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Learners' Satisfaction with Adaptive Learning Systems

Seo Hong Lim *, Lyndon Lim, and Rebekah Wei Ying Lim

Teaching & Learning Centre, Singapore University of Social Sciences, 463 Clementi Rd, Singapore 599494, Singapore
 lyndonlimjk@suss.edu.sg (L. Lim); rebekahlimwy@suss.edu.sg (R.W.Y. Lim)

* Correspondence: shlim@suss.edu.sg

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Abstract: To enhance diverse students' learning experiences, tertiary educational institutions are increasingly adopting adaptive technologies. Although there are views that adaptive learning platforms contribute to learning within higher education, efficacy research of such systems yields mixed results. This is an indication that more could be studied concerning how adaptive learning can be efficacious within higher education contexts particularly when cognate studies have mostly discussed how cognitive measures differ between learners who engaged and those who did not engage with an adaptive learning system. Beyond cognitive measures such as achievement scores provided by adaptive learning systems, this brief paper proposes that learner satisfaction towards such systems - as an imperative factor due to its direct and significant relationship between users and the system - needs to be examined, in part to evaluate the efficacy of adaptive learning systems. Given the complexity of learner satisfaction as a construct, such investigations have the potential to illuminate important factors of system optimizations, developments, and interventions that provide crucial guidelines for higher education institutions to implement successful adaptive learning courses that meet students' satisfaction.

Keywords: Adaptive learning, Learners' satisfaction, e-Learning, Higher education

1. Introduction

To enhance diverse students' learning, tertiary educational institutions have implemented various digital technologies to meet learners' needs. As such, adaptive learning platforms have been gaining popularity in higher education settings. Liu et al. (2017) pointed out that learners learn more effectively when instructional materials are individualized to meet their needs. Supporting this, Dziuban et al. (2016) suggested that the core elements of adaptiveness contribute to incremental learning, regular assessment, and the availability of many paths to a final destination. In this regard, adaptive learning platforms provide students the opportunity to navigate their learning trajectories at a self-determined pace within the scheduled course timeline (Dziuban et al., 2018). We concur and add that with adaptive learning systems, learners could take ownership of their learning experience (Yazon et al., 2002) and accelerate future learning (Walkington et al., 2013). In contrast to the viewpoints that adaptive learning contributes to learning, Booth et al. (2016) indicated that the efficacy of adaptive learning systems within higher education yielded mixed results. Essentially, it remains unclear as to how adaptive learning could be efficacious even though it has been implemented across different higher education contexts and various disciplines to influence student performance. For instance, to investigate the efficacy of adaptive learning systems, Murray and Perez (2015) compared students' scores and completion rates through two instructional methods (i.e., an adaptive learning approach and a conventional approach such as quizzes supplied by the textbook publisher). They found that neither the first nor the second method provided a definitive learning advantage to student learning outcomes. In conclusion, Murray and Perez (2015) stated that both instructional approaches did not vary significantly during the course of students' learning.

Contrarily, Arsovic and Stefanovic (2020) compared two groups of college students in studying the efficacy of an adaptive learning system. The first group comprised students who elected to use the adaptive learning system while the second group comprised students who chose not to use it. They found that students from the first group had significantly higher pass rates than the second group. To this end, the researchers concluded that the findings support the use of the adaptive learning system due to enhanced pass rates between users and non-users. Given these mixed results however, the need to further investigate adaptive learning systems and learning outcomes remains critical to provide useful information for instructors to identify students' knowledge gaps; and for institutions to continue investigating and refining adaptive learning systems that purportedly contribute to students' incremental learning.

2. Learner Satisfaction and e-Learning Systems

Although there are challenges and mixed findings concerning the efficacy of adaptive learning systems, learner satisfaction has been widely acknowledged as an indication of the success of e-learning systems (Ramayah & Lee, 2012; Salam, 2020; Xu & Du, 2019). Learner or user satisfaction has long been regarded as an imperative factor for evaluating the extent of success of an information or learning system because of its direct and significant relationship with overall system use (Delone & McLean, 2003; Forster et al., 2020; Ojo, 2017). Mardiana et al., (2015) and Tsai et al., (2012) postulated that user satisfaction is one of the most important factors when addressing the success of a learning system. Wixom and Todd (2005) further explained other essential factors when evaluating learning systems, for instance, user acceptance of any information system and user intention to adopt it (Naranjo et al., 2019) for a longer period. Importantly, Cidral et al. (2018) emphasized that to assess the long-term application of an information system, it is necessary to measure learner satisfaction. Briefly, learner satisfaction can be defined as a user's perception of a particular information system that can be useful and effective for achieving one's objectives (Delone & McLean, 2004). If learners are more satisfied with a particular system, their intention to continue using it will be proportionately enhanced (Salam, 2020). Subsequently, higher user satisfaction contributes to higher persistence, commitment to a program, and lower drop-out rates (Debourgh, 1999; Ali & Ahmad, 2011; Yukselturk & Yildirim, 2008). Due to the relationship between users and e-learning systems, learner satisfaction plays a significant role (Jung, 2014) concerning the quality of e-learning systems.

Naranjo et al. (2019) indicated that the success of an e-learning system can be measured by learners' satisfaction and intention to use it for a longer period. Thus, users' continued satisfaction can be used as an indication of the success of an e-learning system (Martins et al., 2018; Al-Samarraie et al., 2017). As such, to assess the long-term applications of information systems, it is crucial to measure learner satisfaction (Cidral et al., 2018). The understanding of learner satisfaction is essential in assisting relevant stakeholders in identifying system functionalities, performances, and capabilities to facilitate a productive learning experience for its users. More importantly, the understanding of learner satisfaction and system quality helps to elucidate multidimensional factors within e-learning such as technology support, pedagogical contents, instruction, feedback, and challenges of e-learning systems related to unsatisfying interactions (Abuhassna et al., 2020). Given that adaptive learning systems are considered e-learning systems, it is equally useful to study learner satisfaction, in addition to comparing cognitive measures, when studying the efficacy of adaptive learning systems.

3. Factors Related to Learners' Satisfaction

With the above in mind, to examine factors that are related to instructors' and students' e-learning continuance satisfaction, Al-Samarraie et al. (2017) analyzed data collected from nine instructors and thirty-eight students via an interview survey. They reported five core factors that impact e-learning continuance satisfaction: (1) information quality, (2) task-technology fit, (3) system quality, (4) utility value, and (5) usefulness. The first factor, information quality, refers to the relevance, consistency, and accuracy of the information system. Al-Samarraie et al. (2017) indicated that users' perception of a system's information quality might influence and affect their overall attitude regarding continuance satisfaction. The second factor, task-technology fit, points to the degree to which technology supports the users in performing the tasks. When users perceive that the system is capable of helping them, a positive attitude promotes continuance satisfaction. The third factor, system quality, can be explained by characteristics such as reliability, documentation quality, and user interface consistency. This factor influences user satisfaction and continued use of e-learning. The fourth factor, utility value, refers to the helpfulness of e-learning tasks for the users' current and future goals because it acts as a predictor of users' satisfaction. Finally, the fifth factor, usefulness, involves the use of an e-learning system for enhancing users' performance as it is driven by the factors described above. Thus, instructors' and students' perceived usefulness have positive impacts on system continuation.

To ensure learners continued satisfaction with an e-learning system including adaptive learning systems, higher educational institutions may consider enhancing current e-learning systems by incorporating the above factors that drive learners' satisfaction for long-term usage of educational technology, particularly following its initial development. Further to the five factors discussed, various researchers have reported multiple factors affecting learners' technological satisfaction. For instance, Piccoli et al. (2001) suggested factors such as technology control, reliability, and procedural, and Eom et al. (2006) pointed to factors such as self-directed learning opportunities, context customization, interactivity, and enjoyment. Eom et al. (2006) further suggested factors in the areas of course structure, feedback, self-motivation, and learning style. These different factors provide an understanding of why students may or may not be satisfied with technology implementations. Eventually, further developments, optimization, and interventions can be conducted to support system quality that impacts e-learning continuance satisfaction in learners. Table 1 presents a list of factors related to learner satisfaction, as they engaged with e-learning systems.

Table 1. Factors Related to Learners' Satisfaction.

Authors	Factors Related to Learners' Satisfaction
Abuhassna et al.. (2020)	Students' background, students' experience, students' interaction
Virtanen et al.. (2017)	Clearer instructions, more support from a teacher, possibility to plan own schedule
Rahman et al.. (2015)	Ease of use, perceived value, student-instructor interaction
Wu et al.. (2010)	Ease of use, system functionality, perceived value
Kirmizi (2014)	Educator's support, personal relevance, authentic learning
Sun et al.. (2008)	Usefulness, diverse assessment, ease of use
Arbaugh et al.. (2002)	Perceived flexibility, usefulness, interaction

4. Assessing Usefulness of e-Learning through Learner Satisfaction

To assess the quality of technology learning systems based on students' levels of satisfaction, Virtanen et al. (2017) conducted a comparative study with 61 students assigned to an experimental group and 54 to a control group. They reported that students in the experimental group were satisfied with the possibility of planning their schedules, time, and duration. Students in the experimental group were satisfied with the technological and pedagogical approaches but preferred more and clearer instructions from the teacher. The researchers concluded that the technology-based learning environment created a new opportunity to achieve high degrees of student satisfaction and provided real-time support for various types of learning. They further added that the developed material could be flexibly used in multiple universities and degree programs to support students' learning.

Similarly, the importance of satisfaction as one of the favorable outcomes when assessing the usefulness of technology learning systems has been noted in the following studies. Wu et al. (2010) collected 212 responses using a questionnaire. The results indicated that as students became more accustomed to the e-learning environments, they were more satisfied with the e-learning system. The results demonstrated that performance expectations contributed to learning satisfaction. Kuo et al. (2014) collected 221 online questionnaire responses from graduate and undergraduate students. They reported that learner-content interaction via e-learning had a strong impact on satisfaction, particularly for those students from the program of instructional technology and the learning sciences. To this, Kuo et al. (2014) explained that these two programs might have integrated more media into content design and hence, sensitizing students to important characteristics of learner content more so than other courses in the social sciences. Thus, students in the two programs may have appreciated various media tools more than students from other programs. However, it is worth noting that even though it is crucial to account for user satisfaction as an indication of the success of an e-learning system, research in the area of adaptive learning technologies for education has concentrated more on tailoring instruction to implement e-learning, rather than exploring how adaptive learning is related to learner satisfaction (Lim et al., 2022).

Moreover, to assess learner satisfaction with the use of an adaptive system, Lim et al. (2022) reviewed multiple published instruments that were developed with different subscales. For instance, Asoodar et al. (2016) reported findings based on the 132-item questionnaire. In it, learner satisfaction was operationalized as a construct with six sub-scales: learner dimension, instructor's dimension, course dimension, technology dimension, design dimension, and environmental dimension. In the same vein, Mtebe et al. (2018) proposed that learner satisfaction could be measured based on a 25-item questionnaire. They proposed five subscales: perceived usefulness, course quality, system quality, instructor quality, and service quality. In reviewing various instruments related to learning satisfaction, Lim et al. (2022) found that the instrument learner satisfaction questionnaire (LSQ) developed by Wang (2003) was suitable for use with an adaptive learning system, given its dimensions. The learner satisfaction instrument by Wang (2003) has 17 items across four sub-scales: learner interface, learning community, content, and personalization. In adapting and validating this questionnaire via confirmatory factor analysis, Lim et al. (2022) pointed out that the LSQ was represented by 14 items and could be deployed on a broad scale basis. Given the validation and findings, Lim et al. (2022) concluded that the LSQ-adapted yielded valid and reliable satisfaction scores both at the subscale and at the overall scale level. The scores informed further development and refinement of adaptive learning systems with the view of benefitting students' learning.

5. Conclusion and Future Work

Adaptive learning platforms aimed at meeting learners' needs have become one of the most prominent instructional systems used in tertiary e-learning environments. The pedagogical potential of adaptive systems supports learners to take ownership of their learning experience regardless of programs or educational contexts. Although research studies have suggested mixed results on the efficacy of adaptive systems (Lim et al., 2022), it has been widely recognized that user or learner satisfaction is an imperative factor when addressing the success of an e-learning system. Currently, the effects of adaptive systems on students' satisfaction have not

been widely studied, specifically, in higher education contexts. Future research in understanding the factors of learners' satisfaction in an adaptive environment is necessary to examine the relationships among the determinants that influence learning satisfaction in adaptive courses. The identified core factors that impact e-learning continuance and satisfaction allow for an appreciation of why students may or may not be satisfied with implementations, and why they may not ascribe to it. Beyond learner satisfaction, other factors also may impact the implementation of adaptive learning systems. For example, motivation is another important factor due to its relation to learning and teaching contexts (Ryan & Deci, 2000). Collectively, these factors bring new understanding in areas of design and development for both adaptive technology and course curriculums. Building on core factors identified by prior studies, further research may illuminate critical factors of system optimization, developments, and interventions that provide crucial guidelines for higher education institutions to implement successful e-learning courses that meet learners' satisfaction.

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