Introducing Smart Learning Framework in the Digital World: Towards the Enhancement of Technology-Driven Innovation of Arabic Smart Learning

Eman H. Alkhammash[1]
eman.kms@tu.edu.sa
Department of Computer Science, College of Computers and Information Technology,
Taif University, P.O.Box 11099, Taif 21944, Saudi Arabia;

Abstract
Smart learning is augmented with digital, context-aware, and adaptable technologies to encourage students to learn better and faster. To ensure that digital learning is successful and that implementation is efficient, it is critical that the dimensions of digital learning are arranged correctly and that interactions between the various elements are merged in an efficient and optimal manner. This paper builds and discusses a basic framework for smart learning in the digital age, aimed to improve students' abilities and performance in learning. The proposed framework consists of five dimensions: Teacher, Technology, Learner, Digital content, and Evaluation. The Teacher and Learner dimensions operate on two levels: (a) an abstract level to fit in knowledge and skills or interpersonal characteristics and (b) a concrete level in the form of digital devices used by teachers and learners. Moreover, this paper proposes asynchronous online course delivery model. An Arabic smart learning platform has been developed, based on these smart learning core dimensions and the asynchronous online course delivery model, because despite the official status of this language in many countries, there is a lack of Arabic platforms to teach Arabic. Moreover, many non-native Arabic speakers around the world have expressed an interest in learning it. The Arabic digital platform consists of over 70 lessons classified into three competence levels: beginner, intermediate, and advanced, delivered by Arabic experts and Arabic linguists from various Arab countries. The five dimensions are described for the Arabic platform in this paper. Learner dimension is the Arabic and non-Arabic speakers, Teacher dimension is Arabic experts and Arabic linguistics, Technology dimension consists of technology for Arabic platform that includes web design, cloud computing, big data, etc. The digital contents dimension consists of web-based video, records, etc. The evaluation dimension consists of Teachers rating, comments, and surveys.

Keywords
Arabic digital; smart learning; smart learning framework; digital learning

I. INTRODUCTION (*Heading 1*)

The rapid advancement of technology has paved the way for the creation of context-aware ubiquitous learning environments that can detect students' real-world learning status and provide information to individual students at the right time and in the right place. Zhu et al. [1] have emphasized the crucial role of technologies to support learning and provide effective learning environments.

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As COVID-19 has affected many aspects of life including education, schools and universities around the world have adopted various e-learning platforms [2]. Woods and colleagues argue that the disruption and uncertainty caused by the pandemic have to some extent been alleviated by the use of digital learning platforms, which have been extremely beneficial and successful [3]. Furthermore, the changes induced by COVID-19 are a reminder that the world must prepare for the future of digital education [4]. One such response is the pioneering Madrasati platform, developed in Saudi Arabia during the pandemic to deliver online lessons to students at home. Madrasati has also continued to function after students returned to normal schooling.

However, technology alone is not sufficient to ensure smart learning; various elements should be considered when creating and implementing real-world learning systems. A learning environment can be smart regardless of the types of technology adopted, if it has the right components. Conversely, advanced technologies may not deliver smart learning if other components are poorly constructed. Therefore, the configuration of components of smart learning and their interactions is crucial to obtaining a smart learning environment [5].

This paper explores the essential principles of the development of smart learning systems and proposes a framework for Arabic language smart learning and a corresponding smart education platform. Arabic was chosen because it is the world's fifth most widely spoken language, yet has received little attention for its use of innovative technology in the digital realm. The paper is organized as follows. Section 2 is a literature review of relevant studies in smart digital learning and Arabic digital learning, then the methodology section outlines the smart learning framework and the next details the proposed smart Arabic language platform. The paper concludes with a brief summary and suggestions for future work.

II. LITERATURE REVIEW

A. Smart digital learning

It is important to distinguish among the concepts of electronic (e-learning), mobile (m-learning), and digital learning (d-learning) [6], although they have many characteristics in common. D-learning can combine both m-learning and e-learning. Learning materials in all three types are electronic, whether in the form of texts, images, or videos. The main users of all forms are learners and teachers. D-, e-, and m-learning all require appropriate infrastructure for their deployment in the education environment [6].

Among the main distinguishing characteristics of d-learning are that it offers learning at any time and can be accessed by people in different locations, while m-learning has no geographic boundaries and e-learning is used in private locations. Time and location are independent in d-learning, whereas e-learning will require users to access a site with internet connectivity and m-learning may also involve travel to ensure reliable a wireless internet connection. Moreover, d-learning is more flexible and accessible remotely, m-learning offers synchronous or asynchronous learning, and e-learning may involve lectures in a classroom or internet lab and is synchronous [6].

Spector [7] identifies three foundation areas of smart learning environments, namely epistemology, psychology and technology, then classifies characteristics of such environments as either necessary (efficiency, effectiveness, scalability), highly desirable (being flexible, engaging, adaptive, personalized), or likely to occur (being conversational, reflective, innovative). Another three-way classification is of smart education as comprising three layers: smart learning application, smart computing, and smart campus [8]. The smart learning application layer has a number of components such as a smart classroom, smart monitoring, and smart analytics; the smart computing layer includes the use of technological tools; and the smart campus layer facilitates learning, teaching, research, and decision making. Alternatively, the three core elements of the smart education paradigm can be defined as teacher, learner, and technology [1]. Teacher roles involve designing learning, interacting with students, and giving feedback. The learner can be autonomous or collaborative and must be able to use the technology appropriately. A final classification is that of Ozdamli and Cavus, for whom the basic elements of mobile learning are learner, teacher, environment, content, and assessment. They further identify the core characteristic of mobile learning as being ubiquitous, with portable mobile tools, blended, collaborative, interactive, private, and providing instant information [9].

B. Arabic digital learning

A framework for developing websites to support non-Arabic speakers in overcoming the challenges they confront when learning Arabic, proposed by Al-Jahwari and Abusham [10], comprises student learning, learning activities, and scientific standards. This theoretical framework is intended to help learners improve their abilities, while motivating educational website designers to create websites founded on scientific standards and covering the essential Arabic language skills equally for all levels. An earlier paper by Al-Youbi lists criteria for designing educational websites to teach Arabic to non-native speakers: subject, objectives, content, feedback, usage, interface, interaction, control, navigation, tasks, tools, and management [11]. The paper reports the finding of numerous shortcomings in educational websites in terms of design, content, flexibility, interaction, and skills, because designers fail to consider the appropriate educational curriculum for teaching Arabic language skills. Furthermore, many supposedly educational websites were assessed as not being established on an educational foundation, the majority having been developed with low quality and unsatisfactory outcomes [11].

An alternative set of criteria for educational websites comprises navigation, architecture, ease of use, design, and content, according to a survey of nine Jordanian educational websites selected and evaluated by students [12]. The survey found that the majority of students were satisfied with the use of Jordanian university websites, particularly with the content and navigation standards of the sites assessed. Petra University had the highest score, while Al al-Bayt University received the lowest grade.

Al-Omar [13] investigated several characteristics of websites offering distance education courses, belonging to twelve universities in Saudi Arabia considered, eleven being government-affiliated and the other private. Analysis of data on the degree of usability of remote education websites found the selected websites to be dependable, despite breaking basic usability principles. The authors conclude that Saudi e-learning websites should emphasize the usability of their home page search engines, offer more advanced search capability, and provide sitemaps covering every webpage.

The Madrasati platform mentioned in the introduction above was studied to assess its effectiveness, usefulness, and acceptance from the perspective of 200 randomly chosen Saudi Arabian instructors, who completed a quantitative questionnaire [14]. The results show that instructors were quite happy with the new platform's usability, considering it well-designed technically, highly useful in the classroom, and with a positive impact on the quality of education. Importantly, the quality of the information material on the platform was significant in engendering favorable attitudes among instructors. The Ministry of Education and institutions attempting to integrate technology into their teaching and learning processes might benefit from the findings of this study, which by contributing to a more efficient utilization of Madrasati's extensive features has the potential to advance the development of pedagogy in Saudi Arabia [14].

III. METHODOLOGY

This section describes the five main dimension of a smart digital learning framework, as shown in Figure 1: Teacher, Technology, Learner, Digital contents, and Evaluation. Following that we describe stages of developing self-directed asynchronous online course delivery model.

A. *Main dimension of smart learning framework*

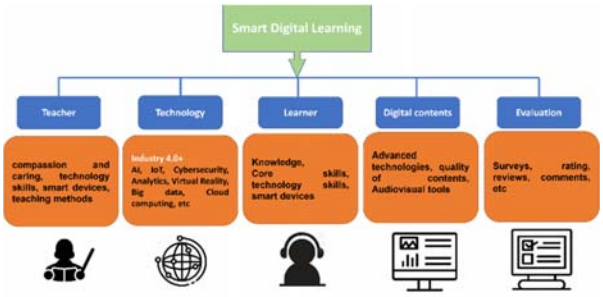

Figure 1. Components of smart digital learning.

The Teacher and Learner dimensions operate on two levels: abstract and concrete. The abstract level concerns the knowledge, skills, and interpersonal characteristics of teachers and learners, whereas the concrete level is the form of the digital devices that they use. The teacher needs to have compassion and care about students to help them achieve their goals. Teachers in the digital era should be able to use various technologies and teaching methods in multiple forms of learning: distance (online), personalized (student-centered, addressing distinct learning needs), and blended (hybrid learning, with online and face-to-face instruction), as well as game-based learning etc. These teaching methods are considered skills that instructors can use to improve the quality of education and are therefore placed at the abstract level of the framework. As to students, they must have a commitment to digital learning which allows them to follow the teacher and complete assignments. They should also be able to communicate and work with others and to use the technology while meeting the minimum requirements for the course. Each of the five dimensions of the framework is now examined in turn.

i. Learner

Placing the learner at the heart of smart education, Zhu and colleagues identify the main objective as providing students with abilities at four levels: knowledge and core skills, personalized experience, comprehensive abilities, and collective intelligence [15]. Another study emphasizes the need to develop smarter learners with the knowledge and skills to adapt to technological change, to be ready for the workplaces, and to live and work in the digital world [9]. Learners' roles involve the ability to access information, use learning styles, study collaboratively, and create, evaluate, and share new information [9].

ii. Teacher

According to Ghaln, before television, instructors served primarily as domain experts who presented information to students [9]. As media technology evolved, the job of the typical teacher shifted from that of an expert to that of a presenter of others' expertise. Many things have altered again as a result of Web 2.0 and social networks. Teachers must change roles and responsibilities again, from presenters of expert knowledge to moderators. Now, as learners' roles and responsibilities also develop alongside mobile technologies, the teacher's function is gradually transforming further, to that of a consultant. Teachers in this capacity must be able to recognize students' interests, connect these to topic-related learning goals, and enable students to achieve these goals in relation to the specific circumstances in which they are learning [9].

iii. Technology

As is clear from the discussion above, technology plays a crucial role in smart learning environments, which should have the following characteristics: mobility, context-awareness, flexibility, seamless connection, ubiquitous pervasiveness, integrity, interactivity, interoperability, and high engagement [16-19]. Mobile phones, laptops, and other mobile devices must be accommodated in the learning environment. M-learning using handheld devices has eliminated geographical borders, allowing for co-operative learning settings with individual and group engagement in education [9]. This has been omitted from Figure 1 on the basis that smart devices are already widely used in households. Almost everyone has a smartphone, of which there are now more than six billion, with several hundred million more expected in the coming years [20].

Digital technology is a broad concept and in order to specify the exact technologies needed for the digital learning framework, it is worth considering those covered by the term 'industry 4.0', such as big data, cloud computing, the internet of things, cybersecurity, virtual reality, etc. All such advanced technologies have the potential to revolutionize digital learning. While industry 4.0 denotes the tendency for manufacturing operations to rely increasingly on automation and data exchange and while its implementation in education is challenging, it is important to strive to improve digital learning by benefiting from the recent industrial revolution. Specifically, in the technology dimension, it is proposed to integrate some of the relevant technology of industry 4.0 into the digital learning framework and the design of platforms to achieve smart and advanced digital learning.

In the context of the technology dimension, recent work by Demir provides a framework with a layered structure [21]. At the core are new or improved teaching methods, while others involve essential/transforming technologies (learning management systems, smart/ambient intelligent classrooms, and virtual classrooms), various enriching technologies (according to the education and training goals), and supportive technologies such as Web 2.0+ which support the technologies of other layers.

This paper takes it as essential to improve the technology used in education, especially because technology is always improving and the world is becoming more linked. We are on the verge of entering the metaverse, where d-learning may undergo significant changes. Here are some examples of how the metaverse could be used in education [22].

Gamification allows users to interact with a virtual area and become immersed in a game.

Learning resources are upgraded by utilizing diverse technologies such as 3D visualization.

The metaverse provides greater contact between students and teachers regardless of their geographical locations.

Notwithstanding these benefits, there are several drawbacks and concerns regarding the metaverse, including the high cost of technology (e.g. virtual reality glasses and headsets) that every student in the class would need. Some activities in the virtual world, such as headset movements, can cause sickness in users, especially children. In the metaverse, accessibility is also a barrier and designing material for the virtual world will be difficult.

iv. Digital content

Digital content design necessitates technological expertise and the resulting content must be of high quality. To generate optimal digital content, collaboration between designers, teachers, and experts in the course area is critical. All stakeholders, including students, instructors, and parents, should be consulted when deciding on content; otherwise, teachers will not be able to achieve the intended outcomes. Users must be able to swiftly locate the information they need when using learning content. One suggestion for engaging learners with the content is to use interactive games or quizzes [10].

v. Evaluation

The evaluation of digital learning involves consideration of numerous factors. An empirical study of the interest of students and teachers in digital learning platforms has identified a variety of characteristics of digital teaching and learning, including the accessibility and availability of materials, knowledge sharing, information exchange, and rapidity of searching for specific content [23]. The study also identifies usability, reliability, content availability, content quality, lesson activities, learner interaction, and evaluation and feedback as features of digital learning and teaching technology. According to the findings, there is no one-size-fits-all design for a successful digital learning platform; each must be built individually depending on the backgrounds, needs, and behaviors of the participants.

Because there are various platforms for digital learning, it is critical to analyze and evaluate these platforms in order to enhance their performance as required. The content quality, platform usability, and user feedback should all be considered during the evaluation. Al-Fraihat and colleagues identify six requirements for a successful platform, namely student quality, teacher quality, technical system, platform services, information, education system, and support [24], while an earlier paper highlights student satisfaction as a critical aspect of the effectiveness of digital learning [25]. Another crucial issue is students' ability to learn for themselves how to use the platform. They can benefit from training in order to improve their abilities and to overcome any apprehensions about using digital learning.

Three primary criteria were evaluated in a recent study in Poland [26]: course quality, e-learning experiences, and self-evaluation of digital literacy. The study identifies content quality as the most essential criterion in response to a lack of platform experience or inadequate e-learning instruction: a third of those surveyed were digitally literate and reported positive experiences with e-learning, while the other two-thirds required additional training.

Table 1 summarizes this section by listing the essential teaching and learning characteristics mentioned in the above papers, as well as the key characteristics of the technologies employed.

TABLE I. CHARACTERISTICS OF TECHNOLOGY AND OF TEACHING AND LEARNING

Technology	**Teaching and learning**
Usability	Content quality
Knowledge availability	D-learning training
Reliability	Feedback
Accessibility	Activities
Evaluation options	Exchange of content
Allows interaction	Personalized learning
Fast search	

B. Self-directed asynchronous online course delivery model.

Asynchronous learning is a kind of learning where students can complete courses and assignments at their homes. In this model, students engage in lessons, share feedback, and complete assignments according to their schedule. In this paper, we introduced phases of the self-directed asynchronous online course delivery model.

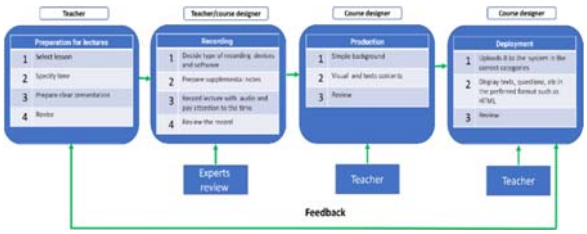

Figure 2. Self-directed asynchronous online course delivery model

As illustrated in Figure 2, Asynchronous online course delivery consists of four major components. The first component is lecture preparation, the second component is recoding, and the third component is production. Finally, the fourth component is deployment.

The teacher's role begins with lesson planning and preparation in accordance with the time slot allotted for the lesson. Following this stage, the recording stage begins, during which the lecture is recorded using specific recoding devices and software. The recording should be completed in time for the lecture. This step can be completed by either the teacher or the course designer. Experts may be called in to validate the lecture. Especially in the Arabic domain, where expert involvement is required to verify content delivery, spelling, and so on.

Production begins in the third phase, when the course designer creates video and integrates audio created in the second phase with video that has a simple and informative background with visual and text contents. A teacher may be involved in this step to ensure that the content is created appropriately. In the fourth stage, the lessons are uploaded online in the right location where lectures should be clearly classified to allow students to easily access courses. Text information, in addition to video, can be added to students at this point.

Students can ask questions, view the contents of each lesson, and read to other students' discussions. Teachers also respond to students' questions. Furthermore, student reviews serve as a form of input for future course improvements.

IV. SMART ARABIC DIGITAL PLATFORM

Arabic is the world's fifth most widely spoken language, the learning and teaching of which has the potential to benefit greatly from the application of new technology in the digital realm. This section presents a platform for smart Arabic language learning, comprising a website and mobile application for Android and iOS that offers three primary services to both Arabic and non-Arabic speakers based on self-directed asynchronous online delivery model.

The first service entails professors and Arabic language experts providing Arabic language classes in a video format accompanied with textual materials. The duration of the videos was based on research which found that the perfect length to hold learners' attention was no more than six minutes. The use of accompanying text aids in understanding the instructional plans and topics discussed, as well as managing the audio. As a result, the skills acquired differ. The way the courses are delivered by the Arabic language experts builds listening skills, the written material develops analytical and critical reading and writing abilities, and hearing the voice develops listening skills. The second service is the provision of linguistic text editing. It allows for the submission of requests for editing in several areas of the Arabic language, which are then edited linguistically and corrected by specialists. The third feature is a live video chat with language specialists and professors who can answer questions and provide individualized lessons.

The goals of the platform are to maximize the advantages of contemporary communication and information technology advancements in digital learning, to enhance Arabic content in digital media by fostering constructive communication, and to make colleges more active in the acquisition of modern digital skills. The following are the primary components of the smart Arabic platform in terms of the framework shown in Figure 1.

Learners: The platform offers lessons to a variety of students, divided into numerous categories to help students find the one that is right for them. Non-Arabic speakers who want to master the foundations of Arabic can access the lectures, while native Arabic speakers can pursue their interest in particular aspects of the language. The platform also allows students on BSc and MSc programs to take advanced Arabic lessons. Each learner can create a profile and register on the platform. There is a website dedicated to students.

Teachers: Teachers are Arabic language experts. There are currently 60 teachers from various Arab countries, including Saudi Arabia, Palestine, Jordan, Egypt, and the United Arab Emirates, each of whom specializes in a specific area of Arabic and teaches in that area. There is a website dedicated to teachers.

Digital content and technology: The platform's content is made up of short videos and texts. The Arabic content consists of over 70 lessons of six minutes maximum duration, a format making it more likely that learners will absorb the contents. Deaf persons can read the contents of each course thanks to the texts. The use of mixed audiovisual tools including video, audio, radio, and images is widely regarded as the most effective way of developing Arabic language skills (reading, writing, listening, and speaking) and accelerating language acquisition [10]. The corresponding activities of listening, speaking, reading, and writing are essentially interrelated; they complement each other and provide reciprocal support, implying that any activity done will contribute to the total development of other skills and relate to each other. Furthermore, any of the four language skills is rarely used alone, implying that when people communicate or converse with someone, they are listening as well as speaking in order to respond and react appropriately [27, 28].

Audiovisual materials are extensively used to teach listening skills and their use has expanded dramatically; even modern English language teachers are properly trained and educated to successfully incorporate audiovisual aids in their teaching [29]. Visual aids bring excitement, interest, and enjoyment to presentations and allow learners to employ more than one sense at the same time by facilitating

communication, talking, speaking, presentation skills, and active viewing [30-31].

The content of the platform is accessible via a website and a mobile app, allowing learners to follow the lessons at any time, on a smartphone, iPad or other mobile device. The materials are organized into numerous categories to help people find the most relevant topic. The content is presented at three competence levels: beginner, intermediate, and advanced, each subdivided into distinct themes and lessons based on learners' abilities and knowledge. Importantly, the website is available in both Arabic and English, allowing non-Arabic speakers to be directed easily to the most appropriate Arabic course. The English version of the site has translations of all of its tabs to allow non-native speakers rapid access to Arabic content that suits them. Finally, there is the intention to develop the platform using artificial intelligence methodologies.

Evaluation: Students can rate the content of each lesson and offer comments and questions. Teachers can also be rated by the students. These evaluation approaches are intended to improve the content of the platform and student outcomes. There is also a content evaluation team that works to examine the content supplied by the experts and to ensure that no errors, spills, or other issues occur.

TABLE II. CHARACTERISTICS OF THE PROPOSED PLATFORM

Dimension	Description
Learner	Arabic speakers Non-Arabic speakers
Teacher	Experts and linguists
Technology	Cloud computing, AI, Website, mobile app, videoconferencing, mobile learning, blended learning
Digital content	Web-based video
Evaluation	Teacher rating, comments, surveys

V. CONCLUSION

This paper proposes a framework for smart digital learning of the Arabic language and asynchronous online course delivery model which can help learners to improve their abilities and motivate educational developers to create platforms that are robustly founded on the core dimensions of smart learning and cover the essential skills at all levels of competence. The five dimensions of the framework are Teacher, Technology, Learner, Digital content, and Evaluation. The Teacher and Learner dimensions operate on two levels: the abstract level, involving knowledge and skills or interpersonal characteristics, and the concrete level, which involves the use of smart devices to achieve digital learning.

Ongoing advances in technology that may aid in the development of smart learning environments, as well as smart learning features and criteria, have been discussed in relation to a smart digital platform for the learning of Arabic that includes over 70 lessons, classified according to students' competence levels and delivered by Arabic experts and linguists from several Arab countries. Although the platform as described is specifically designed for use by Arabic language learners, the framework can be applied to smart digital learning in general, as its dimensions are generic and relevant to other domains.

Future studies should place a greater emphasis on smart learning platforms and features, as the use of digital learning is likely to grow over time. Scholars should be encouraged to perform more research in this field, particularly in Arabic education.

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