A Study of Structured Lecture Podcasting to Facilitate Active Learning

David J. Nickles
Department of Information & Computer Sciences
University of Hawai‘i at Mānoa
nickles@hawaii.edu

Daniel D. Suthers
Department of Information & Computer Sciences
University of Hawai‘i at Mānoa
suthers@hawaii.edu

Abstract

This paper presents an overview of a study of educational podcasting in higher education. This research aims to remedy pedagogical deficiencies in lecture podcasting by structuring content with chapter features designed to facilitate active learning behaviors. Also as mobile media players are quickly becoming ubiquitous, so is media multitasking. However, media multitasking, the processing of multiple information streams, presents challenges for human cognition. This study further investigated relationships in the usage of the chapter features through multitasking preferences and aspects of psychological flow. The study revealed that students used the chapter features as a supporting resource in their lecture study strategies for selection and review behaviors and also to support both their multitasking and flow behavioral preferences. The theory driven method and instrument developed to conduct this research can facilitate future studies.

1. Background

This paper reports a study of podcasting to support an inverted classroom approach to blended learning in higher education. The study focuses on the use and effects of chapter indexing and selection features designed to facilitate active learning approaches to using the podcasts. Before describing details of the present study, we discuss relevant background including ecologies of blended learning and the role of podcasting in these ecologies to support active learning and inverted classrooms. Related concepts of multitasking and flow examined in this study are also discussed.

1.1. Ecologies of blended learning

Developments in information technology have continually been embraced by educators and incorporated into the practices of teaching and learning, fueling the discussion of effective designs, practices and media choices [22]. New technologies broaden the spectrum of human activities that can be blended with learning activities. The blending of complex classrooms and information technologies drives innovative research into educational technology applications and teaching practices. With this rapid advance and change, studies of technology-based learning struggle to differentiate the meaning of labels like ‘e-learning’ and ‘web learning’ and often encapsulate them with their various affordances and modalities in order to study them inclusively [6, 16]. With the rise of recent technologies, including the Web, wikis, blogging, podcasting, social networking, and powerful search engines, formerly distinct spaces of the classroom, the office and personal time are blending [26]. The variety and mix of information technologies often defines the ecology of a blended learning approach.

Although this study will look at a specific intervention regarding lecture podcasting, it does so in the context of a technology rich environment with other supporting and contextually integrated technologies. Thus, this study proposes a theoretical model with an ecological approach. An ecological model can integrate the general factors of information technology adoption with the user’s perspectives of success factors. Kim and Ong’s study of m-learning technologies [19] suggests that a model that integrates user’s perspectives can bridge the measures across the changing environments and quality measures. A key issue that arises from blending lecture into newly available technologies is that the increasing sophistication of lecture media creates higher expectations by the students. This study integrates users’ use perspectives through study behaviors, contextual media tasking, choice and consumption preferences, and sustainment of interest in the lecture media via perceptions of psychological flow during media use.

1.2. Educational podcasting

In recent years, electronic media tools have quickly become a powerful and popular means of teaching because these tools can be used to reach large, diverse audiences irrespective of geographical location [30]. Podcasting has come to center stage as one of
these tools [24]. Since 2005, there has been rapid adoption of the use of podcasting technology in schools. In this flood of adoption, content has been recorded and distributed, but predominantly not internally structured or pedagogically integrated. With the growing popularity of podcasting as a means of disseminating information, there is an important need for the application of teaching practices grounded in learning theory when designing the educational uses and purposes of this multimedia technology. There is a growing interest in investigating the utility and impact of lecture podcasting in learning particularly in the higher education realm where factors such as time management and learning preferences and strategies all play a role in technology adoption. It is an often difficult task to reconcile learning theory with teaching practices [4], but to do so offers the promise of a technology intervention becoming a thriving denizen in the world of learning.

1.3. Active learning

Constructivist learning theories developed through the decades of the 1900’s and led to the development of many pedagogic strategies of Active Learning beginning in the 1980’s [25]. Constructivism is an experientially integrative theory of learning. In a teaching ecology that embraces active learning, the pedagogy is concentrated in the design of creating opportunities where the responsibility of learning is on the learners to actively participate and contemplate in these activities [3]. This paradigm aims to increase the locus of control in learners, to imbue them with the idea that learning is primarily a result of their own behaviors and actions. This study investigated the influence of lecture podcast chapter features on supporting the student’s obligation, by asking how a chapter feature technology intervention was used to facilitate use of the lecture podcast in active learning practices and students’ learning strategies and preferences.

1.4. Inverted classrooms

The passive learning structure of traditional large enrollment courses can be addressed by marrying the lecture hall with learning technologies in two ways. First, the act of listening to a lecture can be made more interactive by customizing the lecture presentation, subdividing the content into logical sections and constructing a clear and addressable navigation of those subdivisions. Second, by using technology, the lecture content can be time-shifted. Time-shifting both increases the presence of the instructor outside of the classroom and opens the class for additional learning activities.

Using digital technology to time-shift lecture outside of the classroom and using the classroom more for discussion, demonstration and group work activities has been termed the inverted classroom [12]. In fact, shifting lectures outside of the classroom has created an opening for experimentation of teaching practices during the face-to-face sessions in a course’s term [20, 28]. Many studies early on focused on time shifting as the primary potential advantage of using lecture podcasting. There are several categories of pedagogical integrity that emerged from studies of lecture podcasting as a time-shifting tool, including:

- Lecture podcasting for redundancy, in case a student misses class or voluntarily chooses not to attend [24].
- Lecture podcasting to invert the classroom, to time-shift lecture outside of class time and bring homework inside the class time [20].
- Lecture podcasting to hybridize the classroom, blending technology into the class and lecture activities [28].
- Lecture podcasting to add preparation and review material before and after lecture to make better use of class time [33, 34].
- Providing iPods that record to all students for lecture capture to enable spontaneous media creation or use, through recording or playback during group or individual study [1].

However, most of these early studies ignored other potential affordances of using podcasts and structured media to enable active learning practices and to support student learning strategies and preferences. The intervention of this study is designed to coordinate structured lecture podcasting’s active learning affordances with a learner’s learning preferences in order to strengthen the nexus between the affordances of the technology and the active learning activities. A comprehensive review of podcast use from K-12 to higher education was made by Khe Foon Hew [14] with a focus on teaching methods, and by and Simon Heilesen [13] focusing on the effects of podcasting [2]. Angela Jowitt [17] reviewed existing literature on lecture podcasting and summarized 10 main advantages and benefits in relation to using podcasts as a lecture conduit: Portability, Multitasking, Flexibility, Asynchronicity, Accessibility, Extension, Convenience, Automation, Repeatability, Selectability and Auditory Modality. These advantages synthesized from the studies reveal the affordances of lecture podcasting when integrated as a time-shifting tool by adding new dimensions of interaction and defining ways to manage listening to lecture. The intervention of this study is designed to coordinate lecture
podcasting’s active learning affordances with pedagogical practices in order to strengthen the nexus between the affordances of the technology and the pedagogical active learning practices.

1.5. Podcast chapter features

There are several active learning strategies that have shown promise in bettering the traditional lecture approach. For example, active learning research has demonstrated that if an instructor periodically pauses through a lecture to allow students to consolidate their notes, students will learn significantly more information [31]. The results of Ruhl et al.’s study [31] demonstrate the positive learning outcomes from segmenting lecture material and inserting time at these divisions. Evaluation and selection of present topics and revisiting topics are additional active learning strategies used to enhance traditional lecture. The chapter feature technology intervention of this study is designed to support these active learning strategies for lecturing. The three primary design objectives are to support Selectability, Reviewability and Tasking. This study revealed that students used the chapter features for review and selection behaviors and also to support both their task management preferences.

1.6. Flow

As researchers are grappling with studying the influences of technology interventions on learning, they are using various methods that consider student behavior, motivation, learning preferences, and sustainment of interest and focus as conceptualized by flow theory [11]. Csikszentmihalyi & Csikszentmihalyi [8] define the concept of psychological flow as the optimal experience for acting on a task. This theory can also inform the pedagogical movement of active learning practices. One of the goals of introducing active learning practices to students is to help them become cognizant of their own learning strategies and behaviors, develop critical thinking about what works for them, and optimize their methods.

Flow is based on the idea that people prefer and intend to repeat optimal experiences (in contrast to other experiences) to sustain an ordered state of consciousness to support involvement, clarity and motivation [8]. As if navigating between Scylla and Charybdis [15], Csikszentmihalyi [9] defined a zone for these recurrent optimal experiences as an avoidance of the zones of frustration and boredom to maintain a zone of positive reinforcement through mental concentration. To achieve a state of flow state, one must find a task that is challenging for their skill level. If it is too challenging then the task becomes frustrating. If the task is not challenging enough for the person’s skills then boredom sets in. For studying, this requires the student to be cognizant of the effectiveness of their own study strategies while choosing the right level or amount of material to master. This study conceptualized flow as an engaged focus and concentration on a study task and the supporting processes including context and technology resources.

Additionally, an important facet of flow behavior is “a sense of control over the environment” [7]. The chapter features are designed to enhance the affordances of lecture podcast experience. Chapter features are designed to facilitate selective focus on the lecture content, to enable a clear structure for pacing and to facilitate review. As an individual negotiates a task, he chooses from the possibilities of activities or actions in the context that he might use as supporting activities to sustain flow.

1.7. Media multitasking

Media multitasking is the processing of multiple information streams. Media multitasking is increasing in prevalence among youth and young adults [18]. Past studies suggest the consideration of multitasking as it arises as a theme with podcast usage [17]. Students may study and consume podcasts in the context of multiple media streams. For example, a student might study a lecture podcast on their computer while surfing the Web or in a room with other media channels such as music playing. Although multitasking may have a negative impact on study productivity, Campbell noted that students reported a preference to multitask while listening to podcasts [5]. This study considered the intervention usage in terms of media multitasking preferences.

2. The present study

Against this background, the present study examined technology adoption, active learning behaviors, multitasking and flow behaviors and learning outcome differences in students’ learning strategies that involved an intervention in the design of podcast chapter features. The study used a mixed methods approach. The experimental model is shown in Figure 1. A questionnaire instrument [36] with Likert-type and open-ended interview style questions was administered to students to assess factors that drive their adoption and their behavioral use tendencies. In addition, demographic questions were added to the instrument. Learning outcomes were
analyzed by age group, gender, media use habits, and by prior experience to explore individual differences individuals and the role that this may play in the intervention technology adoption.

2.1. Theoretical framework

The guiding question of this study is whether students who integrate use of the podcast chapter features into their study habits think and act differently than their counterparts who do not. If so, which qualities and behaviors are important and which metrics can we use to capture these differences? The framework begins with a foundation in the UTAUT (Unified Theory of Acceptance and Use of Technology) model [36] that aims to capture users’ perceptions, attitudes and intentions toward using the technology intervention. Different students will have different backgrounds of learning experiences, and their study habits and preferences will be a product of these experiences. Therefore, the adopting learner may also have different learning strategies than the non-adopting learner. The framework continues with a modification of the behavioral use construct of the framework to query for active learning uses afforded by the chapter features (behavioral selection, pausing and review) since the goal of the technology intervention is to support and facilitate learning behaviors. The adopting learner may also choose a different social and study environment than the non-adopting learner. The framework was expanded to be contextually aware of media consumption preferences (through a multitasking construct) and engagement in listening to the lecture (through a psychological flow construct). This theoretically integrative model aims to capture a learner’s perspectives and behaviors in way that can bridge the metrics across different environments and studies.

2.2. Research questions

Specifically, this study sought to answer the following research questions:

1. Do students accept the podcast chapter features as a useful tool in their coursework activities?
2. How do students use the chapter features of a lecture podcast to exhibit active learning behaviors while studying course content?
3. How do learning outcomes vary in relation to students’ usage of the chapter features to perform identified active learning behaviors?
4. How does the use of lecture podcast chapter features differ between students that multitask from those that prefer to focus on a single task?

3. Method

Higher education students took a 17-week introductory computer science course of computer fluency and applications in which quiz and exam assessments were standard course practice. Class attendance was mandatory and in-class activities were scored. Although the lecture podcast and accompanying listening quizzes were mandatory and scored, the podcast chapter features were presented as an optional available technology for studying course lecture content. The questionnaires were administered and collected by a third party on the course evaluation day at the end of the semester.
3.1. Participants

There were 215 students enrolled in the sections sampled. Out of those present in class, 158 students turned in the questionnaires. Elimination of 30 incomplete questionnaires and two students who tried but were unable to use the podcasts resulted in 126 student questionnaires. The remainder of the paper reports on data for this latter set of 126 participants.

Of the participants, 61% were male and 39% were female. On average, participants were in the age range of 16-25 years old. They predominantly (94%) had no experience using educational podcasts prior to this coursework. Weekly general usage of an iPod was ≤ 5hrs (37.3%), from 6 - 10hrs (25.5%), from 11 - 20hrs (23.5%), and ≥ 20hrs (13.7%).

Since the lecture podcast, the coupled quizzes and exams, and the online technologies supporting these were integrated as standard course practice, all students enrolled in the course presumably were exposed to these elements. Use of the chapter features intervention was up to students, as they deemed appropriate for their study activities. The large sample size relative to class size means we have captured perspectives across a variety of adopters or non-adopters. For example, 40% of respondents elected to not integrate the technology reported. This study aimed to capture student's voluntary use of the chapter features in the context of their current study habits. A future study might require students’ use of chapter features in assigned activities.

3.3. Materials

Podcasts were engineered to provide chapters that afford users the ability to perceive organization of material and non-linearly navigate the chapter bookmarks for playback. The iTunes software and a majority of personal media players provide audio and video output channels. These media players also recognize tracks of metadata within media files and provide access to this metadata through a video controller overlay that fades in and out of view when the pointer device is activated. Figure 2 illustrates how the chapter metadata appears in the iTunes controller overlay. Chapter data is arranged as a chronological index presenting titles, slide thumbnails and links to jump to the beginning of the subdivision.

A chapter is a temporal offset within a lecture podcast media file that represents a fixed selectable index for starting playback. A chapter title marker is the text title attributed to a lecture subdivision. A chapter slide marker is a thumbnail reduction of a chapter slide image that accompanies a lecture subdivision. A chapter marker is a composition of these two elements presented as a two-column row entry: the title and the slide thumbnail. Finally, the complete chapter index is a navigable list of all the chapter marker metadata in the given media file.

3.4. Procedure

The quantitative instrument used in this study was an adapted and extended version of the UTAUT questionnaire [36]. The UTAUT consisted of five four-item scales, measuring students’ performance expectancy, effort expectancy, social influence, perceptions of facilitating conditions and behavioral intention to use a technology intervention (see Figure 1). Items in the intention to use scale are derived from determinants of technology acceptance, and are designed to measure students’ reasons for adopting and using a technology. Students have to answer each item on a seven-point Likert-type affinity scale ranging from 1 = strongly disagree to 7 = strongly agree. Additionally, constructs were added to measure students’ active learning and tasking strategies with five four-term scales, measuring behavioral review, behavioral selection, behavioral multitasking and flow.

Items in the behaviors scale are derived from active learning strategies and task and focus management, and are designed to measure students’ behavioral response to the technology tool. Students have to answer each item on a seven-point Likert-type frequency scale ranging from 1 = almost never to 7 = almost always. The qualitative investigation was conducted through open-ended interview style questions.

There are countless factors in the teaching ecology that can be affected by the intervention. However, learners may only be able to inform us about a subset of these factors that relate directly to themselves. To consolidate the study of the teaching ecology, the questionnaire is focused on two aspects that relate directly to listening to podcasts to hear a lecture. The two aspects are:

1. the usage of chapter features for active learning while preparing for assessments (weekly quizzes and exams), queried as:
   a. Selection
   b. Review
   c. Pausing
2. the context and use as primary or augmented media to study habits and other tasks, queried as:
   a. Multitasking
   b. Flow

These two particular aspects and their subcomponents were further explored in the qualitative investigation of how the technology intervention affects learner behavior.
Figure 1 showed the experimental model for this study and the variables that were measured. The variables represent factors that mediate usage and behaviors attributed to learning strategies with mobile media. The measures of the extent of acceptance (Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions) and behavioral tendencies (Multitasking, Flow, Selection, Review, Pausing) are indirect measures of student interaction with the materials. We propose measuring variables of acceptance and measuring variables of behavioral tendency for individuals as a coupled approach to observe the effect of the technology intervention on the teaching ecology. A more detailed description of the study may be found in [27].

4. Overview of analyses and results

After the semester ended, the collected questionnaires were assessed by reliability analysis. The modified UTAUT survey constructs in the instrument proved reliable with Cronbach’s-α coefficients above 0.7 for all Predictor Variables with the sole exception of the Facilitating Conditions construct. Venkatesh, et al. [36] also found that Facilitating Conditions, although not significant enough to predict intention, was significant in determining usage. Next, a factor analysis was conducted to examine latent factors in the extended behavioral use constructs in the instrument. The emergent factors were described and used in the analyses to represent the types of behavioral usage. The factors were interpreted as representing the constructs of behavioral review, behavioral selection, behavioral multitasking, and aspects of flow, although the constituent variables differed slightly from the original design. The findings of this study indicated that it was a reliable and valid instrument for measuring university students’ acceptance and use of chapter features in a lecture podcast. See [27] for details of the factor analyses.

4.1. Acceptance of the technology intervention

Frequency counts indicated that 60% of all participants (n = 75) reported intention to use the technology intervention when studying the lecture material. To better understand what drove this
acceptance, the next analysis considered the relationships of the constructs of Behavioral Intention to Use and its various predictor variables: Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions (see Figure 2). Performance Expectancy was strongly correlated with Behavioral Intention to Use ($r = 0.805$, $p < 0.01$). This correlation suggests that adopters have a strong tendency believe that use of the chapter features technology in studying will help them perform better on course assessments. However, this correlation could also be driven by a common underlying cause. Students who easily adopt new technologies may also feel more confident about doing well in an introductory computer science course. The other predictor variables (Effort Expectancy, Social Influence, and Facilitating Conditions) also had a moderate positive correlation to Behavioral Intention to Use ($0.4 < r < 0.7$, $p < 0.01$).

The data indicated a small negative correlation ($r = -0.2$, $p < 0.05$) between the age group variable and the general media player usage, suggesting that younger age groups had exhibited higher media use. There was also a small positive correlation ($r = 0.2$, $p < 0.05$) between prior educational podcast use and age groups, suggesting that older students were more likely to have experienced podcasting before taking this course. Also, there was a small positive correlation ($r = 0.2$, $p < 0.05$) between student perceptions of social influence and prior educational podcast use. Students who had prior experience with educational podcasts also perceived that influential academic persons encouraged its use.

### 4.2. Exhibition of active learning behaviors

Three practices that are used in conjunction with traditional lecture and have been shown to have the positive effect on learning outcomes were chosen to measure active learning behaviors. These three practices were decomposed into constituent variables and designed into constructs that represented Behavioral Selection, Behavioral Review and Behavioral Pausing. Two additional constructs (Behavioral Multitasking and Flow) were added as dimensions to measure responses to the affordances in portability and context changes enabled by this technology (Figure 2). From a factor analysis of the constituent variables, two active learning behavior constructs emerged (KMO = 0.85, $\lambda > 1$, $h^2 = 72\%$).

An examination of the questionnaire items of factor 1 indicates the variables included the following behavioral study actions: revise, organize, review, and refresh from the behavioral review construct, and stop and revise from the behavioral pausing construct. The composite set of variables suggests use of the technology system to browse, stimulate recall or reinforce learning. The variables of emergent factor 2 included the behavioral study actions of selecting, skipping and choosing from the behavioral selection construct. The composite set of variables suggests use of the technology system to navigate by familiarity and interest.

Students reported two related sets of active learning behaviors as represented by two emergent factors. One set of activities represents a codification of behavioral review and the other behavioral selection. These emergent factors were then used to analyze the relationships of study behaviors to learning outcomes in the course. Behavioral Multitasking and Flow also emerged as factors verifying the structure of these construct designs.

### 4.3. Learning outcome analysis

In this study, correlations were discovered between the chapter intervention technology and learning outcomes. Learning outcomes were measured in two assessment modes. Listening quizzes provided immediate assessments and semi-semester exams provided delayed assessments. The immediate and delayed assessment modes were used as distinct measures of learning outcomes. The immediate and delayed assessments were also considered over two domains. First is magnitude or the overall average of the assessment scores. The second domain is the change in performance from the first to the second half of the semester.

In this study the scores on the immediate assessments were correlated with the active learning behavioral usage of the chapter features technology. Behavioral review and the interaction of behavioral selection and behavioral review demonstrated a correlation ($p = 0.05$, $r^2 = 98.6\%$, $\eta = 82.5\%$) with the magnitude of the immediate assessment learning outcomes. Further analysis revealed the highest mean quiz averages ($\mu = 89.1$, $\sigma = 10.3$) were produced from the group of students with the highest frequency of behavioral review with the chapter features. When considering the change in immediate assessment performance over the semester, behavioral selection and the interaction of behavioral selection and behavioral review, a correlation with change in performance was found ($p = 0.04$, $r^2 = 90.2\%$, $\eta = 83.1\%$). The data indicated that the students with highest frequency of behavioral selection were the only group to show a positive change ($\Delta = +2.6$) in quiz average from the first to the second half of the semester.

The quantitative data in the study demonstrated no correlation between the delayed assessment
performance and the active learning behavioral usage of the chapter features technology. However, the qualitative data painted a different story. Students revealed that they were using the active learning behaviors with the chapter features during immediate assessment preparation and generating secondary learning objects such as notes and completed quizzes. These secondary learning objects then became the primary resources for many students as they prepared for the examinations. Therefore, the effect of the interaction with the chapter features was manifested in learning objects that in turn persisted the effect to exam preparation.

4.4. Multitasking preferences and sustaining flow with mobile media

The two constructs of Behavioral Multitasking and Flow measured tasking preferences in the context of chapter use. The chapter feature technology provides affordances that may be helpful in task management and context switching. These constructs allow measurement of student tasking preferences from varying perspectives. Recent studies [5, 10, 21] consider student preferences for attending to and switching between multiple tasks. Therefore a construct for Behavioral Multitasking was designed with 4 variables to measure task preference to mobility, control and multiple task preference in respect to taking lecture and using the technology system intervention. From another perspective, recent studies also consider behavior to achieve a state of immersive mental flow while on task. Therefore a second construct for Flow was designed with 4 variables to measure task preference to concentration, focus, and discernment to stay on task in respect to taking lecture and using the technology system intervention. A confirmatory factor analysis strengthened the original constructs (KMO = 0.85, \( \lambda > 1 \), \( h^2 = 73.8\% \)).

Next the relationships between the student tasking preferences and active learning behaviors were analyzed, revealing that the factors of Behavioral Review, Behavioral Selection, Behavioral Multitasking and Flow were all moderately correlated with each other (p < 0.01). Behavioral selection using the chapter features was most strongly correlated with behavioral multitasking (r > 0.7, p < 0.01). Behavioral review using the chapter features was most strongly correlated with students’ attempts to sustain flow while studying (r > 0.7, p < 0.01).

5. Discussion

The data in this study supports a very high positive relationship between Performance Expectancy and Behavioral Intention. The data shows that the students have a moderate tendency to believe that the chapter features technology are a useful and productive tool; the students also have a tendency to believe that use of the chapter features technology will increase their chances of getting a better grade; however, they tend to be stronger in terms of their perception that the chapter features will improve the use of their study time.

The data suggests students have a tendency to use the chapter tools to integrate these review behaviors at least half of the time they study. Students report more frequently using the chapter features to organize their understanding of the material and to refresh their memory. The frequency of the former behavior suggests that of the various review behaviors measured in this study students have a tendency to believe the chapter tools are most helpful to them in organizing their thoughts about the material. Students who return to the chapter features in preparing for delayed assessments have a tendency to believe the chapter tools are most helpful to them in refreshing their thoughts about the material after a period of time has elapsed.

A study by Ohly et al. [29] shows that effective routines are positively related to being creative and proactive. Furthermore, the study found that developing a routine is an effective way to deal with complexity and time constraints in a task [29]. The choice to accept or reject a technology can be based on past experiences in learning or a willingness to try new methods at a threshold of a new learning environment [23]. Previous learning experiences compile and manifest themselves as learning preferences that affect adoption and use. In this study, the adoption of the chapter features technology through behavioral review as an active learning strategy showed a beneficial effect in the immediate assessment scores.

There are motivations (such as performance expectancy, effort expectancy, social influence, and facilitating conditions) that directly affect usage intentions and have been shown to be determinants of use behaviors [35, 36]. In this study, the single largest component of acceptance as defined by behavioral intention to use the intervention technology was performance expectancy, or the perception that using the technology system would help the student get better grades. A study by Sankaran and Bui [32] showed that students who were motivated the most also gained the most in incremental learning benefit. In this study an incremental learning benefit in quiz scores was also highly correlated to behavioral selection as an active learning behavior. Research should continue to investigate how motivations drive actions of selection and choice, and the effect of self-
awareness of learning strategies as a benefit to both deeper learning and life long learning.

The data shows that students have a tendency to frequently use the chapter features when they multitask. Students tend to use the chapter features to control the podcast about half of the time when they are moving around. In contrast students report a tendency to not use the chapter features as they get other things done. This would be reasonable as a product of prioritizing tasks other than lecture.

In the open-ended questions, students who multitasked reported a tendency to prioritize the task of completing the lecture podcast while preferring to add only low cognitive load tasks. Examples of these tasks included browsing Facebook posts or playing Bejeweled while listening to the lecture podcast. Students’ reported a tendency to add low cognitive tasks to their cognitive load as a strategy to avoid the zone of boredom. Analysis of the qualitative data suggests that students may be using chapter features to maintain their interest level in the main task when that task is studying the lecture content. This study found a statistically significant correlation between use of chapter features to achieve flow and learning outcomes represented by immediate assessments.

The student responses in this study indicated that the chapter features provided structure to interact dynamically with the lecture content and supporting maintenance of a flow zone in studying. Students indicated that they could jump around and select what was interesting; and that if they got lost or confused, they could easily go back to review a previous section.

5. Conclusion

The analysis offered here is a development of investigative methods for active learning. This study develops and offers an instrument to begin a discussion about structured media in mobile learning. Interestingly, a number of cases in the literature demonstrate that lecture podcasts are created and delivered within the context of preexisting curriculums. Rarely is media structure considered in terms of how people learn and their study practices. Establishing indicators such as chapter markers within the media and having an infrastructure of support including presentation and navigation of the indicators establishes a necessary foundation for enabling behaviors of selecting, reviewing and pausing and to integrate teaching activities that are able to address academic and socio-emotional learning goals.

Rich media is often created but then left to stand on its own merit with no structured pedagogical inclusion. Often just the strain of creating the media itself can leave the instructor with little time to develop and incorporate the elements of the media appropriately. However, the pervasive media player devices have now become media creators as well, recording audio and video. Instructors can assign students the task of developing learning objects for the classroom. This delegation of control is fundamental to the active learning style of instruction. Students can create more contextually appropriate materials and develop skills in learning and acquiring information in a way that is meaningful to them. In terms of teaching, this is a shift in the locus of control from the instructor teaching, to the instructor facilitating the students teaching themselves. Self-instruction is a lifelong skill that will not only make the current material more meaningful, but will help the student develop metacognitive learning skills to become aware of developing better strategies to learn.

Educators cannot ignore the media and communications technologies that are not only prevalent in the lives of the students outside the classroom, but that permeate the teaching ecology of the classroom and all of its processes. It is imperative that educators learn to address the affordances of the technology in their pedagogical practices and to master control media, and its use and role in learning to connect meaningfully to the student’s life and needs.

6. References

consciousness. Cambridge, UK: Cambridge University Press.


