Design and Implementation of Network Artifact System Based on Web

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Abstract. The article mainly explains technology of Intelligence Computer-assisted Instruction based on web, and propose more reasonable and standard scheme, and analyze the function of each module and the style of implementation.

Keywords: Web, CAI, ICAI, Artifact.

1 INTRODUCTION
Modern information technology characterized by computers and modern network technology, has greatly contributed to the socio-economic development and has led to a revolution in knowledge and information. The traditional CAI courseware system make all the teaching content in the stand-alone device programmatically placed in the courseware, which the path and content learned by students in teaching process. However, lacking of necessary communication means and intelligence, it can not achieve the interaction between teachers and students, and teach according to the different cognitive ability of students. With the maturity of computer network technology, succession of artificial intelligence in the field of expert system, it provide a new space for the development of CAI, which direction is Network, intelligent we believed.

2 THE EVALUATION STANDARD OF ICAI
Intelligence Computer Assisted Instruction—ICAI has the following characteristics:

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Automatically generate a variety of problems and exercises.
Choose content and adjust progress according to the level of student and
learning situation.
Automatic solution to the problem and generate answers based on
understanding of teaching content.
The ability of natural language generation and understanding can realize a
relatively free teaching Q & A system to improve the initiative of
human-computer interaction.
The ability to explain the teaching content.
Diagnose student errors and analyze the causes, then take corrective action.
Evaluation of students' learning behavior.
Evaluation of the teacher's teaching behavior.
The ICAI system with all the above features is perfect, but implementation
is difficult. Generally believed that one or several features above can be called
ICAI.

3 THE TECHNOLOGY OF REALIZATION
3.1 THE REALIZATION OF CLIENT/SERVER
The necessary date information used for teaching and cognitive model of
student describing stored in the server-side. Teachers are responsible for the
implementation of Server-side teaching content update and maintenance
through the Client in the teaching and research office, and students in the
multimedia classroom learned content through the Client and Server
connected, after that the student client software will automatically modify the
cognitive model for students based on the knowledge of the knowledge points.
The supervisors realize supervision and guidance of the teaching process
through the Client and Server connected.

3.2 THE ESTABLISHMENT OF COGNITIVE MODEL
ICAI emphasizes on preparing different teaching content according with the
different cognitive models of students, to realize individual teaching and
heuristic teaching. Under the constraints of cognitive psychology and
pedagogy development, we still can not establish a single person's cognitive
model.

We roughly divided the students’ cognitive model into high, medium and
low three levels according to their different cognitive ability, and also
organize the lesson plans with the same content into high, medium and low
three levels, which respectively support to different students with
corresponding cognitive ability.
3.3 THE REALIZATION OF INTELLIGENT TEACHING PROCESS

We learn from the expert system design methods and realize intelligent function in ICAI courseware system, which organized the corresponding rule base, fact base (study traces record base) and reasoning mechanism, as shown in Figure 1. The following is a brief introduction to the reasoning mechanism: the rule base consists of book, chapter, section, hypertext lesson address, threshold and multiple prerequisites, reflecting the prerequisite for the study; study traces base consists of book, chapter, section, cognitive level, the number of learned, reflecting the students’ cognitive ability. The contents of the rule base are modified by the teachers. Students’ study traces record, one table for each student, modify automatically by the student client software according with study situation. The reference process is judged by a dedicated reference module of the rules provided by the rule base and the facts provided by the students’ study record database. After the completion of each section, the cognitive ability is divided into high, medium and low three levels according to answering the accuracy of the attached exercises, and the results stored in the student study record database. Next time the system prepared the appropriate difficulty of teaching content according to their different cognitive ability. We can see this measure of cognitive ability is dynamic, however you can choose the content manually following your own will. If your selected content has been learned, it will be prepared for the content based on the grade you received; otherwise, it will determine to learn or not according to the rule base and the study traces record. For example: rules in the database limited to learn the second section of first chapter before learned the first section of the first chapter, the system will give a warning for someone break it. In order to enable students to study under the control of the system, three levels of high, medium and low lessons plans are a hypertext document for each section, which does not contain the internet link.

3.3.1 The Given Value of the threshold

When the answer to the question is less than the threshold of the section after
the student completed the study, the system will mark the section unstudied, and force you to re-study the section next time login in. Generally, those special importance chapters have a high threshold.

Here's a way to evaluate the importance degree of a section in this lesson:

\[ \text{Important} (N) = \text{IN} (N) + \text{OUT} (N) \]

Important (N) - Section N (arranging all sections in book by serial number) in the position of the course. IN (N) — the sum number of the remaining sections affect on the knowledge of section N in this course. OUT (N) — the sum number of Section N affects the remaining sections in this course. When all the Important (N) calculations in this lesson are completed, the threshold for a section is given. Threshold Valve (N) is less than 1 of percentage and is proportional to Important (N).

If Right (N) is the accuracy of answering the questions after the student learned the knowledge of Section N. Variant Ruler = 1 - Valve (N). The rules for the given cognitive model are as follows:

\[ \begin{align*}
\text{If } & \text{Right(N)} \\
& \text{If Valve(N)} \leq \text{Right(N)} \\
& \text{If Valve(N)} + \text{Ruler} \times (1/3) \leq \text{Right(N)} \\
& \text{If Valve(N)} + \text{Ruler} \times (2/3) \leq \text{Right(N)} \text{ Then Cognitive ability as "high"}
\end{align*} \]

3.3.2 System Security Technology

Due to ICAI prepares different teaching content for users' different cognitive models (high, medium, low), students are required to register with their own names and passwords in student client software, to ensure the accuracy of the user's cognitive model. The system will be to read the appropriate information from the student database after recognized legitimate user, and sent to the ICAI analysis module to build the student’s cognitive model as the basis for teaching. Otherwise the student will require to simply register, and truthfully fill out his information into the system to become the legitimate user, assign a default value from the student database, which build the basis of cognitive model as he first used the system.

The user logs in for the first time, the password is the user name. After the login in successfully, the system immediately requests to modify the current default password. Later, the user can make any changes to their own password.

3.3.3 Teaching Evaluation

We use the following method to achieve the evaluation of the level of students’ study. \( n \): the total number of users of the system. \( X_i \): the I-th student's test scores.

\[ \text{Definition:} \]

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Known by the definition, $S$ is the standard deviation of the student’s overall academic. $Z_i$ reflects the $i$-th student’s many times of deviation between the score and the average score than the standard deviation. $Z_i$ measure the test results will not be affected by the difficulty of the test, and more persuasive than $X_i$, because of the standard score ($Z_i$) is statistics reference zero (average) position fixed and the unit length (standard deviation), you can do each other comparison after different scores of the original score converted into standard points. For example: The student’s original score were respectively: 80, 90, the standard points were 2.5,2. , which not means the student’s improvement because of the second test original score is higher than the first. The assertion is: the second test standard score is lower than the first, so that the student is step back. Experience showed that the standard values are generally between -3 and + 3. If the standard score is positive, it indicates that the learning competence is above the group level; otherwise, the learning competence is below the group level.

\[
\bar{X} = \frac{\sum_{i=1}^{n} x_i}{n} \quad S = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{X})^2}{n}} \quad Z_i = \frac{X_i - \bar{X}}{S}
\] (a)

4 THE PILOT SYSTEM

According to the above idea, we have established an ICAI test system based on Client / Server model and linear mathematics teaching. The server side of the system uses SQL Server 6.5 to organize and manage the student database (storing student information, answer files, study traces record) and "knowledge base and rule base" (including question bank, test question bank, rule base, communication database and the test paper database). The lesson plan for teaching is organized into a hypertext situation, managed by the IIS (Internet Information Server) of the Windows NT Server running on the server. Client use Chinese Enterprise Edition VB 5.0 as a development platform.

Its main features are intelligent, advanced technology, clear structure, strong interaction, user-friendly, easy to operate, and strong expansion. The study content presented by advanced hypermedia organizational structure, designed in a vivid, flexible and realistic way, using advantages of multimedia data like the map, text, sound, like on Web, and highlight on the mouse selected area, background sound effects and other formal Performance, so that attract students to learn "linear mathematics", fully mobilize the enthusiasm and initiative of students, deepen the students’ impression on difficult of the course, which has achieved good teaching results in the test class. The introduction of teacher client and supervisor client, make students, teachers, supervisors exchange information, and the system has a strong vitality.
5. CONCLUSION
Web-based courseware is the main form of multimedia courseware and a resource base for developing online teaching in the future, however there are still very few excellent practical courseware, and also very small about the development of such courseware model, development tools, development of technology. We believe that only to step up the research and development of such courseware, can make it online teaching into the practical field as soon as possible. It has been proved effective of the methods and techniques mentioned in this paper are the practical application of our Web-based courseware development process.

ACKNOWLEDGMENTS
Peng XIE, Born in 1983, Master graduate, who mainly engaged in the direction of the network database, software engineering. The direction of the paper: Network and database technology.

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