Podcasting, Cognitive Theory, and Really Simple Syndication: What is the Potential Impact When Used Together?

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The addition of video capabilities to portable media playing devices has engendered a broader definition of the term podcast to include video files. Current research designs on podcast use in education are neglectful of the considerations of cognitive load on student learning. Podcasting is the process by which multimedia learning objects (MLOs) are delivered via Really Simple Syndication (RSS). This review identifies connections between the technology, pedagogy, and student learning that should be emphasized in podcast research. The importance of using podcasts is discussed, and the current types and uses of podcasting are identified. Areas where the potential of podcasts have not been realized, such as RSS usage, are also identified. Cognitive load theory and the implications of podcast and learner attributes on the design principles for MLOs are discussed. Finally, conclusions of the current review and suggestions for future studies are presented.

Keywords: cognitive load theory, multimedia learning, podcasting, RSS

Over the past few years, podcasts of lectures have nearly become an expectation for university students, with many institutions offering podcast recordings of lectures. Although archived lecture recordings are beneficial, the power of podcasts can be further leveraged by applying principles that thoughtfully incorporate the potential impacts of design elements on cognitive load. There is no shortage of articles in the literature describing what a podcast is, how to create podcasts, and how students perceive podcasts. What is missing in the podcast literature is a framework for podcast design.
The Cognitive Theory of Multimedia Learning (CTML; Mayer, 2001) is grounded in research-based principles and could facilitate the realization of the potential effects of podcasts on learning.

The word *podcast* is formed from a combination of the words iPod (Apple Inc., 2011) and broadcast. Although podcasting was initially associated with audio files, the addition of video capabilities to portable music devices has broadened the common use of the term podcast to include audio and video objects (Vajoczki, Watt, Marquis, & Holshausen, 2010). Therefore, a podcast is a multimedia object. The differences between podcasts and other multimedia objects are in delivery and development, not in the actual media product. Podcasts may be viewed as less formal media because they are often not scripted or choreographed. However, the criteria for the quality of podcasts should be similar to the criteria for other multimedia objects if podcasts are used as effective instructional tools.

Podcasts are consumed using a wide variety of devices including computers, cell phones, and MP3 players. The broadcasting aspect of podcasting comes from the ability to deliver these multimedia objects directly to the consumer. Podcast feeds are subscribed to and the content is delivered directly to an aggregator account. The simplicity of podcast file creation and the existence of readily available internet storage space have made this method of personal broadcasting accessible to the general public as well as educators (Lazzari, 2009; Richardson, 2009). Podcasts are a valuable learning resource for teachers and students because they provide direct delivery of and access to instructional materials outside of the classroom (Pilarski, Johnstone, Pettepher, & Osheroff, 2008). This article provides a rationale for the use of classroom podcasting and recommendations for podcast design guided by research-based design principles.

**WHY MULTIMEDIA PODCASTS SHOULD BE USED IN EDUCATION**

Multimedia engages, entertains and has enormous potential as a tool of instruction (Richardson, 2009; Walls, Kucsera, Walker, Acee, & McVaugh, 2009). A multimedia learning object (MLO) is an audio-visual segment of learning material. Twenty years of research into multimedia learning by educational psychologists has produced a body of knowledge which models the characteristics of an effective MLO via effects on cognitive load (Mayer, 2009). The increasing popularity of distance learning has directed more attention to MLOs, as they can be both powerful tools to enable students to master complex concepts and the primary method of delivery of distance-learning instruction (Simonson, Smaldino, Albright, & Zvacek, 2009). For MLOs to meet these expectations, the quality of the objects must be examined.
The availability of high quality multimedia materials at home supports learners who are at a disadvantage in the traditional classroom, such as those with learning disabilities or for whom English is not their first language (Copley, 2007). A podcast is a MLO that is distributed automatically, by subscription using the Internet. The wide variety of devices that can play podcasts, and the small file size of podcasts create unique opportunities for mobile learning. Podcasting is the process by which the MLO is delivered via the Internet. Podcast subscriptions are made possible by syndication protocols such as Really Simple Syndication (RSS), a technology originally developed to support subscriptions to text summaries of websites that now facilitates the syndication of multimedia. The affordance of RSS is relatively new and not widely utilized (Lee, Miller, & Newnham, 2009). Advances in internet-based subscription technologies such as RSS create the means for teachers to automatically deliver customized learning objects to students. Through RSS, podcasting provides unique opportunities for enhanced communication between teacher and student (Fernandez, Simo, & Sallan, 2009) and increased access and portability of customized multimedia instructional materials (Evans, 2008). The affordance of RSS sets podcasting apart from previous generations of educational multimedia by facilitating easy access and sharing of media by both teachers and learners (Hew, 2008). Harnessing the power of RSS increases the potential impact of MLOs.

WHAT ARE THE PREVIOUS RESEARCH FINDINGS REGARDING PODCAST USE?

Research into podcast use has typically consisted of surveys of student use or intent to use (Evans, 2008; Fernandez et al., 2009; Vajoczki et al., 2010). Previous research on podcast use varied in design and results. Most podcasts consist of entire lectures (Copley, 2007; Evans; 2007; Hew, 2008; Traphagan et al., 2009; Vajoczki et al., 2010). Although a lecture recording is a poor example of a podcast (Simonson et al., 2009), access to lecture podcasts provides a learning advantage (Evans, 2007; Vajoczki et al., 2010; Walls et al., 2009). Lecture podcasts are useful for students with learning disabilities, who are slow note-takers or are English language learners (Copley, 2007). Each of these uses can be justified in the context of cognitive load theory (CLT; Paas & Van Merrienboer, 1994). Podcasting can negate the adverse effect on performance attributed to absenteeism (Traphagan et al., 2009) and can increase motivation (Bollinger, Suanakorn, & Boggs, 2010). Podcasts improve learning gains over voice or PowerPoint alone (Griffin et al., 2009). Students who access podcast lectures outperform their non-podcast listening or viewing peers (McKinney et al., 2009; Vajoczki et al., 2010). Few studies have attempted to correlate podcast usage to learn-
ing (Griffin et al., 2009; McKinney et al., 2008; Putman & Kingsley, 2009; Traphagan et al., 2009; Vajoczki et al., 2010). However, these podcast studies have not used standardized instruments to measure student achievement. Previous research positively correlates podcast use to course exam grades (Abt, 2007; Griffin et al., 2009; McKinney et al., 2008; Traphagan et al, 2009; Vajoczki et al., 2010). Access to any form of audio or multimedia supplementary materials is associated with student perceptions of assisting learning (Evans, 2007; Fernandez et al., 2009; Griffin et al., 2009; McKinney et al., 2008; Putman & Kingsley, 2009; Traphagan et al., 2009; Vajoczki et al., 2010). These findings should inform both current practice and future studies. However, one aspect of podcast use that has yet to be explored is the effect of RSS on podcast efficacy.

THE POTENTIAL OF RSS IS UNREALIZED

RSS can be the foundation of a personal learning curriculum that provides the average person with the ability to enrich their lives (Harrsch, 2003; Richardson, 2009). RSS facilitates automatic delivery of podcasts, linking learners to usable content (Lee et al., 2009; Moss, O’Connor, & White, 2009). Students generally do not take advantage of the automatic delivery affordance of RSS (Walls et al., 2009). This feature has great potential for teachers in automatically providing timely resources to students and their parents to improve student achievement and communication, however, less than 25% of the studies of educational podcasting have reported any data on the use of RSS (Lee et al., 2009). There appears to be a lack of technical knowledge among students and teachers regarding RSS, corresponding to a lack of knowledge about RSS with internet users in general (Rainie, 2005). This situation may change as simple, free, web-based aggregators such as Google Reader are now widely available to manage RSS feeds (Lee et al., 2009). Exposing students and their parents to the existence and benefits of this technology will encourage changes of Internet use habits that will impact life-long learning (Richardson, 2009).

The technical aspects of podcasting and the potential benefits of RSS should influence the choice of podcast type and method of delivery. However, a critical element that has been omitted from podcast studies is any consideration of podcast quality. Podcast quality must be gauged against design criteria based on research findings. The findings of CLT (Paas & Van Merrienboer, 1994) research must be incorporated into podcast design; previous podcast studies have yet to bring this into consideration. Most podcast studies have yet to go beyond audio podcasts. Only two studies used multimedia podcasts: Fernandez et al. (2009) and Griffin et al. (2009).
HOW ARE PODCASTS CURRENTLY USED?

Podcasts can be used for many purposes. The most common use of podcasts is to provide student-accessible archival records of lectures at the college level (Abt, 2007; Copley, 2007; Evans, 2008; Vajoczki et al., 2010). This use provides a benefit to the students of those courses. However, as a resource to the larger population, this type of podcast is not very useful. Finding and previewing lengthy podcasts is time consuming and inefficient (Lee et al., 2009, Lawlor & Donnelly, 2010). Shorter podcasts with specific learning objectives and more targeted content are needed to fulfill the design principles of multimedia learning and to maximize learning. Podcasts are ideal for use as media to enable ongoing remediation or as supplemental course content. However, the characteristics of the intended audience need to be considered when making instructional design choices given the findings of multimedia learning studies and considerations of individual differences in mental abilities. These characteristics impact the choice of podcast type that will best serve the pedagogical purpose of the MLO. In this section, (a) each type of podcast will be described including advantages and limitations, (b) student podcast usage preferences will be discussed, (c) prior podcast research findings will be summarized, and (d) the potential impact of RSS on podcast use will be discussed.

WHAT TYPES OF PODCASTS CURRENTLY EXIST?

There are three types of podcasts: (1) audio podcasts, (2) enhanced podcasts, and (3) full-motion video podcasts. Audio podcasts are the most widely used type of podcast, however, information delivery is limited to only the auditory mode. Audio podcasts utilize the .mp3 file format. Enhanced podcasts enable still pictures to be displayed and linked to the corresponding narration using chapter markers. The addition of multimedia enables the engagement of the learner through dual channels, auditory and visual. Enhanced podcasts offer reduced file size and streamlined viewing with chapter markers for each image and its associated narrative. Enhanced podcasts utilize the .m4a file format. Full-motion video podcasts incorporate video media, utilizing the .mp4 or .mov file formats. The cognitive benefits of multimedia are well-documented (van Merrienboer & Ayres, 2005; Mayer, 2009), therefore, this article will focus on the use of multimedia podcasts in education. This article will discuss the advantages and disadvantages of each type of multimedia podcast: enhanced and full-motion. Table 1 summarizes the three podcast formats and the advantages and limitations of each due to the characteristics of each podcast type.
Table 1
Advantages and Limitations of Podcast Formats

<table>
<thead>
<tr>
<th>Podcast Type</th>
<th>Advantage</th>
<th>Limitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audio</td>
<td>Small file size, ease of production, free software</td>
<td>Lacks visual channel input</td>
</tr>
<tr>
<td>Enhanced</td>
<td>Engages auditory and visual channels, chapter markers, easier production</td>
<td>Images and chapter markers not supported by all MP3 players, free software</td>
</tr>
<tr>
<td></td>
<td>than full-motion podcast, smaller file size</td>
<td>for MAC only (not PC)</td>
</tr>
<tr>
<td>Full-Motion</td>
<td>Engages auditory and visual channels, motion video</td>
<td>Time consuming to import/edit video, largest file size</td>
</tr>
</tbody>
</table>

The characteristics of each podcast type are not the only factors influencing the choice of podcast type. Additionally, learner characteristics, CLT (Paas & Van Merrienboer, 1994) and CTML (Mayer, 2001) considerations also impact the choice of podcast type.

How do Students Prefer to Use Podcasts?

Results of prior research in the higher education setting identify a common set of student beliefs regarding podcasts. These beliefs are that podcasts are (a) an effective review tool (Evans, 2007; Fernandez, 2009; Lonn & Teasley, 2009; Pilarski et al, 2008; Traphagan et al., 2009; Vajoczki et al., 2010; Walls et al., 2009), (b) improve learning (Lonn & Teasley, 2009; Putman & Kingsley, 2009; Vajoczki et al., 2010), and (c) enhance satisfaction, motivation and interest (Evans, 2007; Fernandez et al., 2009). Lawlor and Donnelly (2010) and Griffin, Mitchell, & Thompson (2009) found a clear student preference for still picture with narration format, or enhanced podcast, over full-motion and audio podcasts. Tertiary students find podcasts to be a valuable learning aid; secondary students should also find that podcasts enhance learning. However, secondary students and their parents will need to be made aware of podcasts. Only 19% of internet users have downloaded a podcast (Madden & Jones, 2008). An oft touted advantage of podcasts is the ability to download the content onto a mobile device. Interestingly, the majority of students listen to or view podcasts on a computer, not a mobile device (Copley, 2007; Evans, 2007; Hew, 2008; Lee et al., 2009; Lonn & Teasley, 2009; Walls et al., 2010). This is likely due to student perceptions of the mobile device as for personal entertainment device instead of for learning. Incorporating podcasts into instruction could result in a change in student perceptions of the utility of personal mobile devices as tools of learning. An examination of the findings of prior studies provide a glimpse into the future potential of podcasts in education.
CTML AND CLT SHOULD GUIDE PODCAST DESIGN

CLT, developed in the 1980's, grounds instructional design decisions in interactions between content and cognitive processes (van Merrienboer & Sweller, 2005). Educational podcasts are created for the purpose of student learning. Generative learning depends on the successful processing of sensory inputs. CTML (Mayer, 2001) and CLT are based in three assumptions: (a) the existence of separate channels for the processing of visual and verbal content, (b) the limitations of channel capacity, and (c) the three stages of active processing as keys to understanding how cognitive processing works. CTML identifies three stages as required for active processing: (a) selection of relevant words and images, (b) organization of this information into a coherent mental schema, and (c) integration of the incoming material with existing knowledge (Mayer, 2001, 2009). These three stages of processing, from lowest to highest level, are called: intrinsic, extraneous and germane processing (van Merrienboer & Sweller, 2005). These three stages occur simultaneously, but cognitive capacity is allocated to the lowest level of processing first, then to the higher stages if capacity remains. The characteristics of multimedia messages and their effect sizes on learning have been researched over the past twenty years by educational psychologists in over 90 research studies. These studies have measured effect sizes of these principles and established boundary conditions to guide their application. These principles are not rules, but are intended to guide designers of multimedia instruction to reflect on the potential cognitive load of the message using the tenets of cognitive theory. These guidelines should be applied to multimedia podcasts as well. Twelve evidence-based principles have been tested for the design of multimedia learning objects. These principles are grouped for discussion in this article by the specific cognitive load management strategy: (a) reduction of extraneous processing, (b) management of essential processing, and (c) fostering generative processing (Mayer, 2009). The three strategies correspond to the respective stages, CTML (Mayer, 2001) is a triarchic theory (DeLueuw & Mayer, 2008).

PODCAST DESIGN ELEMENTS REDUCE EXTRAENOUS PROCESSING

Dual coding theory states that information can be processed through the visual and verbal channels simultaneously, but at limited rates (Mayer, 2001, 2009; Paivio, 1991). Limitations of processing rates necessitate reductions in extraneous processing; the learner must make decisions to select relevant details. Reduction of extraneous processing requires thoughtful design of the physical layout of the message; five principles are aimed at this goal. First, the coherence principle refers to the elimination of extra information
(Mayer, Griffith, Jurkowitz, & Rothman, 2008; Mayer & Jackson, 2005). Second, signaling entails directing the learner’s attention to important information (Stull & Mayer, 2007). Third, presentation of the same information that is narrated as on-screen text is redundancy (Moreno & Mayer, 2002). Fourth, placing text labels near their respective graphic elements is spatial contiguity. Fifth, arranging presentations to have narration run simultaneously with the associated image is temporal contiguity (Mayer 2008, 2009). These five principles work together to minimize the possibility of cognitive overload by making it easier for the learner to select the relevant details and by managing visual channel load by offloading some visual load to the verbal channel. If the multimedia message has extraneous information, high redundancy, or lacks signaling, spatial contiguity and/or temporal contiguity, the learner is less likely to have sufficient cognitive capacity remaining from the process of selection to permit organization of this information into a personal mental schema. This is called essential (Mayer, 2009) or germane processing (van Merrienboer & Ayres, 2005). Poorly designed multimedia materials increase extraneous processing and limit germane processing, therefore it is important to use well-designed multimedia materials in podcast studies.

**Podcast Design Elements Manage Essential Processing**

Managing of essential processing facilitates the learner’s creation of an organizational schema for the learning. Essential processing load is directly related to the inherent complexity of the content of the multimedia message; this load is managed using three principles (DeLeuuw & Mayer, 2008). First, the segmenting principle manages CL by dividing the learning into smaller parts (Mayer, Dow, & Mayer, 2003). Second, pre-training involves teaching terminology before presenting a complex process (Mayer, Mathias, & Wetzell, 2002). Third, the modality principle uses offloading of information from the visual channel into the verbal channel to allow both channels to work simultaneously without overloading either one. The modality principle holds that learners understand a multimedia explanation better if words are presented through the auditory channel as speech rather than text on-screen. Presentation of on-screen text and animation can overload the visual channel, or cause split attention; presenting the words in the verbal channel via narration offloads some processing from the visual channel to the verbal channel (Mayer, Dow et al., 2003; Seufert, Schütze, & Brünken, 2009). These three principles minimize the possibility of cognitive overload while engaging the visual and verbal channels simultaneously for optimal learning conditions. This simultaneous engagement enables the learner to form an organizational schema in working memory while leaving sufficient cognitive
capacity remaining for generative processing, where the new information is integrated with existing knowledge. (Mayer, 2009; Paas & Van Merrienboer, 1994).

Podcast Design Elements Foster Generative Processing

Generative processing is encouraged by using a motivating communication style. Four principles function to motivate learners to use their generative processing capacity (Mayer, 2001, 2008, 2009). First, the multimedia principle states that people learn better from pictures and words than words alone; the combination stimulates generative processing. Second, the personalization principle holds that students learn better when the narration is done in a conversational style rather than formal one (Mayer, Fennell, Farmer, & Campbell, 2004). Third, the voice principle states that an unaccented human voice produces better learning than a computer voice (Mayer, Sobko, & Mautone, 2003). And fourth, the image principle postulates that the presence of the image of the narrator will enhance learning (Mayer, 2009). Designing podcasts which manage cognitive processing is important for podcast study design.

LEARNER AND PODCAST ATTRIBUTES EFFECT
DESIGN PRINCIPLES OF CTML

Testing of the principles of multimedia design based on CTML (Mayer, 2001) has been conducted using both paper- and computer-based multimedia messages with results that have consistently supported CLT (Mayer, 2009). It is reasonable to expect that these CLT-based design principles will be applicable to podcast design. The unique characteristics of podcasts must be considered together with the constructs of CTML (Mayer). In particular, (a) learner control of pacing and (b) use of animation creates additional extraneous CL (Mayer, Hegarty, Mayer, & Campbell, 2005). These findings support the use of the enhanced podcast format. Individual learner characteristics moderate the effect of CTML (Mayer) principles. Previous research has shown that there is a reversal effect for the modality principle (Harskamp, Mayer, & Suhre, 2007); design qualities that benefit slower learners can be disadvantageous for faster learners. Some design principles that have shown large effect sizes in prior research may have different effects in podcast-based research. The additional extraneous CL created by learner pacing decisions and differences in individual learner cognitive processing capacities impact learning gains. These findings dictate that the characteristics of the learner audience must be taken into consideration when designing MLOs and point to learner characteristics as a confounding variable in podcast studies.
Inherent Learner Control of Pacing in Podcasts Impacts Cognition

Is learner controlled pacing beneficial?

Segmenting (Mayer, Dow et al., 2003), redundancy (Mayer & Johnson, 2008; Moreno & Mayer, 2002), and modality (Harskamp et al., 2007) are shown to have large positive effect sizes in research, however, the effects may be moderated by slow pacing or learner controlled pacing of the content (Mayer, 2009). A predominant affordance of podcasts is the inherent learner control of pacing (Traphagan et al., 2009); the podcast gives the learner complete control of the rate of content delivery (Walls et al, 2009). However, Mayer (2008) warns that for some of the slowest learners, the decision process of deciding when to pause the multimedia message can significantly create extraneous cognitive processing. It may be necessary for instructors to provide guidance to those learners within the multimedia message regarding appropriate points in the presentation to pause and reflect. The amount of extraneous processing created by this pacing decision process and its effect on learning likely depend on the characteristics of the learner and the complexity of the content. Supporting this claim, a recent study found that segmenting benefits learners with low working memory (Lusk, Evans, Jeffrey et al., 2009).

Use on-screen text to maximize learning. Redundancy, or printed text that duplicates the narration exactly, has a negative effect on learning (Moreno & Mayer, 2002). However, the use of limited text of two or three words placed near the associated image has a positive effect on learning (Mayer & Johnson, 2008). Learner control of rate moderates the principle of redundancy; with unlimited time, printed words are an advantage for slower learners (Harskamp et al, 2007), and memory capabilities positively correlate to learning gains when redundancy is high (Ardac & Unal, 2008). Similarly, the modality principle is moderated by rate of presentation of content and learner characteristics such as working memory capacity (Harskamp et al, 2007; Seufert, Schütze, & Brünken, 2009). The appropriate design characteristics of the multimedia message depend on the characteristics of the intended audience and the degree of learner control of presentation rate.

Select Images Based on CL Effect

Video podcasts allow instructional designers to choose between animated or static images; this choice has an effect on the degree of learning. CTML (Mayer, 2001) posits that the use of animation necessitates scaffolding for learners to manage CL and encourage generative processing; higher learning gains occur with static images and text compared to computer anima-
tions without assistance (Mayer, Hegarty et al., 2005). Münzer, Seufert, and Brünken (2009) found that the benefits of animation to learners are affected by spatial ability. Rasch and Schnotz (2009) found that learning from images was less efficient than learning from text and did not result in greater learning. There is a complex interplay between learner characteristics such as working memory capacity and prior knowledge and content characteristics that must be carefully considered. An enhanced podcast facilitates the synchronization of narration with still images (Kolb, 2008). Comparison of the much larger cost of and longer time for production of animations to the potential pedagogical benefit may create a preference for the use of the enhanced podcast over full-motion video podcast.

CONCLUSIONS AND SUGGESTIONS FOR FUTURE STUDIES

The use of podcasts has increased dramatically since 2005, and these MLOs are both well-received by students and viewed as having a positive effect on learning. Applicable findings of CTML (Mayer, 2001) research should guide the development of the MLOs used in podcasting to optimize their impact on learning. However, the combination of these two separate fields of study raises questions as to how the inherent properties of podcasts will impact CTML (Mayer) principles and learning. The potential effect of RSS on MLO efficacy is promising, but lack of knowledge of RSS impedes its use. There are many unanswered questions and issues raised by the literature. In this section, recommendations are made for future research that could strengthen the knowledge base on multimedia podcast use in education settings. Specific suggestions follow.

First, additional research is needed on the effect of podcast design elements. Educational psychologists have developed a wealth of knowledge about CTML (Mayer, 2009; Paas & Merrienboer, 1994). Studies of the impact of podcasting on learning should begin with the design of high-quality multimedia messages, building on this existing body of evidence. The delivery vehicle is of little consequence if the multimedia message is of poor quality. Unique affordances of the podcast format, when considered in the context of CLT, raise new questions for further study. Specifically, the effect of learner controlled pacing requires research to determine its impact on the CTML (Mayer, 2001) principles of redundancy, segmenting, and multimedia. MLOs should be constructed so that appropriate cognitive processing is likely to be induced. The segmenting, redundancy, and modality principles need further study to determine their effects within the podcast context and between learners of different abilities. Furthermore, previous research indicates that enhanced podcasts should be the preferred podcast
format based on learning gains (Mayer, Hegarty et al., 2005), however, research is needed to determine if the benefits of the use full-motion podcasts can outweigh the cost of production. This cost versus benefit analysis will be affected by the nature of the content and learner characteristics.

Second, future research on the effects of multimedia podcast use on learning should establish a means to measure the quality of the podcasts used. Previous studies that have correlated podcast usage to learning (Griffin et al., 2009; McKinney et al., 2008; Putman & Kingsley, 2009; Traphagan et al., 2009) provide only limited details of the content or design of the podcasts, limiting the generalizability and replicability of the research. Research has shown that the specifics of MLO design will impact learning gains. Future research should ensure that the podcasts used are of high quality because the quality of the MLO affects learning gains. Variations in podcast quality during the course of a study are a threat to internal validity.

Third, research is needed over longer time spans to minimize the effect of the novelty of the podcast and eliminate novelty as a threat to internal validity. Previous studies examining podcast use have ranged in study time spans from a few weeks or podcasts (Evan, 2007; Griffin et al., 2009; McKinney et al., 2009) to a few months (Fernandez et al., 2009; Moss et al., 2010; Pilarski et al., 2008, Traphagan et al., 2009, Walls et al., 2009). Longitudinal studies would enable study of changes to (a) students’ and teachers’ perceptions of podcast use; (b) students’ patterns of podcast use, such as using personal media players as educational tools; and (c) the use of new technologies such as RSS.

Fourth, future research needs to utilize reliable instruments to measure student learning. Prior research has used a variety of instruments to quantify learning gains ranging from multiple choice tests on podcast specific content to end-of-course grades. Standardized instruments should be used to measure learning gains associated with podcasting to increase validity.

Fifth, the potential of RSS as an educational tool should be examined. Previous research has shown that there is a lack of knowledge about RSS (Lee et al., 2009), therefore researchers using RSS as a delivery mechanism need to provide assistance to participants to facilitate effective use. The ability of podcasts to be downloaded on handheld devices has not been utilized widely by university students even though the vast majority of students own a mobile device capable of playback (Evans, 2007; Walls et al., 2010). Incorporating podcasts as a learning aid in education may lead to changing student perceptions regarding using personal media devices for educational purposes. Future studies should incorporate RSS as a delivery method and should measure student utilization of RSS. The use of RSS could impact the effectiveness of podcasted MLOs; this has yet to be studied.
The use of multimedia podcasts is a trend that continues to grow. Thus, this review will be useful to researchers as they continue to build the body of knowledge concerning the use of the multimedia podcast in education settings.

References


