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Application of Clouds Computing Assisted Instruction to Mobile Learning Activities

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Abstract

The limitation of terminal equipment and the scarcity of mobile learning resource are key constrains of mobile learning development. However, cloud computing supplies a new way of solving the problem. For cloud computing, the calculation and the storage of task are conducted in the cloud server. As a result, computing and storage work of mobile phone are separated from the machine. So user can customize through cloud computing services according to personal need. Thus a lot of works that are realized only in high-performance computers before, but now can be finished through the mobile phones with poor configuration. This paper through theoretical study and based on the theory of mobile learning and cloud computing, it points out the disadvantages of mobile learning and puts forward the solution of cloud computing technology.

Keywords: *Mobile learning; Cloud server; cloud computing*

1. Introduction

With the rapid development of computer technology and network technology, the learning mode in the environment of information technology changes constantly. The occurrence of new technology in the education field brings new learning methods and learning experience. So are the Computer Assisted Instruction, the Distance Education and the Computer Network Education[1]. Owning to the development of wireless communication network and mobile terminal equipment, the application scope of the Computer Network Education are greatly expanded and learning activity are also developed from PC to intelligent terminal. Those result in the appearance of a new study mode-Mobile Learning. Without the limitations of time and space, Mobile Learning enables learners to study at any time and in any place [2]. Mobile learning has more advantages than traditional learning mode in autonomy, convenience, flexibility, interactivity and continuity [3].

At present, mobile learning with the support of clouds computing technology is still in the initial exploration stage, but its unique advantages indicate that clouds computing has a good potential application in the field of mobile learning. Mobile learning can combine the new technology of multimedia with mobile devices, plus the haptic interaction, smart environment, wireless communication and so on, which can combine them together into the field of education and training. Therefore, mobile learning has showed different digital learning characteristic, which is quite different from the general characteristics of the traditional fixed wired PC pattern based on the computer network [4, 5].

2. The Overview of Clouds Computing Assisted Instruction

2.1. Clouds Computing

Clouds computing is a virtual resource pool based on needs, it can distribute the computing tasks in the resource pool, which can make all application systems obtain a variety of software services, computing power and storage space according to different

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needs [6]. Then users can achieve the agreed service according to the level of agreement, while the provider of the services can provide service with pay according to different agreements. The pattern of cloud computing model is different from the traditional calculation pattern which takes PC machine as the center, moreover, its data and programs are no longer stored in the personal computer [7]. However, they are stored in the Internet data center, which is so called "cloud" data. Then users do not need the traditional desktop software and disk space, as well as its processing power. As long as users can have access to the Internet, they can visit "cloud" services at any time and any sites, which can be shown in Figure 1.

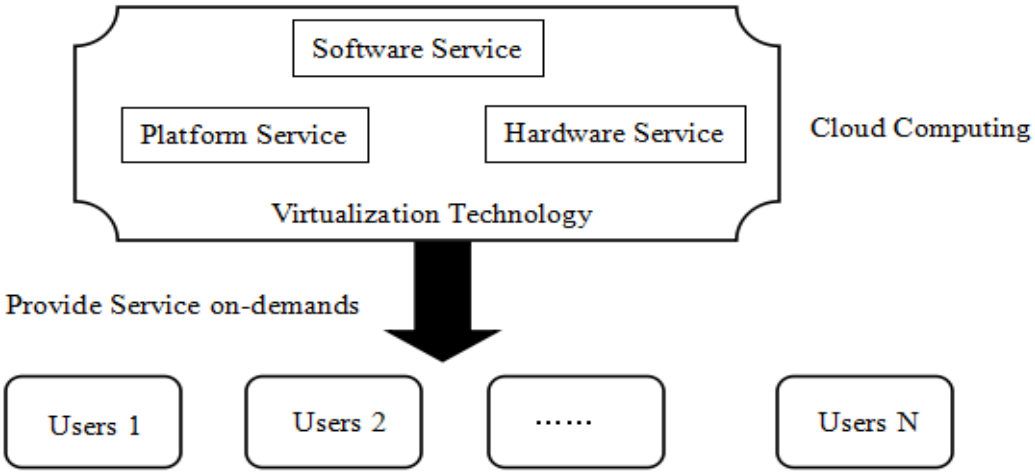

Figure 1. Schematic Diagram of Clouds Computing Model

2.2. Cloud Computing Assisted Instruction

Cloud Computing Assisted Instruction (CCAI) refers that the schools and the teachers make use of the "clouds computing" to provide education with "clouds service", so as to build a personalized and information-based teaching environment, which can support teachers and students with the effective teaching and learning, promote the learner's wisdom development as well as the development of the advanced thinking ability, finally, in order to improve the quality of educating and teaching [8].

Critical Learning Calculations

In a cloud environment, the critical learning modeling that oriented the data mining can learn from the critical learning method in project management. According to specific data mining workflow, combined with the control flows between tasks and the input-output relationship, the workflow was abstracted into DMTOE（Data Mining Task on Edge）network, after obtained the critical learning of the data mining workflow, based on multiple examples pricing model of cloud resource, it carries out the multi examples portfolio purchase.

In DMTOE network, the vertices represent events, directed edges represent tasks, the weights on the edge represent the duration of the task. The node without predecessor node was called the entrance node, and the node without the successor node was called the exit node. There are multiple entrance (exit) nodes in some task graph, and they can be connected to an entrance (exit) node by the edge with the weights of 0. The directed edges described the sequence between the tasks. The node cannot be executed before receiving the message from the successor nodes and a return message from the predecessor nodes.

We assume that the data mining workflow has a total of 15 tasks, 10 data sets, 5 data centers, the dependence relationship between tasks and the call relations between data and tasks, as shown in Figure 2.

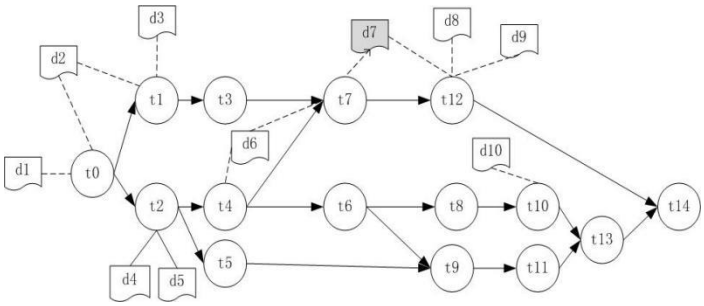

Figure 2. Data Mining Workflow

First, put the data set aside, only analyze the input-output the relationship of the data mining tasks, as shown in Figure 3.

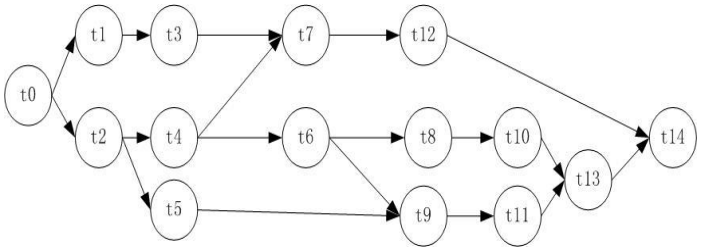

Figure 3. Task Dependency Graph

3. Theory of Mobile Learning

a. Interpretation of Mobile Learning (M-learning)

Mobile learning is to use the mobile devices to learn, which is occurred in the context of learning. It is a kind of mixed learning pattern with other ways of learning modes[9]. However, mobile learning is not simply push content to the small screen through mobile devices, but is focused on the execution driven by the efficient learning process. Mobile learning is the product of mobile communication technology combined with the development of computer network. The intelligent and portable mobile terminal equipment is regarded as an extension of the technology of digital learning.

3.2. Resources Design of Mobile Learning

Mobile learning resources are designed according to the learning objectives, which can show specific learning contents, reactions with certain teaching strategies. As shown in Figure 4. The resources for each course are composed of a variety of media materials, including video, audio course, e-book, images, animation, *etc*. Through the support of a variety of media materials, it can make the clients and users gain multiple intellectual stimulation by using mobile learning terminals, in order to achieve the learning effect. Among them, the content of video course takes 5 or 10 minutes as a module, the content of course takes skills learning as segmentation, there is loose connection among courses; Besides, the content of text takes each knowledge point as various points of different courses, which is closely linked to the content and its form is relatively independent; pictures can support formats such as jpeg, bmp, gif and other common used formats, while audio files can support MP3, WMA and some other forms.

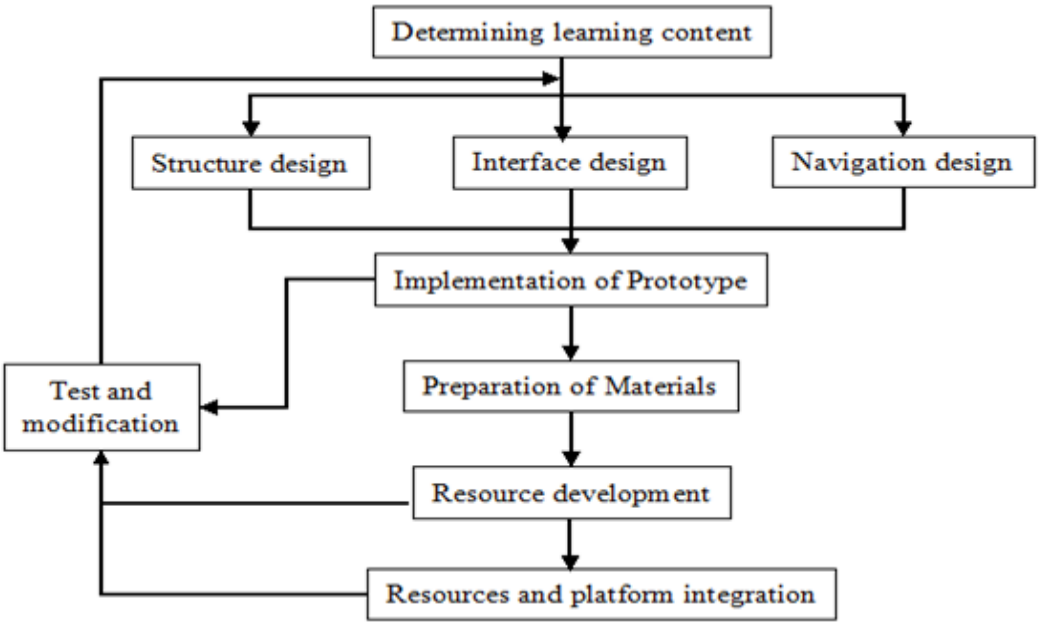

Figure 4. Design and Development of Mobile Learning Resources based on Clouds Computing

b. Design of Mobile Learning Support

Mobile learning activities based on clouds computing are mainly about clouds computing technology and wireless communication technology, which are combined with various multimedia technologies to carry out learning activities that are based on the normal operation and maintenance, therefore, it should ensure all facilities and equipment can have normal operation and maintenance, while the software system should update timely so that the learning content can push conveniently. At the same time, it should ensure network with security environment, during the selection of designing learning function, it should be clear, easier, which also should provide learners with convenient facilitates and channels to get feedback and help.

3.4. Information Consulting Services

The related information to mobile learning contents are mainly released in a variety of ways, which can be including the following types of information: (1) the related information to the mobile learning resources: provide the introduction about course content, the update of learning resources, the acquired methods, the related reference resources and suggestions, learning focus, difficulties and some other information as well as services. (2) the organization of mobile learning services, information of counseling staff: designers of mobile learning activities, learning content, information of counselor's or teacher's who offers help to explain learning difficulties. (3) management information: it refers to the selection of the registered curriculum, downloading the directory of information resources, information about learning and tracking, *etc*.. (4) technology information: it refers to the facilities and equipment as well as the information that is related to technical support. (5) supervision information: it is mainly the information about the reaction of learner's learning process.

3.5. Technology Support Services

Mobile computing learning activities based on clouds computing is a variety of learning activities combined with clouds computing technology, wireless communication technology and various multimedia technology, which can carry out the learning activities.

The normal operation and maintenance of facilities and equipment well as software system can ensure update software timely and push learning contents conveniently. Moreover, the safe environment and clear learning function can provide learners to get knowledge easily.

3.6. Learning Methods Support

There are lots of differences between mobile learning activities and traditional classroom, learning environment, E-Learning, the scenes of mobile learning also have many differences, during to learner have accepted long-term classroom teaching, when learners adapt mobile learning, it needs to adjust the learning method gradually, which should provide support about the learning methods during the process of learning.

3.7. Design of Mobile Learning Scenes

There are obvious differences between mobile learning and traditional learning, the instructional designer of mobile learning or designer of mobile learning cannot design mobile learning situations and scenes only by subjective ideas, who should analyze from the angle of learners. The scene is the description about mobile learning learner as well as their activities, which is often included the following elements:

(1) Background: it refers to the initial state learning environment that the activities started.
(2) Participant: usually it refers to learners, who may be one or more, namely it is is about answering "who".
(3) Objective: there is a specific goal in the specific context for every scenes and characters, namely, it is about to answer "why things happened".
(4) Event: it refers to the change of character or background.

In short, the creation of mobile learning scene is the description of learners in a variety of scenarios through various different kinds of activities to achieve the learning objectives of the specific courses. Typical mobile learning scenarios can be dived according to the different classification, which can be divided into several categories shown in Table 1:

Table 1. Classification of Mobile Learning Scenes

Classification of Mobile Learning Scenes	Application Types of Mobile Learning
Different Learning Process	Knowledge Transferring
	Knowledge Construction
Different Forms of Organization	Individual Learning
	Collaborative Learning
Different from the Traditional Learning Environment	Formal Learning
	Informal Learning
Different Mobile Devices	Based on Smart Phone
	Based on Wearable Devices

4. Deployment Environment Design of Cloud

Based on the consideration of performance and portability, the most suitable terminal equipment for mobile learning based on clouds computing is smart phone. The screen size of smart phone is about 4 inches to 6 inches, thus the screen size is moderate, which can not only have effective presentation about learning contents, but also have high portability. Besides, the network transmission rate Like 4G and WIFI can make users learn knowledge easily and quickly. Moreover, at present, the mainstream of smart phone has Google, Android and Apple's IOS operating system, which can support for clouds computing with many clouds services. Therefore, the smart phone can completely carry out the mobile learning tasks under clouds computing environment.

4.1. Measurement about Cloud Model

The cloud model's spray characteristic refers to the character of cloud drop distributes around cloud expectation curve's discrete degree. Professor Liuyu, *etc*. made researches on excess entropy measures cloud drop's discrete degree with fixed entropy. But these works did not show the essence factors of determine cloud model's spray characteristic, i, e , the standard deviation Y's distribution of cloud drop quantitative data X determines the cloud model's spray characteristic. The same as the cloud distribution probability density of cloud model algorithm identified is the theoretical basis of uncertainty reverse cloud model algorithm, this chapter revised the cloud distribution probability density and gave a strict proof according to spray characteristic Y >0.

The positive direction cloud model algorithm steps in one-dimension theory's domain are as following:

Step 1: Generates normal random number y_i whose expectation is E_n , standard deviation is He;

Step 2: Generates normal random number x_i whose expectation is Ex, standard deviation is y_i , x_i is a concrete and quantitative realize of qualitative concept A operates in its corresponding quantitative theory of the domain U, called cloud drop qualitative data;

Step 3: Calculates $r_i = \exp\left(-\frac{(x_i - E_x)^2}{2y_i^2}\right)$, r_i is the certainty degree or subjection degree of x_i belongs to qualitative concept A;

Step 4: Repeats step one to three until generates n cloud.

Prove: because $y - r\left(E_n, H_e^{\ 2}\right)$, En refers to the discourse domain must be greater than zero, as $x \square N\left(E_x, y^2\right)$, y , as the standard deviation of x , must be greater than zero, so according to normal distribution random variable meets 3 σ rule, gets $E_n / H_e \geq 3$. Besides, the probability density of Y is

$$x_i(y) = \frac{1}{\sqrt{2\pi H_e}} \exp\left[-\frac{(t - E_n)}{2He^2}\right]$$

When $x_i = y$, the conditional probability density is

$$x_{i,j}(x|y) = \frac{1}{\sqrt{2\pi y}} \exp\left[-\frac{(x - E_x)^2}{2y^2}\right]$$

Gets joint probability density through conditional probability density formula:

$$x(i, j) = \frac{1}{2\pi H_e j} - \exp\left[-\frac{(j - E_n)^2}{2He^2} - \frac{(i - Ei)^2}{2j^2}\right]$$

Gets probability density which marginal probability density is cloud distribution through joint probability density formula:

$$x_i(x) = \int_x^y \frac{1}{2\pi He y} \exp\left[-\frac{(y-En)}{2He} - \frac{(x-E_x)}{2y^2}\right]$$

This formula has no analytic form Quod x_i demonstrandum.

From step 2, 3, y is the standard deviation of cloud drop qualitative data X, its distribution character directly determines the cloud drop's distribution character, the bigger distribution scale of Y, the more cloud drop distributes discrete. Because

$$Y \sim N(En, He^2)$$

This text takes $a = En / He$ as the measurement of cloud drop's discrete degree, called spray factor, because qualitative data's standard deviation Y, En and He must be greater than zero at the same time so $a \geq 3$. Spray factor a integrative considers the nature that standard deviation Y of cloud drop's qualitative data X must be greater than zero, the distribution of Y directly affects cloud drop discrete degree and a determines the distribution character of Y, so 0.0 can be the significant digital characteristic of cloud model to presents the discrete condition of cloud drop's distribution. The spray characteristic of cloud model has the following characters:

Character 1: The distribution characteristics of cloud drop's qualitative data standard deviation determines the cloud drop's distribution characteristics, a refers to the cloud drop's discrete degree and $a \geq 3$. The smaller a be, the bigger discrete degree of cloud drop's distribution; when $\alpha = 3$, the discrete degree of cloud drop's distribution reaches the biggest; the bigger α is, the smaller discrete degree of cloud drop's distribution, finally tends to normal distribution. Now the cloud drop all approximate distributes on cloud expectation curve.

Character 2: cloud distribution's corresponding range of spray factor: $3 \leq a \leq 18$.

The spray factor determines the distribution characters of cloud drop qualitative data, and the kurtosis describe the figure of data distribution at the same time, the kurtosis of normal distribution is 3, if the kurtosis of cloud distribution values around 3, the cloud distribution turns to normal distribution[8]. The kurtosis of cloud distribution defines as following:

Definition 1: the kurtosis of cloud distribution

$$K(X) = 9 - \frac{6}{\left(1 + \frac{He^2}{En^2}\right)^2} = 9 - \frac{6}{\left(1 + \frac{1}{\alpha^2}\right)^2}$$

when cloud distribution approximate degrades into normal distribution. i, e, essentially, when spray factor meets $3 \leq a \leq 18$, the distribution of cloud drop's qualitative data can be called as cloud distribution. So in later discussion, can only considers the condition when spray factor meets $3 \leq a \leq 18$.

5. Design of Mobile Learning Model

The design of mobile learning activity design should play the advantages of mobile technology completely, under the guidance of teaching design, it should pay attention to the learner's experience about mobile learning. (Shown in Figure 5).At present, there are mainly two kinds of models of mobile learning: one is SMS (short message service)based on on demands, the other is WAP educational site based on browsing. Both two models have their deficiencies: with SMS model, usually the data exist some delay in learning and teaching, thus, teaching and learning can not realize real-time interaction. Besides, the amount of data transmission of this model is quite limited, which can only transmit text information, so it is difficult to meet the needs of users for multimedia resources. As for model of WAP educational sites, because of the establishment of the WAP sites is too limited, there is few educational learning resources, so it is difficult to play its role. In addition, this method is based on WAP protocol, the data transmission rate is not high. The emergence of clouds computing can make up mobile learning for the shortages of the

above two models. A large number of educational resources can be stored in the cloud server, without the establishment of specialized educational sites, which can achieve large-scale mobile learning. Clouds computing integrates the new technology of multi-computer, Internet, which has broken the limits of single WAP agreement.

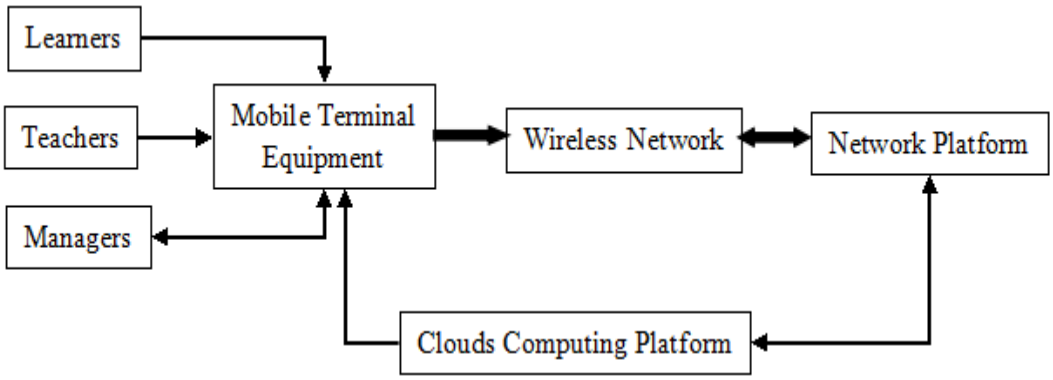

Figure 5. Structure of Mobile Learning System based on Clouds Computing

The fundamental purpose of combining clouds computing with modern education is to fully achieve the integration of education, information, storage, sharing through the network services, which can maximize the utilization and integration of educational resources. As shown in Figure 6.

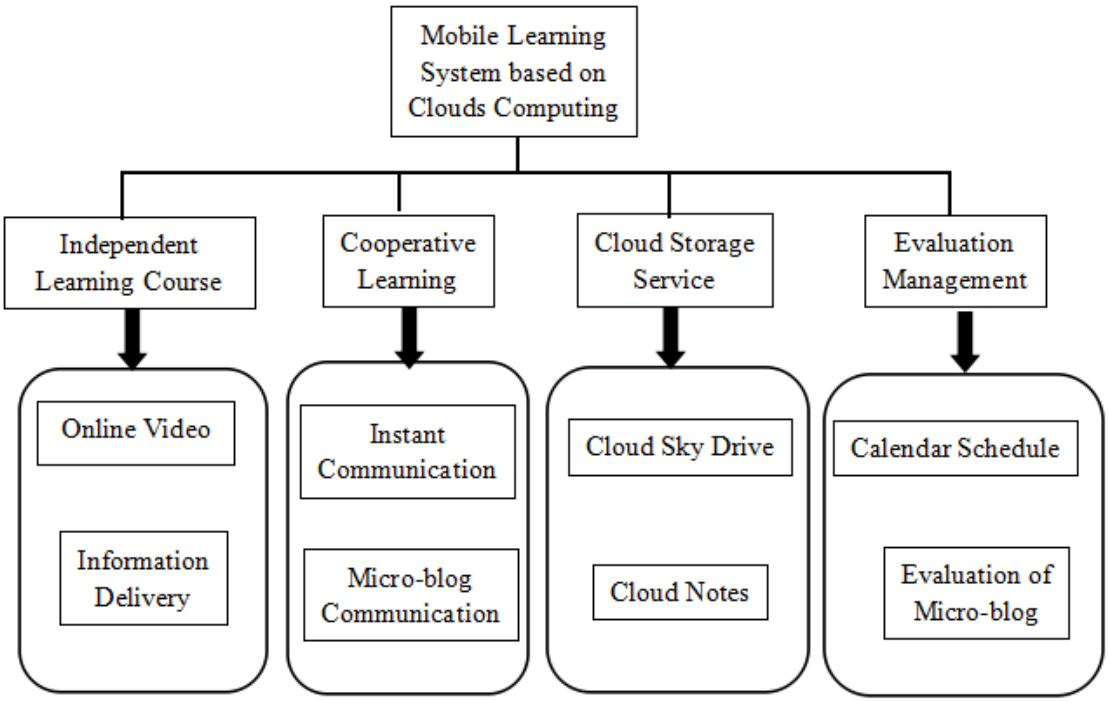

Figure 6. Function Structure of Mobile Learning System based on Clouds Computing

In a word, in the context of clouds computing, the learners can only use mobile devices to have access to "cloud" server and choose learning content independently, so as to have real-time interaction. Mobile learning system can create a learning environment for the learners whenever and wherever possible to start learning. It also can make learners

choose learning contents independently, learning by themselves. Moreover, students and teachers can have real-time or non-real time communication and discussion freely.

6. Conclusion

This paper explored the design of mobile learning system based on clouds computing, in an effort to realize the combination of new technology and advanced learning concept, hoping to meet the requirements of people who can get information freely at anyplace and anytime, with personalized and diversified mobile learning contents, so as to improve the quality of education and realize the balanced development of education, cultivating more high-quality talents, so as to provide new strategies for the education and training industry. Although the construction of mobile learning system based on clouds computing existed many problems, with the clouds computing technology and application becoming more and more mature, the mobile learning system with the support of clouds computing technology will show strong vitality in the near future, which will have a profound effect on the field of education.

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