**Adaptive and Personalized Learning Environments in Global Online Management/Business Education**

**Abstract**

Intelligent tutoring systems have been used in management and business education to help learners master problem solving, reasoning, planning, learning, perceiving, and acting. Development of adaptive and personalized learning environments have the potential to further develop these skills in management and business education students. Cultural misunderstandings can lead to reduction in student participation and performance. Integration of international content has been found to reduce disparity within groups. An overview of intelligent tutoring systems, adaptive and personalized learning environments, and importance of cultural context are provided. Recommendations for instructional designers are presented.

**Introduction**

Computerized decisions and artificial intelligence (AI) have been used in business education to address development of skills requiring problem solving, knowledge, reasoning, planning, learning, perceiving, and acting (Oliveriam, Aureliano, de Franca, & Tedesco, 2014). Business educators are now using adaptive learning environments to incorporate these decisions with AI and machine learning. An adaptive learning environment is one in which the educational system adapts to the needs of the learner. Not all adaptive learning environments are presented completely through a computer-based application; some integrate technology-based activities with face-to-face interactions with an instructor and with on-the-job observations and actions (Dutton, 2018). Other adaptive, or personalized, learning environments are presented through a learning management system. The goal of this paper is to explore the elements and design decisions of adaptive, personalized learning environments presented within online education that is serving the purpose of providing education or training to management or business education learners at a distance.

**Brief History of AI in Learning Environments**

Just after the turn of the 21st century, educators speculated that AI would perform many intellectual tasks by more effective, faster, and less expensive means (Gold, Rodgers, & Smith, 2003). Since early in the age of computing, AI agents have been used within production to make decisions on passage or failure during quality testing of a product (Nilsson, 1980) and were a focus of business education to know how to program the AI systems. The role of AI agents in educational environments was similar but different than manufacturing applications. Within learning platforms, AI agents made decisions about the learner’s progress or performance rather than a production quality measurement. These early educational systems with incorporated AI served as intelligent tutoring systems and offered highly individualized drill-and-practice sessions (McArthur, Lewis, & Bishary, 2005).

Even though the start of intelligent tutoring systems began in the early 1980s with the development of WEST (Burton & Brown, 1982) and SOPHIE (Brown, Burton, & deKleer, 1982), refinement as adaptive learning environments and personalized learning systems has progressed as technological advances have been made with AI and online educational environments and learning management systems development. Shifts to 1-to-1 computing and adoption of mobile devices for educational purposes have increased use of intelligent tutoring systems and other learning management systems for personal, vocational, and business education (Biloš, Turkalj, & Kelić, 2017). The use of online education and 1-to-1 computing required a shift in positional and epistemic authority toward the learners and their learning and away from the teacher-directed model (Towndrow & Vallance, 2013). The use of the technology mediated the learner’s independence as the change of the teacher’s role shifted from the sole-source and arbiter of the knowledge to a learning environment where the learner had greater responsibility for completing learning tasks.

The goals of differentiated learning (Tomlinson, 1999) proposed to consider the varied needs of the learner while presenting instruction. The goal was to close the gap between learners in the same educational environment by assessing each learner then providing the necessary scaffolds and resources to attain the required competencies of the instruction. Early AI systems worked to examine evidence of learning in an environment and provided explanation-based learning presentations to help the students or provided examples of domain knowledge to serve as examples of the goal concept (Chi, Bassok, Lewis, Reimann, & Glaser, 1989). Early models for creating ontology-based recommendations for learners to adapt to their needs were the open learner modeling (OWL-OLM; Denaux, Aroyo, & Dimitrova, 2005) and the Personal Reader (Dolog, Henze, Nejdl, & Sintek, 2004). Another system, the TELOS ontology driven system, operated in a multi-agent system to annotate actors, activities, and resources that worked to evaluate and support the development of knowledge, skills, and performance of the learner (Paquette, Mariño, Rogozan, & Léonard, 2015).

Later systems used natural language processing with the AI and machine learning within learning environments. Tools from computational linguistics such as Coh-Metrix (narrativity, deep cohesion, referential cohesion, syntax simplicity, and word concreteness) and natural language processing algorithms helped to analyze word usage within collaborative group interactions and informed intelligent tutoring systems about adaptations to take within monitored and unmonitored learning environments (Dowell, Cade, Tausczik, Pennebaker, & Graesser, 2014). Analysis of the dialogue within the learning environment occurred at the individual level and at the collaborative group level. The design of computer supported collaborative learning environments (CSCL) have been for small group collaboration, structured or unstructured asynchronous message boards, peer review, and, less frequently, collaborative activities that allocated roles in the group based upon roles or knowledge distribution (Manathunga & Hernández-Leo, 2015). The testing of the instructional design strategies and methods in massive situations was necessary to determine the scalability of the tools and theories.

Drawing upon the engagement generated within CSCL environments (Slavin, 1980), learners within a CSCL have developed learning communities as they sought and constructed knowledge. Often, the group formation in a CSCL learning environment has been a random assignment or according to personal features such as learning styles or interests (Alfonseca, Carro, Martin, Ortigosa, & Paredes, 2006). A merger of collaboration and adaptation benefits the learner by following a rule-based formalism to present the most suitable set of tasks for the individual learner and for the group (Alfonseca et al., 2006).

**Background to Adaptive Learning in Intelligent Tutors**

The implementation and advancements in computer data processing has supported the development of individual-based intelligent tutoring systems. Patentable processes, such as the neural adaptive learning device and neural adaptive learning method using a relational concept map (Won & Kim, 2016), have developed methods for storing problems, concepts, and relationships between problems and concepts. The adaptive learning device is operated using machine learning to extract concepts and related problems for the learner to test the learner’s knowledge, skills, and abilities. A history of performance is maintained and updates the machine learning to cue the learner for more practice or to reinforce the learner with a sense of accomplishment when mastering a concept.

In other systems, feedback mechanisms provided cues to the learners and adapted as the learners mastered or failed to master a subject. Within a course to teach students how to write programming code, the adaptive learning system used desirable path algorithms to guide students in a manner similar to how a teacher would have guided the learner. For example, in one programming course at MIT that used the desirable path algorithms, 64% of incorrect submissions were correctable with a relatively simple error model that provided feedback to the students (Singh, Gulwani, & Solar-Lezama, 2013). Computer Supported Cooperative Work (CSCW) environments used an intelligent tutor to support learning in a collaborative learning environment when a human tutor or team members were not available to help (Marin, Hunger, Werner, Meila, & Schuetz, 2004). In the CSCW, many of the students had fallen behind in their collaborative teamwork and required additional support. A learning algorithm was applied to recognize the pattern, search for the pattern in a knowledge database, then provide feedback. If the pattern was not found, the new pattern was added to the database and cued for human tutor interactions. The intelligent agent asked questions and sought feedback from the learner to assess understanding of a topic.

In a variety of situations, especially in massive open online course (MOOC) environments, adaptive learning systems have been implemented to support interventions and interactions for learners at pre-task and in-task points of their instruction to provide pre-task interventions, in-task instructions and peer interactions, and domain-specific content and activities (Fauvel, 2015; Suen, 2014). In other course environments, intelligent topic-based information agents searched the web for content that is recommended to students within a MOOC that are driven by the topic being presented, rather than learner performance, and resulted in improved student performance (Razek, 2014). Ultimately, the learning impact of any AI interventions were dependent upon the learning design and the capability of the system to efficiently adapt and intervene in the learner’s instruction without being obtrusive (Magnisalis, Demetriadis, & Karakostas, 2011).

The data-driven development of instructional environments and the optimization of the use of educational technologies to inform intelligent tutoring systems has been carried out within educational data mining and learning analytics (Birari, 2015). Intelligent tutoring systems have analyzed data to cluster the student performance, compared outcomes to a preset goal, and provided support to the learners. Each subsequent offering of a MOOC, or other adaptive learning system, would benefit from the evaluation of the prior course offering and the students’ behavior and performance.

As management and business education expands to global audiences, such as the education provided through the business education platform, Open SAP, organizations are partnering with academic institutions to draw upon the instructional design expertise (SAP, 2018; Shah, 2016) and understanding of global and indigenous leadership requirements (Turner, Baker, Schroeder, Johnson, & Chung, in press). Following, an examination of culture influences provides a foundation for management and business educators to consider the inputs within an adaptive and personalized learning environment related to culture. These cultural elements should be attended to with the same level of importance as the learner’s performance on activities, quizzes, and self- assessments.

**Culture and Online Learning**

Culture influences how people think and learn, their learning preferences, and their habits (Parrish & Linder-VanBerschot, 2010). Effects of cultural background are manifested not only on learners but, also on teachers, their teaching strategies, and the design of instruction (Gunawardane & Lapointe, 2007). Among other factors, globalization and technological advances have led to increasingly multicultural online learning environments. However, scholars observe that educational spaces traditionally perpetrate cultural hegemony as the culture of the dominant group and the instructor determine not only what is taught, but also how it is taught, and what forms of knowing and thinking are validated (Uzuner, 2009). Cultural hegemony is exacerbated in online classrooms (Uzuner, 2009), as the cultural diversity is not visible, and the learners and instructors are physically removed from each other and the challenges of diverse learners are not immediately observable (Moore, 2006). Problems of cultural hegemony in learning environments and the need for cultural inclusivity are widely researched, more so in virtual settings in the recent years. Instructional design models of culture, engage with issues of culture in the design and developmental phases of learning and promote cultural inclusivity (Young, 2008). These models take cultural differences into considerations in course design, communication, choice and structuring of learning experiences, and assessment strategies (Parrish & Linder-VanBerschot, 2010).

**Instructional Design Models of Culture**

Frameworks of culture and learning generally use Hofstede’s six dimensions of culture (power distance, collectivism vs individualism, masculinity vs femininity, uncertainty avoidance, long-term vs short-term orientation, indulgence vs restraint), and Hall’s classification of cultural differences (based on conceptualizations of physical space, time, and context) as starting points (Young, 2008). Reeves (1992) adapted Hofstede’s cultural dimensions to online pedagogy and identified ten areas for pedagogical considerations. More recently, Parrish and Linder-VanBershcot (2010) adapted Hofstede’s and Hall’s dimensions and developed the Cultural Dimensions of Learning Framework (CDLF) specifically for online learning environments. While Reeves and Parrish and Van-Bershot provide over-arching frameworks for cultural considerations in online learning environment, Henderson (1996, 2007), Thomas, Mitchell, & Joseph (2002), Lee (2003), Edmundsen (2007), and Young (2008), developed cultural models specifically for instructional design. These models of culture demonstrate how cultural considerations can be integrated into the design process to enhance learning (Young 2008).

Nevertheless, culture is neither monolithic nor static. Consequently, one of the main challenges that instructional designers and instructors face in dealing with issues of culture in online learning environments is the difficulty in identifying “where cultural universals apply and where cultural differences and subcultures will influence the processes and outcomes” (Jung, 2014, p. 15). Another issue is the lack of awareness among instructors and instructional designers about how their cultural biases color the choice and structure of instructional material, strategies, and assessments (Rogers, Graham, & Mayes, 2007). Ensuring culturally sensitive behavior and practices among learners in multicultural online environments also poses a challenge for instructors and designers (Parrish & Linder-VanBerschot, 2010). From an instructional design perspective, at least five aspects are said to determine effective engagement of culturally diverse learners: course design (Gunawardena, 2014; Parrish & Linder-VanBerschot, 2010), selection of text or learning material (Reiners, 2009), communication or interaction frequency and style (Shattuck, 2005; (Liu, Liu, Lee, & Magjuka, 2010), assessment strategies (Liu et al., 2010), and availability of choice in content and learning activities (Gunawardena, 2014; Parrish & Linder-VanBerschot, 2010).

**Cultural Considerations in Online Business Education**

Even though addressing issues of culture in management education contexts is gaining traction, there is not much research on cultural issues in online business education environments. In one of the rare studies on cultural issues in online management education, Liu et al (2010) examined the impact of cultural differences on the learning experiences of online MBA students specifically. The researchers identified four specific areas of concern where future instructors and instructional designers needed to address: instruction, collaboration, assessment, and case based learning. Online Business learning environments led by U.S. instructors were perceived to be less structured and high on peer-to-peer and student-faculty interaction; they were perceived to be more discussion- and interaction-based rather than lecture-based where the instructor often did not lead the learning process with explanations, elaborations, or re-cap of key learning points. These learning environments also included collaborative learning tasks and assignments where students from collective cultures felt challenged to take the lead or decline as opposed to those from individualistic cultures. Moreover, prevalent assessment strategies used by U.S. based educators that were ongoing, application, and process-oriented as also posed difficulties to those used to assessments that were exam-oriented, designed to test knowledge, and encouraged memorization and recall. Most importantly. Lie et al, noted that business education was predominantly case-based and educators from the U.S. used U.S. based cases for teaching and assessment purposes. Even though these cases were useful in learning about U.S. business culture and expectations, students from other business cultures could not relate to them and found that the case scenarios and the issues they delineated could not be applied to their countries. In a study on culturally-based adaptive learning, Reiners (2009) observed that choice of case scenarios in marketing involving sex or nudity or case vignettes that examine outsourcing, child labor, or intellectual property rights chosen for analysis in business courses could also be culturally inappropriate.

**Recommendations to Instructional Designers**

The strengths of CSCL environments include the support of peers within the environment. The implementation of AI in a CSCL has the potential to provide the most suitable activities and challenges to the individuals and the group. Engagement within the face-to-face and computer-based CSCL environments has been found to have positive effects on knowledge gain, skill acquisition, social interaction, and group task performance (Chen, Wang, & Kirschner, 2018). The assignment of group membership in the CSCL has helped with group awareness, student behavior engagement, and social regulation (Liu, Liu, & Liu, 2018). Collaborative behaviors and group cohesion were positively related to collaborative creation within the CSCL environment; however, the cognitive quality was not related (Wang & Hong, 2018). Thus, there is need for the instructional design and development of individualized assessments and measures to inform the adaptive and personalized learning environment such that the learners received the instructional materials necessary for their success. Students working with diverse peers in a CSCL at times have experienced social and cultural tensions that had the potential to damage the quality of online participation and interactions (Mittelmeier, Rienties, Tempelaar, Haiiaire, & Whitelock, 2018). However, use of content from international contexts decreased the disparity within the groups, especially when the content was relevant to the students’ backgrounds (Mittelmeier et al., 2018).

Development of a high quality adaptive and personalized learning environment also adds to the potential for improved learner performance. Analysis of standards for development of high quality online courses indicates the most emphasized standards to include “instructional analysis, design and development, student attributes, support and satisfaction, and institutional mission, structure, and support” (Martin, Polly, Jokiaho, & May, 2017, p. 6). Thus, student attributes, an element important to the individualization of the adaptive and personalized learning environment, is a key element to attend to when developing online management and business education learning environments.

**Conclusion**

The multiple challenges that business educators are faced with in culturally diverse online learning environments demand that they are aware of and are able to address the complex influences of culture on their choices and practices as instructors and learners’ engagement (Wang & Kang, 2006). These issues indicate a clear need for culturally sensitive and culturally responsive learning and instructional strategies that are available to them through adaptive learning technologies (Reiners & Dreher, 2009).

Within in development of adaptive and personalized learning environments, care must given to the context in which the learning is to take place. Instructional designers consider how the elements of the model influence the interpretation during their analysis of the audience to use the learning environment. This limitation can be addressed in robust instructional design.

Learning in an adaptive learning system or in a traditional adaptive learning situation permits the learner to assess the learning. Management and business skills and abilities developed through active learning results in a meta-cognitive activity that is crucial for the development of leadership and strategic skills, whose key elements require abstract, adaptive conceptual thinking to make connections within patterns (DeGeest & Brown, 2011). The recommendation to incorporate AI and adaptive learning management and business education has many opportunities to add to the literature about process, cognitive, and meta-cognitive development for individuals and for groups.

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