

# The Application of Artificial Intelligence in Ubiquitous Learning

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**Abstract:** The artificial intelligence has now facilitated the development of ubiquitous learning. The application of artificial intelligence in ubiquitous learning could help teachers and learners make judgement and reduce redundant information, provide direct services, enhance learning efficiency and highlight individual differences. Also, in the future, the teaching and learning elements, such as teachers, learners, teaching content, teaching environment and teaching media would have corresponding changes.

## 1. Introduction

In the smart era, there are a large number of new techniques appeared, such as Internet of Things, Big Data, 5G, Wireless Sensor Networks, Block Chain, Artificial Intelligence. These could all bring changes to our education. The essence of ubiquitous learning is to realize the 5A learning (Anyone, Anytime, Anywhere, Any device, Anyway) [1]. Therefore, among these techniques, artificial intelligence is one of the vital tools to cater for ubiquitous learning.

## 2. The Developmental Problems of Ubiquitous Learning

In 1998, Mark Weiser published "The future of ubiquitous computing on campus" in Communications of the ACM. Up to now, mainframe era [2], personal computing era and ubiquitous computing era are three waves of computing revolution.<sup>1</sup> The ubiquitous computing makes the computers more persuasive, convenient and less expensive, and therefore the information is much more accessible by wireless communication.<sup>2</sup> Basing on the technique of ubiquitous computer, ubiquitous learning is "everyday learning environment that is supported by mobile and embedded computers and wireless networks in our everyday life" <sup>2</sup> Ubiquitous learning could be apt to learner's need [3], preferences, cognitive characteristics, interests by using both virtue and electronic resources in learner's own context or environment. <sup>2</sup>

However, ubiquitous learning does have some drawbacks. First, although ubiquitous learning provides the learners with massive amount of information, the quality of information could not all be guaranteed. It is a fact that learners indeed obtain much information, but sometimes the information is in the form of fragmented pieces, because learner could make use of fragmented time to absorb information. Therefore, the knowledge presented on the internet could also be fragmented, and this is at the price of systematic knowledge and reflection of knowledge itself. Second, the ubiquitous learning has been implemented by a lot of schools or organizations. When they design the corresponding programs, they just simply consider the use of smart disciplines, current situation and teaching and learning factors, such as teachers, learners, teaching content, etc [4]. For the ubiquitous learning, most of the researches and teaching concentrate on the techniques to realize it, not knowledge itself. However, techniques invented is to serve the teaching and learning, so the status quo could not meet the original purpose of education. Third, the ubiquitous learning now highlights on the resources the internet provides with and ignores the role of teacher and curriculum. In fact, the teachers' guidance and in-depth communication between teachers and learners are still essential factors to deep learning. Fourth, ubiquitous learning is also confined by the internet, such as network flow, the availability and universality of the internet, the internet speed, its safety, etc [5]. Moreover, the researches of ubiquitous learning focus on the learning mode, the establishment of

repository, and realizing techniques. Therefore, the influencing factors such human being and society have not receive enough attention [6].

### **3. The Application of Artificial Intelligence in the Ubiquitous learning**

The advent of Artificial Intelligence brings new opportunities to ubiquitous learning [7]. In 1956, the term Artificial Intelligence (AI) was coined at the Dartmouth Artificial Intelligence Conference raised by John McCarthy, and Artificial Intelligence means to endow machines with human beings' thinking. Artificial intelligence could be applied in many areas, such as medicine, computer science, agriculture, medical treatment, electronic business, etc. Also, it could be implemented in the educational field, which is called as Artificial Intelligence in Education (AIED). As for the ubiquitous learning, it has the characteristic of permanency, accessibility, contextuality, interactivity, individuality and Immediacy.<sup>3</sup> The artificial intelligence could improve the efficiency and effectiveness of ubiquitous learning [8].

#### **3.1. Making judgement and reducing redundant information**

Ubiquitous learning makes learner easily obtain huge deal of information. It is impossible for learners to make judgement upon all the information which is needed, so intelligence could make judgements or decisions just like human being. It is known that on the internet there is enormous information, which is a big burden for learner to avoid and identify unnecessary information. Artificial intelligence is a kind of automated system, which could think critically. As the ubiquitous learning is an interactive learning process, artificial intelligence help to know what learners need and want and predict their future development. Artificial intelligence could make contribution to recognize and sort out the effective information. So it could intelligently gather all the necessary information .

#### **3.2. Providing direct services**

For the AI-led ubiquitous learning, all the data and information collected could be directly applied to the learners, which would not rely on the teachers' guidance and exploration.<sup>4</sup> Also by analyzing learning conditions, artificial intelligence would make inferences to learners' learning condition, such as current learning state, learning goals or learning mood. Thus they would bring learners' the most suitable and direct service. After that, instant responses and inferences would be generated and feedbacked. Early computer assisted teaching and learning is a kind of drill-and-practice mode, it functioned as a platform to present and retrieve learning materials, and it now has developed to be natural dialogues between computers and learners.<sup>5</sup> The artificial intelligence in ubiquitous learning make learner obtain first hand theoretical understanding of the problem, elicited method to figure it out and evident proofs in its areas.<sup>6</sup>

#### **3.3. Enhancing learning efficiency**

The foreign research of AIED mainly focuses on the learners' adaptive learning, which is implemented in the online learning, individual analyses, practice and evaluation, teaching and learning environment.<sup>7</sup> The domestic research concentrates on the intelligent tutor, intelligence testing, learning partner, data digging and learning analysis.<sup>7</sup> It could enhance learners' autonomous ability, interest and participations. By the techniques of artificial intelligence, the learners could be monitored, accessed, managed automatically in ubiquitous learning. Also artificial intelligence in the ubiquitous learning could make inferences, improvement, thinking, comprehension, identification, planning, designing, problem solving and predictions just like human beings. At the same time, it could save human resources. Moreover, it offers integrated platform to those learners who are reluctant to receive traditional teaching. The material offered in the platform might in different forms, such as visual, audio, literary, 3D, etc. The ubiquitous learning resorts to artificial intelligence to deal with the big data by strong computing ability, and thus makes optimal choices in a short time and contribution to learners' deep learning. In order to enhance the learning efficiency, artificial dominated teaching robots, intelligent tutoring systems, and adaptive learning systems has

already been applied.<sup>8</sup>

### **3.4. Highlighting individual difference**

In the ubiquitous learning, artificial intelligence could push information to learners according to their own learning styles, cognitive styles, interests, personality and levels. The differentiated instruction could satisfy learners' individual differences and offer them customized services. During the learning process, artificial intelligence help people recognize learners' individual learning pattern, together with the techniques of ubiquitous learning. This gives the learners real chances to gain personalized learning experiences. Ubiquitous learning now is in the knowledge society. The society brings learners new forms of knowledge and new process of formation, so the flexibility of artificial intelligence makes learners more accessible to the different forms of knowledge.<sup>6</sup> Learners' personal interaction and outcome are the highlights of ubiquitous learning. Artificial intelligence diagnosed the corresponding behaviors and individualized learning model is drawn. Learners learn at his or her own pace, get targeted tutor, highly qualified problem-solving methods, and appropriated learning exercises.

## **4. The Future Trend**

As the product of the fourth industrial revolution, artificial intelligence do promote the development of ubiquitous learning. In the future, ubiquitous learning would realize lifelong learning, flexible learning, and smart learning by adopting artificial intelligence. It would make effects on the teaching and learning elements, such as teachers, learners, teaching content, teaching media and teaching environment [9].

### **4.1. Teachers**

For the ubiquitous learning, artificial intelligence would further help teachers recognize individual differences, interests and preferences and establish multiple interaction with consideration of learners' psychological and emotional needs. Although artificial intelligence would obtain the intelligence of human beings, the teachers would not disappear. By using artificial intelligence, the teachers still perform their duties as designer, instructor, organizer, manager, researcher and lifelong learners.

### **4.2. Learners**

Learners could learn at any places or any time and own better information literacy and comprehensive ability in ubiquitous learning. Artificial intelligence could assist learners to direct their own learning, avoid troublesome irrelevant information, manage their learning by themselves so as to achieve effective learning. Learners could also enjoy the multimode information selected and organized by artificial intelligence, when they learn inside or outside classroom, insider or outside school or carry out informal or formal learning. Artificial intelligence would surely find out its own new way for learners to carry out Moocs, online and blended learning.<sup>9</sup>

### **4.3. Teaching content**

With the techniques of artificial intelligence, ubiquitous learning need not only to satisfy learners' knowledge requirements but also to cater for learners' cognitive ability, learning styles, teaching environment and teaching medias. Mover, it should expand learners' knowledge, dig out learners' interest, stimulate learners' learning motivation and promote learners' individual development. The future trend of learning content would not confine itself to the provision of the resource services, and it would also be interrelated with teaching activities, such as curriculum development, activity design and record, teaching evaluation and reflection, which is highly connected with teaching content. In addition, the learning content now only involves the development and employment of concrete teaching resources, and it relates to human resources.

#### **4.4. Teaching environment**

As the educational web would be more widely used, more stable and safer, the use of artificial intelligence would make the teaching network environment smarter and smarter. It would shape the teaching and learning environment more interactive and better realize seamless learning. Additionally, the learning spaces would not be limited to the physical spaces, it could be persuasive, permanent and persistent in every day life. 10 With the help of artificial intelligence, the learning environment in the ubiquitous learning would be more personalized, user friendly and adaptive.

#### **4.5. Teaching media**

The computer terminals and intelligent devices as teaching media would keep updated. As the educational resources are tremendously huge, it needs big data and artificial intelligence to make judgement and select. Artificial intelligence could deal with the information provided by teaching medias, organize them and supply the learners with ordered and specific resources, and this would make the operation of teaching media much easier and smarter.

### **5. Conclusion**

Learning is a rather complex activity. Only human beings' effort could not satisfy learners' development. The ubiquitous learning and one of its techniques, artificial intelligence, allow learner with wider scope of learning experiences. The application of AI in ubiquitous learning make us be aware of how learning happens [10], how learning is influenced and how learning is supported. The ultimate goal of ubiquitous learning is to form learners' individualized learning, differentiated learning, deep learning, autonomous learning in a large scale.

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