs were conducted on the behavioral beliefs (the beliefs underlying attitudes), as attitude was the only TPB construct to emerge as a significant predictor of students' intentions at both data collection time-points. At Time 1 and Time 2, the distribution of participants was split into two groups using the median score for intention at each time point ( $Mdn = 5.3$  at Time 1 and 5.0 at Time 2) as the discriminating point for analyses. Using this technique, the participants were divided into two groups (1) those students at or below the median score for intentions (students with lower intentions) and (2) above the median score for intentions (students with higher intentions). When considering the univariate tests of between-subject effects for these analyses, a Bonferroni adjustment was used ( $p = .008$ ).

As shown in Table 4, at Time 1, according to Wilks' criterion, there was a significant multivariate effect of intentions on behavioral beliefs for downloading and listening to the enhanced podcasts,  $F(6, 152) = 5.07, p < .001, \eta^2 = .17$ . As expected, those students lower on intention were more likely than those higher on intentions to report that they would find downloading and listening to the enhanced podcasts unhelpful. Those students higher on intention were more likely than those lower on intentions to report that downloading and listening to the enhanced podcasts would increase the flexibility and convenience of how they study and increase the effort that they put into organizing their study.

According to Wilk's criterion, at Time 2 there was a significant multivariate effect of intentions on behavioral beliefs for downloading and listening to the enhanced podcasts,  $F(6, 122) = 9.826, p < .001, \eta^2 = .33$  (see Table 4). As at Time 1, those students lower on intention were more likely than those higher on intentions to report that they would find downloading and listening to the enhanced podcasts unhelpful. At Time 2, those students higher on intention were more likely than those lower on intentions to endorse a number of positive behavioral beliefs about downloading and listening to the enhanced podcasts including that this activity would improve their overall grade for the unit, improve their understanding of the material presented in the unit, and increase the flexibility and convenience of how they study. As at Time 1, those students higher on intention were more likely than those lower on intention to believe that downloading and listening to the podcasts would increase the effort that they put into organising their study.

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Insert Table 4 about here

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Discussion

The present study was designed to examine the psychosocial influences, as proposed by the TPB, related to student use of enhanced podcasts as an educational tool. In an examination of the predictors of students' intentions and behavior across an academic semester, support was found for some of the TPB model's proposed links in that attitudes towards using the podcasts influenced students' intentions to do so and that subjective norm (perceived approval from important others) predicted intentions at least in the early part of the academic semester. In addition, students' intentions predicted their podcast use in the latter part of the semester. Perceived behavioral control, however, predicted neither intentions nor behavior. In a descriptive manner, an analysis of the belief basis of attitudes, the only TPB construct to emerge as a significant predictor of intentions at both time-points in the semester, identified some of the underlying factors that may be determining students' intentions to engage with this on-line technology as part of their learning options.

Overall, general support was found for the TPB in this context in that, at both time points, the TPB variables accounted for a large proportion of variance (40% and 53%, between Time 1 and Time 2, and between Time 2 and Time 3, respectively) in the prediction of intentions, proportions of variance larger than the average percentages reported in TPB meta-analytic results (Armitage & Conner, 2001a). A smaller proportion of variance (9% and 37%, at the two time points, respectively) in the prediction of downloading and listening behavior was explained. Although the proportion of variance accounted for in people's behavior in the second half of semester is comparable to TPB meta-analytic findings (Armitage & Conner, 2001a), the proportion of variance accounted for in the first half of semester is considerably smaller, indicating that intention and PBC are not reliable indicators of students' podcast use at this earlier time-point in the semester. Hypothesis 1 (intention to download and listen to podcasts would be predicted by attitude, subjective norms, and perceived behavioral control) was partially supported in that attitude and subjective norm were predictors of intentions to download and listen to the podcasts, with subjective norm only significant in the first half of semester. Contrary to

Hypothesis 1, perceived behavioral control was not found to predict intentions. Students' perceptions of their behavioral control with regards to downloading and listening to the podcasts did not have a significant impact on their intentions to engage in podcast use. Although this finding is unexpected, it may be that, as a new technology on offer in this context, students' perceptions of their control in being able to both download and listen to the podcasts may have been unstable, although it would be expected that a more reliable association between control perceptions and intentions would emerge as the semester progressed. To decrease the possibility of confounding the results of the current study, no information concerning the podcasting program (e.g., benefits or barriers of use) was presented to the class before the completion of the first stage of the study. It may be that this very lack of information created a less reliable association between students' control perceptions and intentions. However, it is also possible that, as the enhanced podcasting of lectures is a new innovation, students' estimates of control will only be more reliable once they gain more knowledge and experience with the technology (should they have continued access to this option in future subject offerings).

In partial support of Hypothesis 2 (intention to download and listen to the podcasts would lead to downloading and listening to the podcasts), intention was found to be a predictor of behaviors in the later half of the semester. Contrary to Hypothesis 2, in the first half of semester, intention was significant in the first step, but not in the final model for podcast use. The failure of students' intentions to predict their podcast use at this early stage of the academic semester suggests that, in a similar vein to control perceptions, any assessment of intended plans to engage with a new technology will be more reliable as students become more familiar with the technology. Perceived behavioral control was not a significant predictor of behavior at either time point. Although a relatively common finding in TPB research (Conner & Armitage, 1998), this result is also likely to be due to the lack of reliability of people's control estimates for an unfamiliar online technology.

Given that attitude was the most consistent predictor of students' intentions to use the podcasts, the current study also explored the underlying beliefs of this TPB construct. As expected, across both time periods, those higher on intentions to download and listen to the enhanced podcasts were more likely than those lower on intentions to believe that using the podcasts would increase the flexibility and convenience of how they study. Later in the semester, students higher on intentions were also more likely than those lower on intentions to believe that using the podcasts would improve their overall grade for the unit and improve their understanding of the material presented in the unit. Each of these results indicates that a positive evaluation of the consequences discriminates between those higher and lower on intention to download and listen to the podcasts. Accordingly, providing specific examples of the benefits of using enhanced podcasts may increase the number of students intending to use the podcasts. Also, the results indicate that later in the semester, after the results of mid-semester assessments have been released, is a critical period in which reiterating the educational benefits of the enhanced podcasts may increase the number of students intending to use the technology.

Across both time periods, those students lower on intention were more likely than those higher on intention to believe that using the podcasts would be unhelpful. Again, this result suggests that advertising the specific benefits of podcasting may increase the number of students intending to use them, a finding that may have implications for those designing learning experiences. Unexpectedly, those students higher on intention were more likely than those lower on intentions to believe that using the podcasts would increase the effort they put into organizing their study. Although not in the direction expected, this result may indicate that those students higher on intention were actually more likely than those lower on intention to be forming attitudes based on specific considerations of how they would access and use the podcasts. This finding is also in line with previous studies which indicate that students do not multitask while listening to education podcasts but instead incorporate the podcast into their dedicated study time and routine (Lee & Chan, 2007).

The findings of the current study have applied implications for educators wishing to employ new on-line technologies such as enhanced podcasting. In general, explicitly stating the positive aspects of podcast use can improve students' intended uptake. For instance, explicit statements about the educational benefits of enhanced podcasting (e.g., to increase the convenience and flexibility of learning) may influence students' willingness to embrace the new technology. Early in the semester, engagement may be enhanced through statements of support from important referent groups. Consistent with accepted notions about the diffusion process of a new technology (Rogers, 1995), for instance, reinforcing the notion that family, friends, and teaching staff would want students to avail themselves of all opportunities to improve their learning by the use of offered resources, including enhanced podcasting, may influence their initial engagement with the technology.

The findings of this study contribute to the sparse body of research examining psychosocial predictors of student use of enhanced podcasts. Drawing on a strong theoretical model, this study has examined enhanced podcasting across a semester and moved beyond simple ratings of student acceptance used previously. Despite the strengths of this study, a number of limitations should be considered. First, the students were enrolled in an introductory class and may not be representative of more advanced student cohorts. Social pressure may have a different influence on students who feel more established as tertiary students. Second, a self-report measure of enhanced podcast use was employed and so some students may have over reported their use of the technology. Although employing an objective measure of the lecture downloads would have provided valuable data, the system for monitoring file downloads within Blackboard was found to be highly inaccurate. For example, one week's lecture was reported as being downloaded only twice in total. As such, this would represent the test downloads only (one on Windows and one on Mac OS). Further downloads of this file in an attempt to increase Blackboard's "download count" for this lecture failed to change the statistic. Whether this problem with incorrect reporting of download statistics is a general problem with Blackboard, or

one unique to the system used for this study is not known. Certainly an objective measure of the lectures each student downloaded would assist in understanding between downloads and the relationship with the target behavior. Third, there was an over representation of females in this study. Future research should aim to recruit a more representative sample, perhaps through identifying some university subjects with more even gender distributions, to determine the role of gender in podcast use. Finally, given the limited amount of variance in behavior predicted by the TPB, future research should explore the utility of incorporating constructs specifically designed to predict behaviors related to technology uptake. One possible model, the Technology Adoption Model (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989), assumes that important determinants of technology use are perceived usefulness and perceived ease of use of the technology. In previous studies of online behaviors, the Technology Adoption Model has made unique contributions to the prediction of intentions to use online shopping tools (Gentry & Clantone, 2002) and the attitudes related to participation in virtual communities.<sup>14</sup> Given that this study found underlying beliefs related to the perceived usefulness of the enhanced podcasts to their learning to differentiate between students lower and higher in their intentions to embrace the technology, further research should be conducted to determine if drawing on constructs from the Technology Adoption Model would improve the prediction of enhanced podcast use.

Overall, this study has provided some support for the TPB in the prediction of enhanced podcast use in that students' attitudes towards downloading and listening to the podcasts predicted intention across the academic semester. Also, perceived social pressure from important others (at least in the first half of the semester) to download and listen to the podcasts impacted upon students' intentions to engage with this on-line technology. In the latter half of the semester, after some exposure to and experience with the technology, students' intentions to download and listen to the enhanced podcasts predicted actual use. The beliefs underlying students' attitudes distinguished between those higher and those lower on intentions to use the enhanced podcasts, especially based on the perceived benefits, rather than perceived costs of use. It appears that, as

students become more familiar with enhanced podcasts both as a technology, and as a study resource, the ability to predict students' behaviors from their intentions improves. This research contributes to the growing body of knowledge about student interactions with podcasting technology. Specifically, this research demonstrates a way to move beyond student acceptance surveys and utilize established theoretical models and explore student intentions over time. Future research should continue to identify the determinants of students' willingness to embrace this on-line technology, especially given the rise in popularity of its use as an educational tool.

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Table 1

*Descriptive Analysis of Measurement for student downloading and listening to lecture podcasts at Time 1 (below the diagonal) and Time 2 (above the diagonal): Bivariate Correlations, Means, Standard Deviations, and Alpha Coefficients*

| Variable                    | 1      | 2       | 3       | 4      | 5      | <i>M</i> | <i>SD</i> | $\alpha$ |
|-----------------------------|--------|---------|---------|--------|--------|----------|-----------|----------|
| 1. Attitude                 | -      | .48***  | .55***  | .72*** | .53*** | 5.06     | 1.28      | .87      |
| 2. Subjective norm          | .44*** | -       | .44***  | .42*** | .37*** | 5.38     | 1.09      | .58***   |
| 3. PBC <sup>a</sup>         | .39*** | .42***  | -       | .47*** | .28*** | 5.66     | 1.29      | .48***   |
| 4. Intention                | .62*** | .401*** | .299*** | -      | .57*** | 4.63     | 1.65      | .94      |
| 5. Podcast use <sup>b</sup> | .289** | .190*   | .163    | .236** | -      | 2.18     | 2.20      | -        |
| <i>M</i>                    | 4.81   | 5.07    | 5.76    | 5.21   | 1.93   | -        |           |          |
| <i>SD</i>                   | 1.36   | 1.23    | 1.19    | 1.30   | 2.02   |          | -         |          |
| $\alpha$                    | .88    | .56***  | .45***  | .904   | -      |          |           | -        |

*Note.* \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ . Correlations, means and standard deviations below the diagonal are for Time 1; correlations, means and standard deviations above the diagonal are for Time 2. Where a construct was measured with two items, Pearson's  $r$  (and significance) is reported.

<sup>a</sup> Perceived behavioral control. All constructs were measured on 7-point scales

<sup>b</sup> The number of podcast lectures downloaded during the subject

Table 2

*Hierarchical Regression Analyses Predicting Behavioral Intention for Time 1 and Time 2*

| Step   | Predictor                    | $\beta$   |
|--------|------------------------------|-----------|
| Time 1 |                              |           |
| 1      | Attitude                     | .54***    |
|        | Subjective norm              | .15*      |
|        | Perceived behavioral control | .02       |
|        | $R^2$                        | .40       |
|        | Model $F$                    | 34.935*** |
| Time 2 |                              |           |
| 1      | Attitude                     | .63***    |
|        | Subjective norm              | .08       |
|        | Perceived behavioral control | .09       |
|        | $R^2$                        | .53       |
|        | Model $F$                    | 46.63***  |

\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$

Table 3

*Hierarchical Regression Analyses Predicting Downloading and Listening to Podcasts at Time 2 and Time 3*

| Step   | Predictor                    | $\beta_{\text{step 1}}$ | $\beta_{\text{step 2}}$ |
|--------|------------------------------|-------------------------|-------------------------|
| Time 1 |                              |                         |                         |
| 1      | Intention                    | .20*                    | .08                     |
|        | Perceived behavioral control | .10                     | .04                     |
| 2      | Attitude                     |                         | .20                     |
|        | Subjective norm              |                         | .05                     |
|        | $\Delta R^2$                 | .07                     | .03                     |
|        | $\Delta F$                   | 4.48*                   | 1.94                    |
|        | $R^2$                        | .07                     | .093                    |
|        | Model $F$                    | 4.48*                   | 3.24*                   |
| Time 2 |                              |                         |                         |
| 1      | Intention                    | .56***                  | .38**                   |
|        | Perceived behavioral control | .03                     | -.07                    |
| 2      | Attitude                     |                         | .24                     |
|        | Subjective norm              |                         | .12                     |
|        | $\Delta R^2$                 | .33                     | .04                     |
|        | $\Delta F$                   | 27.26***                | 3.48*                   |
|        | $R^2$                        | .33                     | .37                     |
|        | Model $F$                    | 27.26***                | 15.97***                |

\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$

*Note:* Predictor data for podcast use at Time 2 was collected at Time 1.

Predictor data for podcast use at Time 3 was collected at Time 2.

Table 4

*Behavioral Beliefs of Participants High and Low on Intention to Download and Listen to Podcasts at Time 1 and Time 2.*

|   | Low intenders<br><i>N</i> = 66<br><i>M</i> | High intenders<br><i>N</i> = 93<br><i>M</i> |
|---|--|---|
| Time 1  |  |   |
| Improve my overall grade for this unit                          | 4.4  | 5.0   |
| Improve my understanding of the material presented in this unit | 4.9  | 5.3   |
| Increase the flexibility and convenience of how I study         | 5.1  | 6.0*  |
| Affect my download quotas                                       | 4.6  | 4.5   |
| Find the podcasts unhelpful                                     | 3.4  | 2.7*  |
| Increase the effort I put into organising my study              | 4.1  | 4.9*  |
|   | Low intenders<br><i>N</i> = 77<br><i>M</i> | High intenders<br><i>N</i> = 52<br><i>M</i> |
| Time 2  |  |   |
| Improve my overall grade for this unit                          | 4.6  | 5.6*  |
| Improve my understanding of the material presented in this unit | 4.9  | 5.9*  |
| Increase the flexibility and convenience of how I study         | 4.8  | 6.4*  |
| Affect my download quotas                                       | 4.2  | 3.7   |
| Find the podcasts unhelpful                                     | 3.2  | 2.3*  |
| Increase the effort I put into organising my study              | 4.3  | 5.0*  |

\* $p < .008$

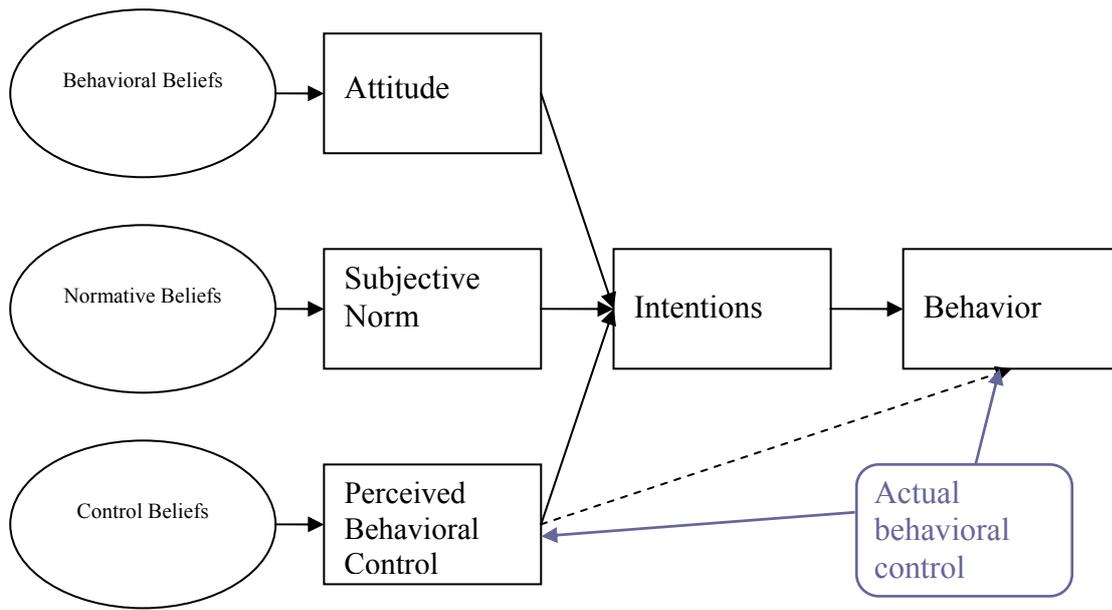


Figure 1: The Theory of Planned Behavior

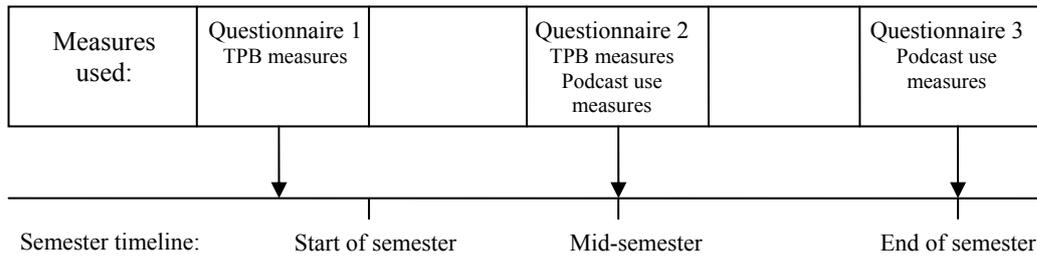


Figure 2: Data Collection Timeline