Adaptive Learning Framework in UAE Public Schools

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Educational systems are under intense pressure from the technological revolution, which demands graduates who can use new technologies to tackle critical societal issues in innovative and crucial ways. The Adaptive Learning Framework (Alef) is a smart learning program that is mandated in United Arab Emirates (UAE) public schools to promote student-centered, interactive, and differentiated learning and personalized experiences.

e-learning   Adaptive Learning Framework (Alef)   artificial intelligence   personalized learning

1. Introduction

Educational systems are facing new challenges as a result of the Fourth Industrial Revolution (4IR, IR 4.0) (Yuhastina et al. 2020; Koizumi 2019). A considerable technological upheaval has been brought about by the 4IR, including the introduction of AI, the Internet of Things (IoT), cloud computing, digital games, etc. (Ahmad et al. 2022; Liu and Stephen 2019). Educational systems are under intense pressure from the technological revolution, which demands graduates who can use new technologies to tackle critical societal issues in innovative and crucial ways (Alhamuddin et al. 2022). Educational systems are now being challenged to prepare students for jobs that do not yet exist, technologies that have not been invented, and problems that have not been encountered (World Economic Forum 2018). One way to overcome this challenge is through the integration of 4IR technologies into teaching and learning. Technology-based pedagogical practices should be implemented in schools to promote students' motivation and independence and provide tailored and convenient access to information (Khurma et al. 2023; Ally and Wark 2020).

Artificial intelligence (AI) is one technology that has been rapidly advanced by the 4IR. The term "artificial intelligence", coined by McCarthy in 1956, is associated with the science and engineering of making intelligent machines. The study of AI was founded on the premise that the central property of human intelligence can be mimicked and simulated by a machine (Lu 2019; Luxton 2016). According to Ilkka (2018), although AI has been around for several decades, the recent industrial revolution has accelerated the urgent need for the implementation of AI in many fields, including education. He postulates that AI and machine learning will have implications for workforce preparation and teaching and learning practices (Koizumi 2019; Lee et al. 2018). With the rise of AI, education systems around the world face two challenges: exploiting AI to improve the educational process and preparing students with new skills for increasingly automated economies and societies (Vincent-Lancrin and van der Vlies 2020).

Recognizing the above challenges and the importance of artificial intelligence in our future society, the UAE government and its leaders announced an AI strategy in October 2017. This strategy was created to help achieve Centennial 2071 objectives by enhancing the performance of many governmental sectors and investing in AI and aimed to develop AI applications in many areas, including education. The objectives of the AI strategy are to build the UAE's reputation as an AI destination, attract and train talents for future jobs enabled by AI, provide world-leading research capabilities to work with industries, and up-skill and re-skill talents (UAE Centennial 2071 2018; UAE Government Leaders Programme 2018; UAE 2031 2018; Halaweh 2018). In response, the UAE Ministry of Education (MoE) implemented a program called the Adaptive Learning Framework (Alef) in its public high schools. AI is at the heart of Alef, an interactive shareware program that tailors the content provided to each student based on their individual needs, input, and identified strengths and weaknesses. The Alef program is available for all core subjects and is aligned with the MoE curriculum. It provides students with immediate feedback and gives educators and parents access to analytical data and information (Alkhalisi 2019; Alyammahi 2019).

2. Adaptive Learning Framework (Alef) in UAE Public Schools

The UAE's Ministry of Education introduced Alef to all public high schools to fulfill the national agenda of the UAE and provide its educational system with the most recent innovations in digital education, such as artificial intelligence and big data (Al Arood and Aljallad 2020). This will help the UAE further its national aim of creating a world-class educational system with the highest possible standards. Alef supports the pedagogical integration of technology into teaching and learning, as it is one of the most significant axes of change in the educational process and one of the most prominent pillars of a twenty-first-century human renaissance. By implementing Alef, teachers and parents are able to evaluate students' performance, subject comprehension, and time spent on each session in real-time, which enables them to identify each student's strengths and weaknesses through the intelligent framework used to construct Alef (Abdallah 2018; Media and News 2020).

The intelligent framework of Alef is comparable to the framework proposed by Faisal et al. (2015). Their model blends crowdsourcing into the creation and presentation of instructional materials, thereby enabling intelligent e-learning systems to provide a meaningful, individualized, and pedagogically sound learning experience. The framework comprises learner, course, teacher, and recommender systems. The learner model is created and kept in a database with comprehensive information about the learner's profile and learning preferences. The framework gives crowdsourcing feedback indicating whether or not students have mastered the subject matter. This feedback is utilized to monitor each student's strengths and weaknesses and improve their preparation for the next lesson. The course model incorporates course prerequisites, goals, topics, and course materials. Except for course materials, the repository stores all information while the recommender system dynamically modifies it. The teacher model consists of an expert system modified via crowdsourcing and a knowledge base that incorporates the knowledge and experiences of many teachers in the same field. The recommender system suggests pedagogically sound content and methods for learning. The resulting recommendations improve the learner profile, the learning

environment, and the learner's preferences. The role of learning management systems in managing student learning and providing feedback was also confirmed by Adzharuddin and Ling (2013).

The aforementioned framework gives Alef a number of advantages. One of these advantages is the adoption of a student-centered teaching approach and the empowerment of teachers to encourage independent learning and boost students' engagement (Chiu and Chai 2020). According to Clark and Kaw (2020), students using adaptive learning software are exposed to a variety of learning formats (such as videos, text, graphics, or simulations), assessments, and immediate feedback as they move along a personalized learning path. This path may be one where mastery is being demonstrated or one where remediation is being offered. Similarly, Serrano et al. (2019) confirmed the effective role of technology-based learning platforms in enhancing student engagement and improving learning outcomes. The ability of Alef to encourage differentiation in learning, as well as independent learning, is another advantage of using the program. Because of the instant feedback they receive about their students' progress, teachers can focus their efforts on differentiating learning to different groups of students (Eaton et al. 2018). Most of these advantages were evident in Alyammahi's (2019) study, which was implemented in one public school in the UAE. The results of the study demonstrated that the use of Alef increased students' interest in and engagement with core subjects. All of the students who participated in the study reported that using Alef motivated them to learn and made learning enjoyable. The Alef program also helped students become more self-reliant and confident in their academic abilities. Additionally, it assisted the students in grasping key concepts, which, in turn, boosted their academic achievement. The findings of a study by Alhosani (2019) confirmed that Alef provided teachers with live data that enabled them to distinguish between students who were having difficulty and those who were performing well, thereby supporting them. Alahmari and Kyei-Blankson (2016) also confirmed the role of an e-learning system in promoting teacher collaboration with students and parents for enhanced learning outcomes. In addition, other findings demonstrated that students' engagement and motivation to learn increased as a result of using this individualized learning system, which offered students engaging digital instructional content (De Oliveira et al. 2019).

The opportunity provided by Alef to follow students' progress is not limited only to the students and their teachers. Alef provides parents with an application that allows them to participate in their children's learning journey (Alhosani 2019). Multiple studies have found that when parents are involved in their children's education, their academic performance improves. One of the most positive outcomes of parents' engagement is the promotion of self-regulatory skills (Jeynes 2012). Parental engagement refers to the engagement of parents in activities that advance the education and learning of their children in order to increase their academic and social well-being (Novianti and Garzia 2020; Fan and Williams 2010; Lui et al. 2020). In addition to achievement and academic performance, parents' engagement in the education and learning of their children is associated with improved self-regulation, stronger study habits, and more positive attitudes toward learning (Xu and Wu 2013; Obradović et al. 2021). The use of interactive technologies with accessible resources can help in developing the engagement of parents in their children's learning (Jayawardena et al. 2020; Ewin et al. 2021). This enables data-driven educational interactions between teachers, students, and parents (Starčič and Vukan 2019).

Alef offers an entirely new communication framework between students, teachers, parents, and technology. According to Kent et al. (2022), this framework establishes a collaboration paradigm between parents and teachers. Alef provides teachers with monitoring tools that enable them to "concoct" and track the progress of individual students (Bieliková et al. 2014). There are two potential benefits for the teacher: (a) they can allocate their valuable time to providing one-on-one assistance where it is most needed, and (b) they can be provided with a summary of common difficulties on a topic that may require a whole-class intervention while also identifying individual difficulties (Alnusairat 2022). The purpose of detecting and showing this type of information is to enhance students' self-regulated learning skills. The program offers parents the same chances as teachers to contribute to the progress of their children. Discussions between children and their parents regarding their progress empower both sides since everyone can genuinely share their own experiences.

In Alef's performance screen, parents are able to monitor their children's progress in every lesson in each subject as well as the number of lessons and the details about each lesson. In addition, a message assessing the student's level is displayed. The report screen allows parents to view a weekly report of their child's performance. It also shows the topics that the child excelled in during the week, the topics that need development, and the activities that the child must perform to develop certain skills (Home Alef Education 2021; Pawlak 2019). Parents receive immediate real-time feedback about their child's progress. In addition, parents are informed about their children's learning gaps, which will enable parents to provide them with the appropriate support (Alkhalisi 2019).

Despite all the advantages that Alef provides for students' learning, Abujaja and Abukari (2019) identified two major challenges associated with Alef. First, some teachers rely excessively on Alef to deliver their lessons, which limits students' opportunities to engage in real-world and hands-on activities and experiences. Second, in some Alef lessons, students can bypass the video explanation and go straight to the assessment, where the students choose random answers to determine the correct answer. Then, the students go through a second attempt to choose the correct answer. If this happens, the data presented to the teachers about their students' learning would mislead the teachers and make it harder for them to make the right decisions related to their students' learning. Alyammahi (2019) identified the need for cultural transformation and change management to enhance teachers and students' adaptation to the system since teachers and students reported they found it overwhelming to adapt to the new system and identified it as a major challenge. Similarly, Bieliková et al. (2014) noted that various types of learning objects (explanations, exercises, questions) are not effectively distinguished in the platform, affecting the recommendations for outside material made by the system. Thus, a high volume of recommendations for outside material is presented, increasing the load on students for learning. Although independent learning has been praised in the literature, Mirata and Bergamin (2019) noted that adaptive learning frameworks put more of a burden on students by making them solve questions on their own, which might be difficult for them. The monotonous and fixed interface of the learning software was also found to be a key challenge in managing the software, as revealed by Gee (2022) and Kumar et al. (2020). Alahmari and Kyei-Blankson (2016) also identified some challenges related to e-learning systems, including teacher development and training and internet access.

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