Study on Individualized Network Teaching Model Based on Intelligent Agent Technology

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Abstract

From the perspective of modern cognitive science, firstly the theoretical model of network teaching is analyzed, and then an individualized network teaching model based on intelligent agent technology. Finally, implementation strategies of individualized network teaching will be discussed.

Keywords: network teaching, intelligent agent technology, cognitive structure

1. Theoretical Model of Network Teaching

Network teaching is a kind of brand-new teaching system and teaching mode which is based on computer communication network. The network teachings have four advantages (1). Flexibility. Teaching and learning can be adjusted more flexibly, no longer restricted by time and place (2). Interactivity. The network put the teachers and students, students and students, human and computers, into a more natural and actual environments of language communication, by the chat online and E-mail *etc.*, (3) Autonomy. The students can arrange their learning schedules and the learning contents according to their own needs and level (4). High efficiency. Computer software control conventional mechanical training, large-scale correcting job, testing job, score and teaching management. The main functions of network teaching platform are shown as Figure 1.
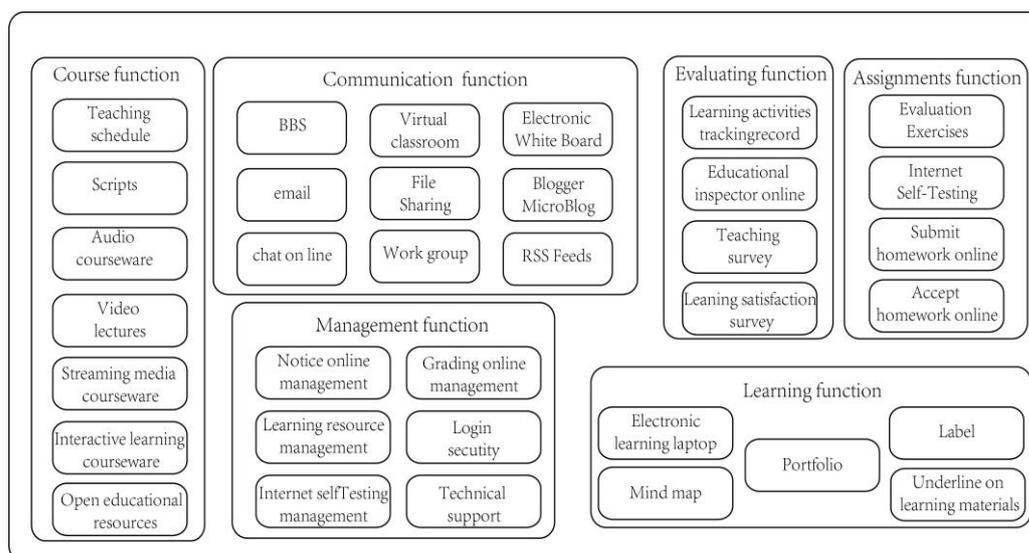

Figure 1. The Main Functions of Network Teaching Platform

In this article, we will analyze the theoretical model of network teaching, and discuss an individualized network teaching model which is combined with distributed object computing technology and intelligent agent technology. Finally, implementation strategies of individualized network teaching will be discussed.

According to modern research in Cognitive science, theoretical models of teaching experienced three stages: Behavioristic learning theory based on stimulus-response association; cognitive learning theory based on Epistemology [1]. Constructivist learning theory studies the whole learning process scientifically from the epistemological point of view, emphasizing the important role of learning subject's own cognitive structure, while also emphasizing the teaching subject's leading rose in the learning process. So it not only eliminate the drawback of Behavioristic learning theory which ignore the learner's subjective intiative completely, but also overcome the lack of Cognitive learning theory which emphasizes the learner's own cognitive processes one-sided, ignoring the teacher's subjective intiative. It focuses on the interaction between the teachers and students, and focuses on the Self-constructing of the two sides of teaching, forms an optimized interactive environment.

It is clear that the main role of the teacher is not only preparing lessons. It's more important thing is how to find the existing cognitive structure of each learner, and use appropriate methods and means to establish a reasonable teaching situations, and assist each learner's Self-constructing effectively, and takes different teaching strategies for each learner. This is called the individualized teaching. The teacher's subjective intiative can be reflected in three aspects: the construction of teaching content, it means the excavation and construction of knowledge and its application model; the construction of teaching object, it means the learning subject's personalized cognitive structure analysis; the construction of teaching methods, it means their own individualized teaching instructional design.

The learning subjects construct their own personalized cognitive struction with the aid of teachers. It's more important to cultivate their metacognitive capability. It shows that the traditional teaching model essentially accords with Behavioristic Learning Theory; the current courseware-based network teaching model accords with Cognitive Learning Theory. Compared to traditional teaching, although teaching courseware based on multimedia technology seems to have much effect. However, because its essence is established in Cognitive Learning Theory, its potential impact is short-lived. Therefore, the change from the traditional teaching model to the network teaching mode is a change from a theoretical framework to another. It will give transformative negation to the traditional teaching. The network teaching model will have a profound impact on the development of network teaching.

2. Individual Network Teaching Model based on Constructivist Learning Theory

Individual network teaching model based on Constructivist Learning Theory should involve the active constructive behavior of teachers and learners. The teacher's active construction is reflected in teaching design and teaching process. The former refers to the individual lesson plans, and the latter refers to the analysis of learner's learning behavior and cognitive structure, and purposefully introduces the corresponding knowledge and knowledge application mode, help the leaner's active construction, achieve dynamic teaching. The learner active construction behavior will reflect in the learning process. Through interaction with the teachers, learners will feedback their cognitive information to the teachers. The teachers will introduce a comprehensive analysis, and then introduce new knowledge and knowledge application model. This paper will discuss the implementation of individualized teaching process. Figure 2 will show the individual network teaching model.
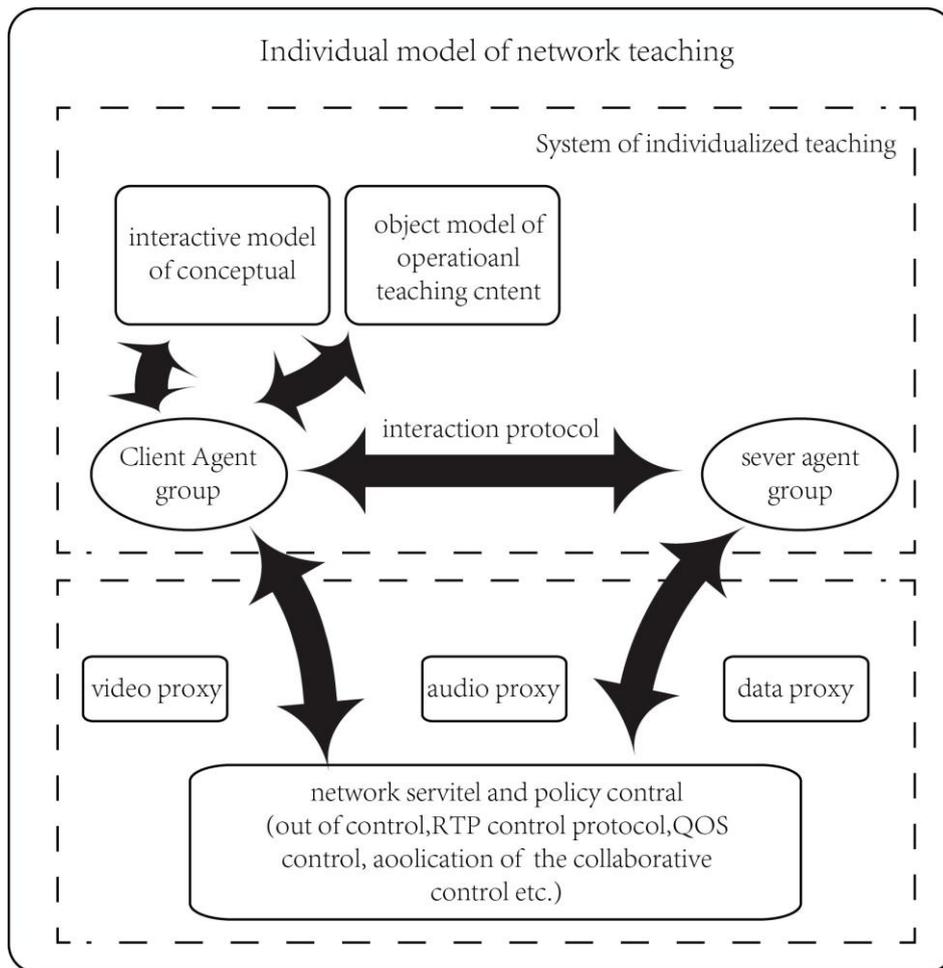
Figure 2.The Model of Individual Network Teaching

There into, Support Subsystem provides a variety of basis function for individualized teaching. It is Abstract Interfaces of the lower network service function, shielding specific network's complex behavior. All the unit teaching models implemented by individualized Teaching Subsystem use the Service Interface provided, to build advanced Service-interface function blocks (SIFB), to realize the basic process of construction for the individualized teaching [2].

Individualized Teaching Subsystem accomplishes the entire implementation process of individualized teaching. The Customer Agent Group accomplish the interaction with the learner, the learner's learning behavior analysis, the interaction with the Server Agent Group, and Relevant Agent of Support Subsystem. The individualized teaching contents implemented by this model include conceptual teaching content and operational teaching content. The operational teaching content is based on the object model, such as computer software operation, variety of operation of virtual instruments, etc. The object model is mainstream technology for software realization now and in the future. The current computer-based software tools have achieved the object model mostly. By means of the object model provided by the various operating object, the Client Agent can control the operating object's behavior .Thereby, the dynamic interactive with the Learning Subject is realized. We can get the learning subject's operating behavior and analyze it, accordingly the individualized teaching is realized. Conceptual teaching content based on the component model define a suitable model structure for interaction, all the teaching content is based on this model structure. In the teaching process, the Client Agent and the

Learning Subject implement the reciprocal teaching of conceptual teaching content by this model, and then the individualized teaching will be realized [3].

The Server Agent Group implements the interactive with the Client Agent Group, analysis of learners' group-learning behavior, and implement the database's interactive. On the basis of predetermined interaction protocol. The Server Agent Group and the Client Agent Group can realize interactive.

3. Realization of Individualized Network Teaching

3.1. Implementation Strategies of the Individualized Teaching

According to the Constructivist Learning Theory, the learning subject's learning activities are active knowledge construction based on their existing cognitive structure of personality. Therefore, the discovery of different learning subject's cognitive structure of personality, and on this basis, to learn how to purposefully establish relevant learning situation; and to prompt the new learning activities interacting with the existing cognitive structure, realize the existing cognitive structure, realize the continuous differentiation, reorganization and expansion.

The paper will discuss the technical strategies based on knowledge schema and its construction. The core idea involves two aspects: learning subject's cognitive structure based on knowledge, knowledge application model, cognitive style, and information receiving style; interactive teaching based on cognitive construction. Its implementation contents include: establishment of knowledge model, and interactive teaching implementation process based on knowledge model. [4]They essentially reflect the Constructivist Learning Theory's teaching ideas. Different courses correspond to different instances of knowledge model. Teachers can build models of knowledge structure by visual environment.

The implement of interactive teaching process is based on directive model. The whole teaching activities will be decomposed into a series of teaching steps; each step is based on learning objects' existing knowledge structure. Through one or many unit model of teaching, corresponding knowledge and knowledge application model will be instantiate [5].

It's clear that this kind of teaching strategy firstly means individualized teaching design; secondly means the same knowledge model example. Different learner has different teaching track. The whole teaching process shows obvious individualized characteristics.

3.2. Reference Model to Achieve Individualized Teaching

Individualized teaching model involves only Subsystem of individualized teaching as Figure 1. The model is built on group Agent technology [6]. The Client Agent is composed of Communication Agent. Teaching Agent and Analysis Agent [7]. The Serer agent is composed of Communication Agent, Teacher Agent and Data Agent. The Communication Agents of both sides interact information according to predetermined agreement in the interactive teaching. Data Agent achieve access to the database, achieve the acquisition of knowledge model example content, and store the teaching information and personalized cognitive construction. Analysis Agent analyze the learning subject's learning behavior dynamically, and the results will be uploaded to the Server by Communication Agent, in order to determine the individual's next teaching instruction and teaching content. It means adjust its position in the knowledge model instance, or elicit the other teaching case.

The Client Agent implements the interactive teaching with the learning subject, the teaching information is issued by the Server, and it will be unpacked by Communication Agent. The Server's Teaching Agent is used to mediate multiple clients, to analyze crowd

behavior of learning subjects in order to guide Data Agent's specific behavior. The interaction between agent groups is shown in Figure 3.
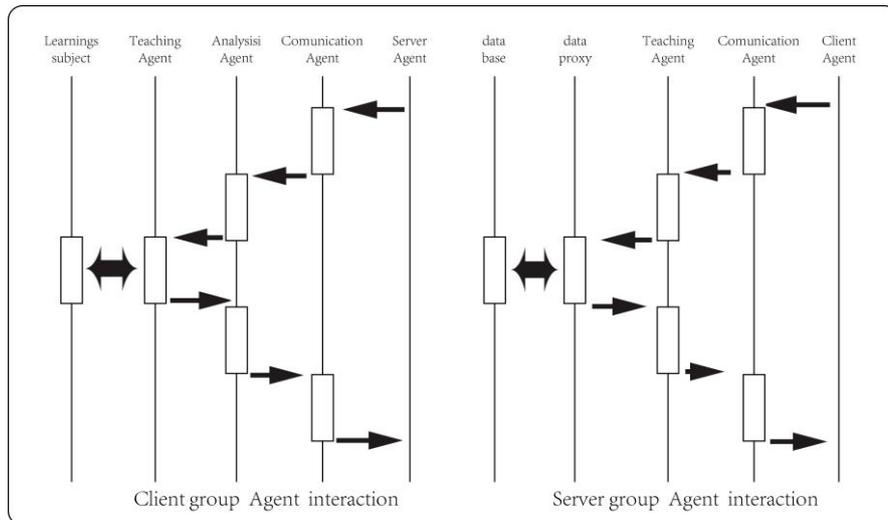

Figure 3. The Interaction between Agent Groups

It is clear that the model supports individualized teaching; each learning subject's teaching process will be realized by the Teaching Agent and Analysis Agent of the Client.

As a new teaching model, network teaching is not an electronic replica of the traditional teaching. Its ultimate goal should be to achieve interactive, and individualized teaching. By means of modern information technology, the teachers and learners' creativity will be stimulated. The paper discussed the implementation strategies of individualized teaching, by combining with intelligent agent technology and distributed object computing technology. The conference implementation model which supports individualized teaching is introduced.

4. Network Teaching Platform based on Net-Web Platform Technology

Network teaching platform based on net-web platform technology is non real-time and self-contained network teaching system. The teaching resources will be organized to the relevant WEB pages by interactive Web applications, and will be stored in a WEB server. The elementary object of network teaching platform is to provide an interactive, opening and easy-to-use network teaching environment by making full use of existing network software and hardware resources, and to provide a rich and efficient technology and software tools. The current network teaching platform usually sets up WEB teaching site in LAN, and the teaching contents will appear in the site in the form of the WEB page courseware. The users access to the site of the courseware to implement online education. A perfect network teaching platform based on WEB is a software system which provides overall services for long-distance teaching based on the bidirectional multimedia communication network.

4.1. The Characteristics of Network Teaching Platform

Under the guidance of the clear teaching goal, teachers will make the teaching design carefully, and show the teaching material and teaching content to students by all kinds of courseware or real-time interpretation. This is the typical characteristic of the network teaching. Therefore, Guided by the teaching paradigm, network teaching platform has the following characteristics:

1. Not only focus on learning content, more emphasis on the learning activity design in the learning process. The support of network teaching platform will change from planning content to activity design, emphasizing the significance of stimulating students to actively construct knowledge by a variety of learning activities.

2. Emphasis on individual differences, provide study materials, strategies and methods for different learners.

3. Emphasis on distributed team collaboration. Network teaching platform must provide support for virtual community and group cooperation.

4. Emphasis on distributed cognition. Course content is no longer provided by the teachers, it must be constructed and realized by teachers and students jointly. Platform must support collaborative editing and personalized annotations, and support students to participate in the course content.

5. Emphasis on Learning process oriented evaluation, take the developmental evaluation based on electronic portfolio.

4.2. Development Trends and Models of Network Teaching Platform

4.2.1. From Content Design to Learning Design

The current network teaching platforms take learning object as the core, focus on building and managing of objects, lack of awareness of the teaching activities. Therefore, recent years witnessed a new trend in the development of network teaching design. That is the change from the view which takes learning object as core to the new view which takes learning activities as core. The designs of learning object make teaching and learning process specific. Learners can promote learning activities in a certain order, so as to achieve teaching goals [8]. According to this view, only learning objects cannot constitute the effective teaching, these learning objects must be organized into a certain structure, combine learning objects with specific learning behavior through learning activities. Teachers' teaching design mainly reflected in the design of learning activities.

To support the design of learning activities, IMS developed the learning design standards (IMS Learning Design) in 2003, hereinafter referred to as LD standards. LD standards' goal is to provide a common framework to describe the process of teaching and learning, integrate the activities of the learners and teachers and learning resources and services used in the process. It also supports a variety of teaching methods, multiple learners' learning (including individual learners), Blended-learning. Figure 4 is the LD standard conceptual model.
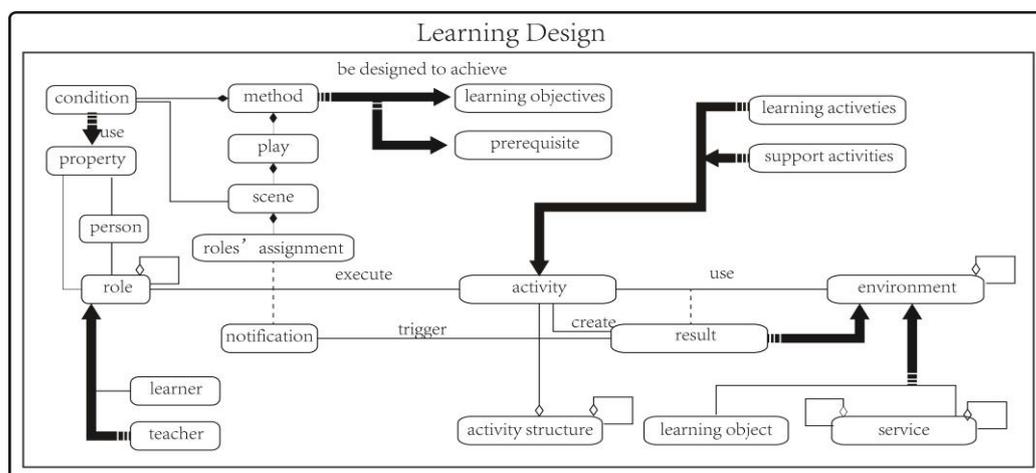

Figure 4. The Model of LD Standard Conceptual

4.2.2. From Network Course to Adaptive Learning

With network teaching based on modern information technology, learners can choose the time, place and learning content to study freely. Computers can record and analysis learners' learning information, which will lay a solid foundation for adaptive learning. Adaptive learning means we must build a personalized dynamic learning path according to the learners' learning performance and characteristics. Because under the network learning environment, learners' individual differences is far greater than individual differences in the traditional teaching mode, so to provide good adaptability will be the key to the success or of network teaching in the future.

Adaptive learning system is mainly composed of the following four parts [10]:

1. Knowledge Space: including media space and the domain model. Media space refers to the education resources and the corresponding description information. Domain model describe the current knowledge structure and learning goals in the field.

2. User model: abstract description of learners' information and data, such as state of knowledge, learning style preferences. User model consists of two different sub models, one sub model describe the current state of the learner's knowledge, the other one describe Learners' cognitive style and preferences. User model is divided into the two sub models because the learner's knowledge state in the first model is changing along with the interaction between the learners and E-Learning system, but the learner's cognitive style and preferences remain relatively stable is relatively constant in a very long period of time.

3. Learning observation: record the interactive situation between learners and system, such as whether the learners have visited a resource, or the time spent on a resource. Learning observation related to learners' behavior, and the result will be used to update the user model.

4. Adaptive model: defines a set of rules in order to describe the system's actual status, including concept selection rules and content selection rules. Figure 5 shows the structure of adaptive learning system, including the main components of the adaptive learning system model and the relationship between the components [11].
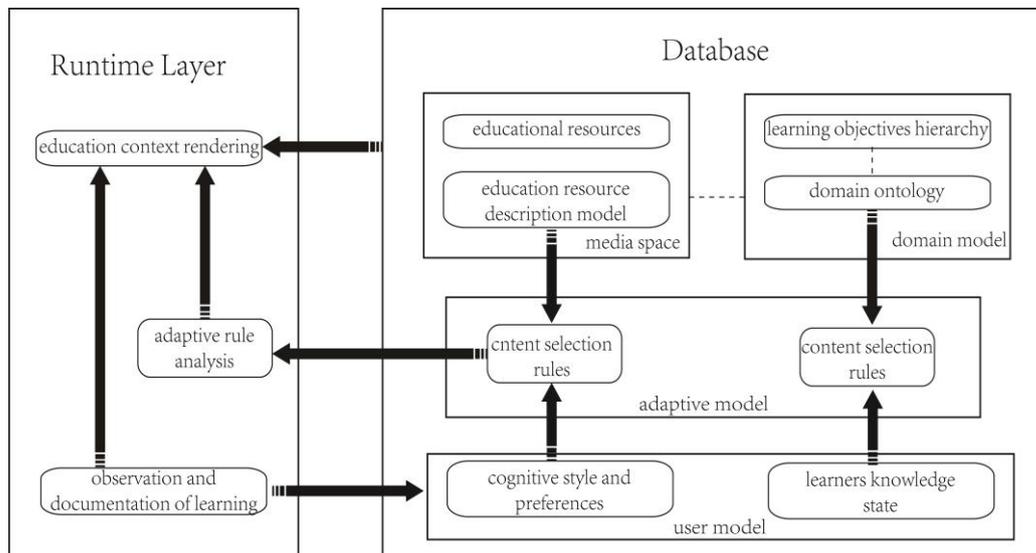

Figure 5. Structure of Adaptive Learning System

4.2.3. From Self-Regulated Learning to Cooperative Learning

In the past, network teaching platform only supports self-regulated learning, but with the rise of the concept of collaborative learning, network teaching platform will not only

support self-regulated learning, but also support cooperative learning in small groups as the unit. Figure 6 shows the model of CSCL System. [12]
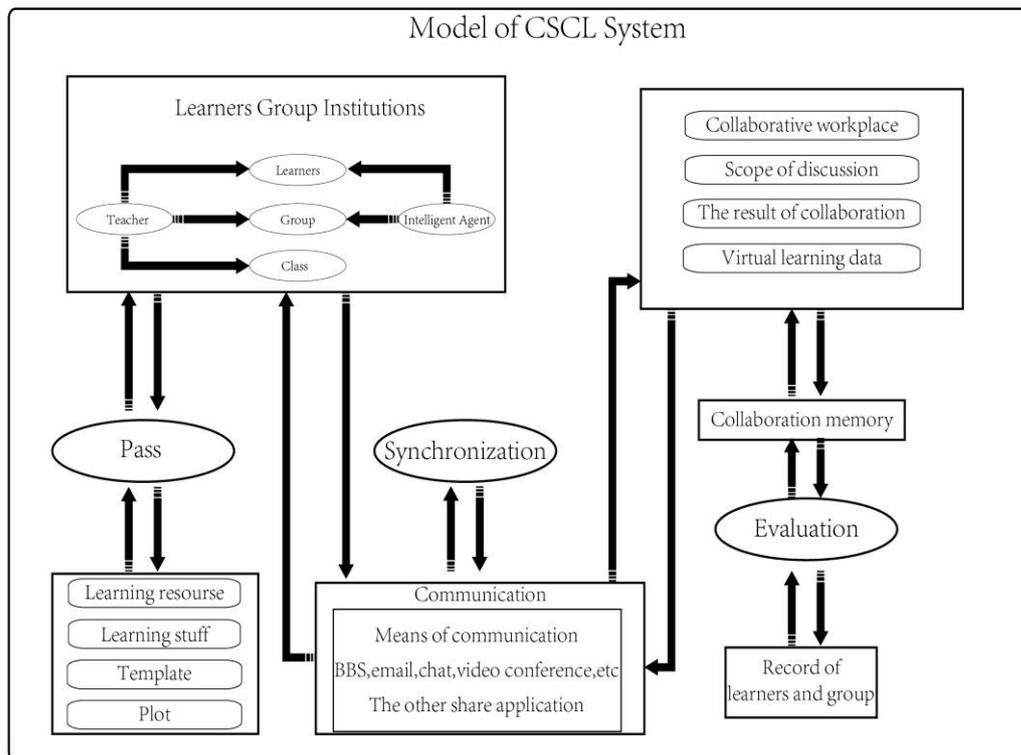

Figure 6.   Model of CSCL System

In this model, teacher, class, group, learners and intelligent agent form learners group, teacher will manage class and learning group, instruct students' study in the group. Intelligent agents provide learning resource for learners, such as learning stuff, group-tasks, template and plot. The system provides communication support, trace, evaluate and store the learning data.

5. Conclusion

Network teaching has a tremendous development space, has important significance for distribution of educational resources [13]. Network teaching platform which has excellent performance is the foundation of the realization of network teaching. To establish an advanced network teaching system, we must constantly track the progress of the new technology, use advanced technology to build effective network teaching system. This paper studied an individualized network teaching model based on intelligent agent technology and network teaching platform based on net-web platform technology. It will have certain reference significance for the further development of network teaching.

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