Framework for a smart adult education environment

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ABSTRACT: Smart education is an advanced application in the development of information systems for education. As an important part of life-long education, adult education also is increasingly influenced by smart education. By analysing the nature and characteristics of smart education, the work presented in this article probed the application of new information technology to adult education. These include cloud computing, the *internet of things*, big data and the mobile Internet. The work has considered the characteristics of adult learning to construct an adult smart education system and explored the smart adult education environment.

INTRODUCTION

The application of cloud computing, the *internet of things*, big data, and the mobile Internet is changing on-line education and learning. Smart education as an application of ICT (information and communications technology) in education has received increased attention globally [1]. The conversion of digital education to smart education has become a developmental trend for future education. Backed by new technology, support services have developed, such as ubiquitous learning, mobile learning, personalised learning and push services. Given its advantages, the characteristics of smart education have become an important research topic.

As adult education is an important part of education itself, a new teaching mode using social media, such as WeChat, microblog and Tencent QQ (an instant messaging software service), is needed to promote and improve adult learning. Smart education provides modern, diversified distance learning, with a variety of learning paths and support services. By effectively integrating a variety of learning resources, smart education will be convenient for learners and will improve adult on-line learning.

SMART EDUCATION

Definition of Smart Education

Smart education uses modern information technology to promote the sharing of high quality educational resources. Hence, it improves the quality and standard of education, as well as changing traditional ways of teaching and learning. Smart education also can be understood as the intelligent development of the education industry as it strengthens teaching and learning abilities, as well as changing the teaching and learning environment. There is no unified definition of *smart education*.

Zhu Zhiting, a Chinese expert on the use of information technology in education has proposed an authoritative definition, which is that smart education refers to the construction of a smart learning environment for learners by applying modern information technology media, such as the *internet of things*, cloud computing, ubiquitous computing and mobile networks; to teach learners with smart pedagogy and to promote learners to conduct smart learning in smart learning environments. The target of smart learning is to cultivate the learner's innovative, practice and application ability [2].

Smart education provides a smart learning environment requiring R&D, to develop a comprehensive and in-depth application of modern information technology. As stated above, the basic target of smart learning is to cultivate the

learner's innovative, practice and application ability. It also promotes critical thinking as part of the learner's *smart development*. It focuses mainly on the application of technology to education, changing the way learners learn.

Characteristics of Smart Education

- Diversification of the means of education:

  In the context of smart education, the teacher can adopt various tools for knowledge explanation, integrate a range of information resources and help students to build their knowledge from various perspectives. In addition, the teacher can teach using various courseware and instruction software, according to the characteristics of students and subject. This makes the course teaching more vivid; for example, animation simulation can be used to exhibit static knowledge in a dynamic way, e.g. during mathematics teaching of trigonometric functions; and during physics teaching to display the Kepler laws to students; during chemistry teaching to display the anabolic process of organic matter. Also, during geology teaching, the Internet resource, Google Earth, could be used to examine landforms.

- Liberalisation of learning style:

  Smart education changes the learner's learning style. The learner can use a mobile device connected to the mobile Internet to learn. The learning resources will not be paper-based, but diversified and electronic. The learning place and time is not limited by traditional classroom teaching, as the learner can learn anywhere and any time, according to the learner's requirements.

  The learning content is also diversified and is not restricted by teacher diktat. Hence, the learners can realise effective distance learning. In the context of smart learning environments, the learner can transition electronic learning to intelligent learning. Smart learning systems allow different learning plans for different learners and tailor the learning resources, according to the learner's requirements, ability and interest.

- Knowledge construction:

  Smart education has changed the nature of teaching. Students are changed, from passive knowledge receivers to active exploration and learning. In this way, they experience the formative process of knowledge acquisition. With the application of virtual reality and 3D technology, learners can be provided with a learning environment close to the real setting allowing students to understand the teaching content in a more intuitive way.

  For example, when learning about the Palace Museum in Beijing, virtual reality technology can be adopted to provide students with a virtual tour, so as to better experience the museum; or when learning about a chemical reaction, simulation technology can be used so that the learners can experience the process. Such techniques can avoid the danger of some experiments, lower the experimental cost and improve the effectiveness of teaching.

STRUCTURE OF THE ADULT SMART EDUCATION SYSTEM

As a deep application of information technology, adult smart education should be an educational information ecosystem based on new information technology, in which the learner can learn using a variety of terminal equipment. Adult smart education improves adult education, and realises an in-depth integration between modern information technology and adult education. It has integrated smart adult teaching and learning, smart management and evaluation, as well as smart scientific research and services, so as to promote the adult learner's advanced and sustainable development of vocational skills [2]. The components of the adult smart education system are shown in Figure 1.

The Adult Smart Education Cloud Centre

The Adult Smart Education Cloud Centre is a key driver of adult smart education (see Figure 1). It addresses such key problems as fundraising, boosting applications and sharing. Thus, adult smart education is at the core of adult education development. It provides adult learning with identity and data interface authentication services. It can also provide adult learning with such basic supporting services as unified data control to integrate software and hardware resource for adult education, and provide adult educational institutions with storage and network security.

Adult smart education will realise centralised management and distribution of information, as it integrates various adult educational software and resources on a unified information platform. In the end, it will provide adult educators and learners with a platform for adult learning and communication.

The adult smart education cloud centre should integrate all the teaching resources related to adult education. The smart cloud management platform can serve as the centre and hub for data storage, resource integration, data exchange, operations, data network management and supporting services to support the development of adult education [3].

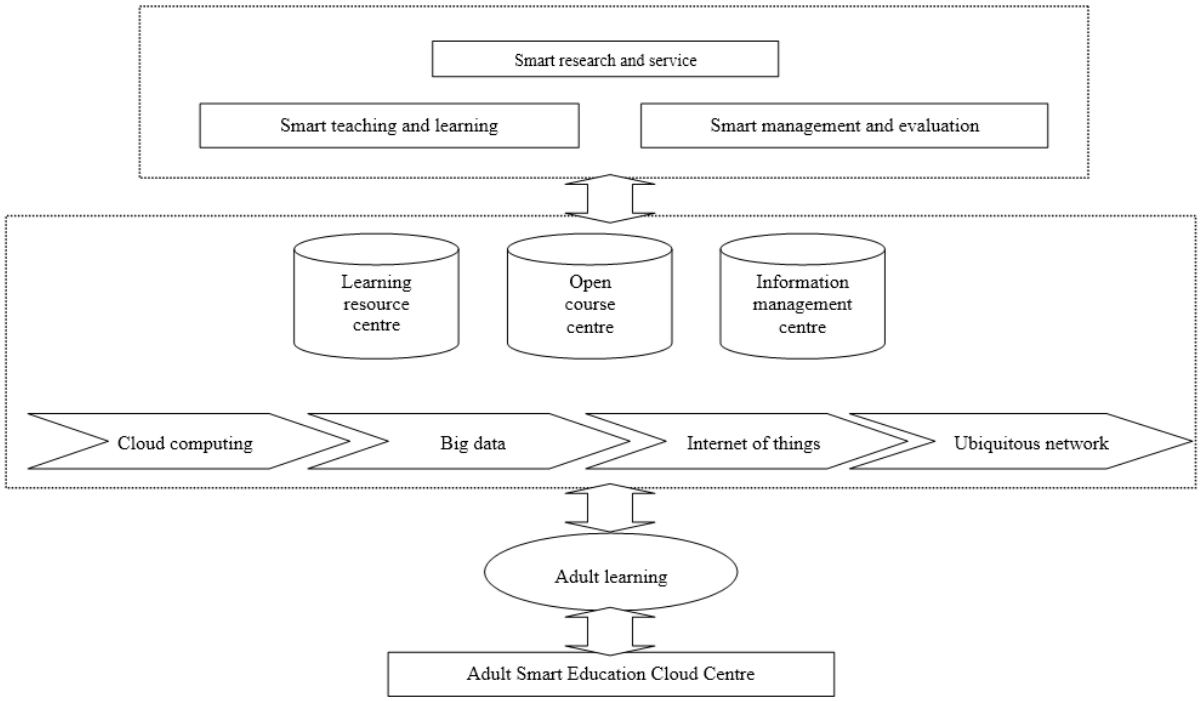

Figure 1: Structure of the adult smart education environment system.

Supporting Technologies

Supporting technologies are the key to the development of adult smart education by supporting the smart education environment. To improve the adult smart education environment and improve the effectiveness of adult education, it is necessary to apply new information technology:

- Cloud computing:

  Cloud computing is the third IT wave based on the development of network technology. It has become an important part of emerging industry and the education sector development. It is used mainly to realise ubiquitous and distributed computing. The technology includes distributed, parallel and grid computing. Computing occurs on servers distributed around the world, supporting large-scale computation and processing mass information for users requiring data and information support services.

- Big data:

  There is a wide range of sources of big data, e.g. diversified educational resources and sensor data. Big data technology can collect and store masses of data. It can analyse, *clean* and share the data, as well as supporting its visual integration. Big data is characterised by the integration of interdisciplinary data and the rapid growth of the data volume. It allows the management of interdisciplinary data, with non-structural characteristics. The distributed processing of the data is its most significant feature.

- *Internet of things*:

  With the *internet of things*, information sensor equipment is adapted to gather, monitor and manage real-time information. It is connected to the Internet, forming a huge network, connecting things to things, and things to people. Hence, the network provides the connection, management, recognition and control between people and things. The application of the *internet of things* is important for adult learning, e.g. in experiment information gathering, and is an important part of the adult smart learning environment. The basis of the *internet of things* is information gathering, and this is an important channel by which to connect things and people. At present, sensor and RFID (radio frequency ID) are used mainly in this process. According to set parameters, sensor information is passed to a collection point via the *internet of things*. After collection, the information will update the network information centre, perhaps through a wireless network. Then, the collected information will be processed by an intelligent control system.

- Ubiquitous network:

  Ubiquitous network refers to an integrated communication network of the Internet and the *internet of things*. This expansion of Internet working supports inter-industry applications of information resources and multi-

technology integration, as well as the collaborative use of resource data. This can be used to achieve the integration of information and physical things in adult education. The ubiquitous network development aims to be everywhere, to connect everything and to be omnipotent. It will help the adult learner to communicate and learn at any time or place and in any environment. It connects to the adult learner through an appropriate terminal, providing a diversified and individualised information support service [4].

Intelligent Educational Resource Service

Intelligent learning resources are the basis of adult smart education. The adult intelligent learning resource service includes the following:

- Adult intelligent learning resource centre:

  The learning resource centre is necessary for intelligent teaching by the teacher and for smart learning by the adult learner. The adult learning resource centre is composed of teaching cases, multimedia courseware, micro-courses, micro-practical courses, test questions, test papers, e-books, media material, relevant resource Web sites and learning tools. The adult learning resource centre is oriented to adult vocational training, continuing education and skill improvement. A variety of channels can be adopted to integrate high-quality educational resources suitable for adult learners. Data mining technology is used to process information about the learning process, so as to update the adult learning resource centre.

- Open course centre:

  With the extensive application of MOOCs (massive open on-line courses) in education, as well as the development of the micro-course and the flipped classroom (where course lecture and homework activities are reversed, e.g. students view video lectures before attending class, and during class they carry out projects, discussions or exercises), the construction of open course resources has grown, which also provides necessary course resources for adult learning. The open course centre is controlled by the course management as a resource-sharing facility. The open course resource centre should be established on an open education application platform and should support large-scale on-line interactive learning, with adult learners able to visit freely,

- Information management centre:

  The information management centre provides standardised collection and management of education data and is necessary for adult smart education. The information refers mainly to basic business data, which are frequently used by the adult education manager and the adult learner, e.g. information related to students, teachers, education courses and research. Unified data standards should be adopted and the centre should be connected to the information data of various adult institutions.

Intelligent Business

- Adult intelligent teaching and learning:

  Intelligent teaching refers to teachers of adult education making full use of tools of the intelligent environment, e.g. social media, such as microblogs, WeChat and the learning space, as well as the learning resources of the smart cloud centre under the smart teaching environment. The main target of smart teaching is to improve adults' learning efficiency, their participation; and to capture attention. It is effective and diverse, with in-depth interaction.

  Smart learning means that the adult learner studies with various tools at any time and any where under the smart environment. They acquire their learning resource directly and can participate in learning as required. They can still enjoy personalised learning resources and service under the smart learning environment. Thus, smart learning can stimulate an adult learner's interest, with adult learning that is personalised, immersive, persistent and efficient [5].

- Smart management and evaluation of adult learning:

  Smart management has turned adult learning, from people management by machine to intelligent management. In a unified intelligent cloud platform, the information about adult learning can be managed automatically. The resource allocation for adult learning can be optimised and the data integrated and the learning managed. The smart cloud platform centre can use such advanced technology as big data and the *internet of things*.

  The adult learner's vocational skill and continuing education data can be excavated regularly to provide adult learners with accurate evaluations. Furthermore, evaluation data can be saved to the cloud. In this way, the smart management platform can push personalised learning resources to the adult learner, according to this archival information. This allows targeted suggestions to be made to learners regarding their development.

- Smart research and smart service in adult learning:

  The implementation of smart research is an important way to improve a learner's learning ability and to identify where there is a lack of knowledge. Smart research can cultivate an adult learner's innovative and lateral thinking ability. While doing scientific research, the adult learner can share other people's results and realise technological innovation under the smart platform.

  Smart service is the foundation of the entire smart education system, allowing harmonious operation. Adult learners are provided with support services, such as on-line consultation, evaluation and learning. These can be divided into operation and maintenance cloud services, as well as a public training service. The adult learner is provided with an on-line personalised training service supported by the operation and maintenance of the smart education system.

CONCLUSIONS

At present, education information systems are in a stage of rapid development, which provides a sound development opportunity for adult education. Adult education can be delivered now from an information platform, as a public knowledge service that is integrated with various education resources. In this environment, smart education effectively can achieve a *leap forward* reform of adult education. This can change the nature and concept of the learning, as well as improving the quality and efficiency of adult education. This is of great importance to the reform of adult education.

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