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Factors Influencing the Selection of an Adaptive Learning Technology within University and K-12

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FACTORS INFLUENCING THE SELECTION OF AN ADAPTIVE LEARNING TECHNOLOGY WITHIN UNIVERSITIES AND K-12

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Abstract

Technology continues to shape the landscape of higher education, universities and K-12, therefore, need to design programs that accommodate the diverse needs of their students. As universities and K-12 consider pathways for meeting these needs, it will be fundamental that consideration is given to sound pedagogical principles for teaching and learning within these changing landscapes. This position paper reports on the key principles and factors influencing the selection of an adaptive learning system within universities. An extensive literature review demonstrates the benefits when an adaptive learning system gives equal consideration to technology and pedagogical issues.

Introduction

The concept of adaptive has been around for centuries. Lee and Park (2004 p. 468) suggest that “Adaptive instruction has had a long history and has been implemented in various forms and setting, from group-based, classroom instruction to web-base open space instructions.” Lee and Park (2004) also affirm that adaptive learning principles existed prior to the 1800s; however, within the past two decades, there has been a fusion of the key principles of adaptive learning with new and emerging technologies that should be recognized as a new era This fusion with technology creates a contemporary definition for adaptive learning that according to Paramythis et al.,

“... is the capacity of a system to: monitor the activities of its users; interpret these on the basis of domain-specific models; infer user requirements and preferences out of the interpreted activities, appropriately representing these in associated models; and, finally, acting upon the available knowledge on its users and the subject matter at hand, to dynamically facilitate the learning process” (2004, p.3-4).

Vassileva (2012) and Ardimento et al. (2011) support the definition of Paramythis et al. by indicating that in an adaptive system the learner’s needs are paramount and that the learner’s behavior is developed using data obtained during the learner’s interaction--a representation of the learner’s profile . Although the concept of adaptive learning is not new, the inclusion of advanced technologies has catapulted this concept to **university** and K-12 seeking alternative modes for content delivery.

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A major criticism of contemporary adaptive learning systems is that many do not give adequate attention to pedagogical issues (Raible et al, 2014), recognizing the need to design systems within a balanced framework that includes the benefits of both technology and pedagogy.

Ultimately, the goal of an adaptive learning system should be one that “respects students’ differences based on determined learning styles and gives regard to their knowledge and skills as changed during the course” (Kostolanyon and Sarmarova 2014 p.172).

In the last decade, the emergence of adaptive learning technologies produced several for profit organizations within the education technology market. Several companies promise to personalize the learning experience (Raible et. al., 2014), however, objective reviews are necessary to establish the potential of adaptive learning system within higher education. These reviews should address key components of teaching and learning that include pedagogical, instructional, administrative needs and students’ learning needs. This position paper reports on key factors and principles influencing the selection and implementation of an adaptive learning system for higher education institutions and K-12. The researchers collected data from an extensive literature review and formulated three questions that guided the literature review process:

- What are the key principles of an adaptive learning system?
- What are the key factors influencing the selection of an adaptive learning system?
- How can educational institutions prepare for the implementation of an adaptive learning system?

Methodology for the literature review

The researchers created a set of criteria to select journal articles used in the literature search. These criteria included, but were not limited to, the age of the publication, specifically selected keywords and peer review articles. With the above mentioned information, the researchers

created a document to ensure all articles identified in the search were given the same scrutiny. On completion of the search, the researchers further discussed the findings of the literature reviewed; the findings are presented below by themes.

Key principles influencing the selection of an adaptive learning system

A large and growing body of literature suggests there are key principles that should be considered in the evaluation of an adaptive learning system. These principles include, but are not limited to, standardized and consistent content; the design of independent learning objects (Vassileva, 2012); the implementation of the constructivist principles of teaching and learning (Jones and Jo, 2004); personalized learning (Paramythis et al., 2004; Challis, 2005); the transformation of the instructor's and student's role in the course delivery process (Ruiz, et al., 2006; Calliss 2005); the ability of the selected system to give data in 'real time' (Challis, 2005); consideration for the capacity of the selected system to provide proactive data analysis to enhance students' retention (Raible et al., 2014); ability of the system to provide "students with enriched opportunities to learn in their own time and space and exploit the potential to adapt to their needs more fully" (Challis 2005, p.524); capacity of the system to be integrated with different learning management systems and accommodate the transfer of learning profiles (Raible et al., 2014); and capacity of the system to apply a range of methods to enhance the learning process (Nuri and Sevin, 2013).

Most of the articles reviewed did not adequately address the issue of pedagogy, the foundation of any adaptive system. According to Yang and Ya-Ting (2013, p.726), "Adaptive instruction is indeed central to social constructivist pedagogy," therefore, it is imperative that full consideration be given to this issue. In addition, Arapi et al. (2008) state that a personal framework will help establish a pedagogically-sound, inclusive learning experience for the learner.

The human element is another factor omitted from the articles reviewed on adaptive technology. Teaching and learning is a social interaction between the learner and the instructor (Thurman, et al. 2013 and Jowallah 2014), therefore, course design should enhance human interaction.

While the authors' view the trend towards adaptive learning as positive, consideration of the key instructional principles within the context of these new and emerging technologies (Holland and Holland, 2014) are essential. According to Wilson (2005), and as cited in Holland and Holland (2014), new technologies can overwhelm, and, thus, prevent its use to improve learning.

Key factors for consideration in an adaptive learning system

Key factors in the adoption of an adaptive learning system, found in the literature, include, but are not limited to technical, user **experience** and resources.

Comment [MB2]: Prior sections did not use a comma before and in a series. With several authors, you need to check for consistency, but either is correct. I removed the comma in this section for consistency.

The evolution of technology has allowed these systems to evolve and introduce complex capabilities such as immense data storage, on-demand system scalability and learning algorithms.

Zliobaite et al. (2012) believe adaptive learning systems generate an “evolving stream” of data that require real-time analysis from a learning algorithm. Zliobaite et al. (2012) urge caution with the use of a learning algorithm as it is ever changing, which leads to validity issues. Also, the algorithm needs to be transparent to the user. Without transparency, the user will not be able to judge which criteria their performance is being evaluated against and will lose faith in the accuracy of the system.

A positive user experience is critical to the success of an adaptive learning system. Many faculty and students may be familiar with a learning management system environment; however, an adaptive learning environment is foreign as the content organization and sequencing are radically different and often inflexible. Vassileva (2012) suggests adaptive learning systems prevent faculty from using different pedagogical techniques due to the rigid structure of the platform, therefore removing a faculty’s influence over the manner of course delivery.

Another critical element to a positive user experience is faculty and student ability to solve technology problems when they occur (Kara and Sevim, 2013). Faculty and student training in conjunction with just in time technical assistance should provide the necessary knowledge to successfully utilize an adaptive learning system to its fullest potential.

Resources can also determine the success or failure of an adaptive learning system adoption. Significant planning must be done in the areas of budget, user training, faculty compensation, technological infrastructure and timelines.

Certain considerations are worthy of administrative pondering when preparing to implement an initiative that includes new technology. An adaptive learning initiative represents a major shift within an institution, and should therefore be approached with administrative experience and knowledge about preparation for such a shift. Hence, institutional preparation for the implementation of adaptive learning systems should start with strategic planning that considers the institution, its technological systems and its stakeholders as a unified entity. McGill et al. (2014) conclude that multi-level institutional support that considers the institution and the technology plays a critical role in sustainable technology initiatives. In the context of adaptive

learning systems, choosing a system that works well is certainly important, but only represents a small part regarding sustainability. Sustainability preparations should include ongoing financial support and financial investment mechanisms, progression of the technological and the faculty support systems, and an extensive plan for broad long-term internal stakeholder buy-in. Overall, evolution of the entire initiative as it impacts students, instructors, administrators and technical systems is a critical factor in strategic planning (McGill et al., 2014). Additionally, preparation for evolution of the system might include planned flexibility and futuristic thinking. In short, a critical overarching question is, how can the planned adaptive learning system be integrated into future delivery mediums?

The overall goal of an adaptive learning system is to support student learning. Student learning is impacted by strong teaching practices. Therefore, systematic impedance to student learning and/or instructor pedagogy becomes a key consideration in the planning stages of the implementation of an adaptive learning system. Hence, attention should be given to the support and development for both students and instructors that will limit any impediment to progress (McGill et al., 2014). While non-functional systems may impede the progress of students and instructors, general barriers to technology integration might also apply to the implementation of adaptive learning systems. Therefore, institutions should consider strategically planning instructional support that includes addressing barriers before they become barriers. Ertmer (1999) discusses first and second order barriers to technology integration. First order barriers might include access, availability and funding as have formerly been addressed in this paper. Second order barriers include attitudes and beliefs about technology. Simply because an adaptive learning system is accessible, available and well-funded does not mean that instructors will be excited to implement it. Implementation may require training that helps change attitudes about an incoming initiative. Positive attitudes will contribute to a broad buy-in foundation and increased value of the system to the university (McGill et al.). In an adaptive learning system, instructors play a key role, but their role is different from the traditional instructional role. Consequently, addressing their attitudes and understandings about the changing role of the instructor in an adaptive learning system is critical in the planning process.

Conclusion

Careful examination of the literature provides pathways to follow for institutions considering the purchase and implementation of adaptive learning systems. Along the path, foundational concepts exist that will aid in making good choices that will fit the needs of the total institution and help build a sustainable and impactful adaptive learning system. Considering the needs of the stakeholders involved and clearly defining adaptive learning systems for them will further communicate the value that such systems can add to an institution.

In an emerging market that is becoming saturated with vendors, institutions have to look deeper than sales promotions before purchasing and implementing adaptive learning systems. Systematic planning that starts with the historical background of adaptive learning systems is necessary. Furthermore, clear categorization of current systems on the market can help in choosing a system. In categorizing, institutions will know whether or not a given system functions to meet their needs. Understanding the models used as foundational building blocks within each system can foster good decision making about what particular models within a system would prove beneficial in meeting the needs of the student and instructors. Furthermore, planning a clear framework for acquisition that provides information about a system's support mechanisms, pedagogical bent and level of student to student and student to teacher interaction may prove beneficial in matching a system with the needs of the institution. An overlying principal is the administrative understanding that institutional needs include students, instructors, administrators, support staff and other individuals that might be impacted by the acquisition of an adaptive learning system. Following a specified, long-term and strategic plan will support broad buy-in that will help sustain a program for years.

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