Web-based Intelligent Tutorial System: It’s Design & Development

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Abstract
Present Intelligent and web-based E-learning is one of regarded topics. So researchers are trying to optimize and expand its application in the field of education. The aim of this paper is developing of E-learning software which is customizable, dynamic, intelligent and adaptive with Pedagogy view for learners in intelligent schools. This system is an integration of adaptive web-based E-learning with expert systems as well. Learning process in this system is as follows. First intelligent tutor determines learning style and characteristics of learner by a questionnaire and then makes his model. After that the expert system simulator plans a pre-test and then calculates his score. If the learner gets the required score, the concept will be trained. Finally the learner will be evaluated by a post-test. The proposed system can improves the education efficiency highly as well as decreases the costs and problems of an expert tutor. As a result, every time and everywhere (ETEW) learning would be provided via web in this system. Moreover the learners can enjoy a cheap remote learning even at home in a virtual simulated physical class. So they can learn thousands courses very simple and fast.

Keywords
Expert Tutor, Intelligent Learning, E-learning, Web-based learning

1. Introduction
The application of computers in learning began on 1980. Many efforts have been done in order to update and optimize electronic learning (E-learning) yet which great and dramatic advances have been observed in recent years. Generally, E-learning means to improve educational efficiency using information and communication technology [1].

At the first, some Medias like CDs or web applied for E-learning. But these kinds of education are static, non-intelligent and inflexible. Because the course subject had been organized by prior procedure and then trained to different learner in the same style. Diversity of learners led to decrease the efficiency of this style. In fact, repeating some lessons was needed for some learners in this method and also some lessons must be removed for some other learners. Later the researchers in pedagogy sciences (training/learning methods) concluded that the learning must be dynamic and intelligent. The fact is that an expert tutor can adapts the sequence of lessons and speed of training with aptitude and characteristics of learner. He can also adjust the expression style with learner’s mood as well as cancels the class due to incorporate mental conditions of the learner.

Nowadays, “web-based learning” and “intelligent learning” is one of the most regarded topics in education [2,3]. Moreover, expert tutor is infrequent and expensive. A web-based tutor has some benefits like tirelessly, predominate on concepts, low cost and invariant of time and place. However millions learners of the world can learn by thousands of expert tutor via web in an intelligent and virtual schools.

This paper introduces an intelligent system to apply the abilities of expert systems. So E-learning would be efficient, adaptive and performed by computer and web. Adaptation of web-based contexts is very important, because the contexts would be used by millions variant learners. So the concept, which is developed for one user, isn’t applicable for others [3].

The proposed system determines the learning style by a test. Then the learning process starts. Gradually, some characteristics of learner may be change by learner's progress. These improvements would be saved by system in learning process. So learner model gets more accurate step by step.

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System can receives scientific and mental feedback of learner expertise and intellectually and then change the learning style during the process. This web-based system is developed to facilitate learning every time and everywhere (ETEW). Web-based content is installed and supported in one place while millions learners of the world can use it just via a computer connected to the internet [4]. The aim of proposed system is that to offer the content which the user is not aware about it.

2. Intelligent E-learning System

The adaptive intelligent systems are not novel at all. All of these systems are a kind of “Intelligent Tutoring Systems (ITS)” or “Adaptive Hypermedia Systems” [5]. E-learning systems are categorized into two classes: intelligent and non-intelligent. Non-intelligent learning is static, inflexible as mentioned. In these systems, tutor develops course topics previously. Then software engineer presents them in variant methods and the same style to learners. The same style for variant learners is the biggest disadvantage of these systems. Since there are different kinds of learners in E-learning systems in aspect of awareness and mentality, it intensively needs to organize the course contents intelligent and present them to the learner well.

The aim of intelligent E-learning is to realize the customized and adaptive E-learning using of course content, learner type and education method [6]. This system can recognize the student type. Then it can chooses appropriate course content from knowledge base and present the contents in proper style to the learners. Figure 1 shows the process of ITS.

![Diagram of Intelligent Tutoring System](image)

**Fig. 1. Process of Intelligent Tutoring System**

Some available intelligent E-learning systems are introduced in the following to handle the pragmatics of three elements: content, learner model and education methods for adaptive and customized learning

- **VCA System** [7]: To train the learners, it considers individual differences and talents of learners to develop a virtual classmate agent.

- **SQL-Tutor System** [8]: It has been developed by guided exploration. This system selects some questions in basis of learner’s model. Then it evaluates learner’s answer. It updates the model based on answer validity. Choosing questions would be repeated based on model.

- **Lisp-Tutor system** [9]: This system guides the learner intelligently in each step of problem solving without considering his answers. This system tries to teach LISP.
DeSIGN System [10,11]: This is a software to teach American Language to deaf learners. This system teaches English words by elements of “train- test” and “teacher” graphically. This system is used in Pittsburg deaf School now.

EIAS system [12]: It is as adviser for collaborative learning.

CAES system [13]: It has been developed by integration of shipping simulation and intelligent decision system. Its task is to teach shipping to captains in virtual turbulent sea.

UC-Links [14]: It is an intelligent system to present the courses in the universities.

GENITOR system [15]: It is the generator of training programs.

ICATS [16]: This system coordinates the expert system with multimedia system in an intelligent learning system.

3. Web Based Intelligent Tutoring System (WITS)

The WITS is very important in order to improve efficiency and effectiveness of educational environments. These systems can also be responsible and compatible with the heterogeneous population of learners. An E-learning which is efficient, adaptive and dynamic can recognize learning style of learner by pedagogy principles. It can adapt the learners with current status of system. Then it changes its behavior dynamically and presents the learning concepts according to learner’s model. This way leads to improve learning rate finally.

Some psychologist and pedagogy researchers applied many models in adaptive E-learning systems to model behavior and learning style of learners. This model has many advantages in comparison with others. They are proper analysis, recognition of ideal learning style and application of educational science in modeling [17]. Next section introduces styles of learning based on Jakson model and questionnaire.

3.1 Learning Styles

An adaptive E-learning system is based on accurate recognition of behaviors and individual characteristics. In addition of aptitude, personality and behavior, learning style is very important as well [17].

This paper is based on five learning style which is summarizes in Table 1:

- Sensation seeking (SS): These people are impulsive and aren’t patient.
- New situations are exciting so that they can’t wait and would like to experience and explore it immediately. They believe to action and perform multiple tasks simultaneously. These people would rather to explore their environment by themselves and also learn by test and error.
- Goal Oriented achievers (GOA): They adjust certain and difficult goals.
- They try to increase their abilities by attaining skills and collecting required cognitive resources to realize their goals. They think that troubles are as instructive challenges. Furthermore they believe that can realize to whatever they want.
- Emotionally Intelligent Achievers (EIA): Emotional independence and rational thinking are prominent characteristic of them. They are patient learners who have the best efficiency after perceiving of logic behind a problem. They can generalize well from one problem to others. They often divide a problem to smaller and intelligible ones in this process.
- Conscientious Achievers (CA): They are responsible and wise people.
- They can learn well by collecting, analysis and review some information before action. They prefer to analyze all problem aspects. Thus they can relate discrete data to each other and avoid making a mistake. These people usually have extensive knowledge in areas of interest.
- Deep learning Achievers (DLA): they have deep perception of concepts.
They want to know how can use previous taught practically. They may learn well when would be aware of not value. So they can test that theory or idea. In fact, learning is difficult for them, when they don’t know the target [17].

<table>
<thead>
<tr>
<th>Learning style</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensation Seeking</td>
<td>They believe that experiences create learning.</td>
</tr>
<tr>
<td>Goal-oriented Achievers</td>
<td>They set difficult and certain target. They have self- confidence to achieve them.</td>
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<tr>
<td>Emotionally Intelligent Achievers</td>
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Table 1: Summarizes the Mentioned Learning Styles

4. New Architecture of a Web-Based ITS
We propose the formal model of a web-based intelligent tutoring system showed in figure 2. The model consists of five parts. New ITS contains curriculum model with a set of cognitive states which records its cognition or knowledge of the student that a set of user states (student model) recording basic information such as personal data, student characteristics, pre-knowledge, error knowledge, etc. about the student. The student model updates its state after finishing a learning process. Due to the differences among uses’ teaching strategy preferences, learning style, memory and knowledge levels unique to the expert model. The interface model make selection of a set of knowledge concepts that based on the student’s knowledge of the domain, links between knowledge concepts, and student’s desired detail level of the presented educational content. Evaluation of the student’s performance updates the inferable student characteristics and may create a feedback for student such as tasks, life chatting with other students as a kind of learning called collaborative learning. Finally, the new ITS makes use of domain knowledge and teaching model to design a teaching process based its cognition or knowledge about the use of intelligent e-learning. A student state used to record information about the student vital for the system’s student-adapted operation. It includes personal data that concerns information that for the identification of the student. Knowledge level such as novice, beginner, intermediate, advanced, etc. of the sub-domains and the whole domain. Interaction records which record the interaction of a student with a system. User characteristics and knowledge levels directly affect the teaching process whereas most of the interaction information indirectly.

A formal model of a web-based intelligent tutoring system is presented the system represents domain knowledge based on ontology to improve the sharing and reusing of domain knowledge and the system constructs the user environment based on student’ cognitive abilities, knowledge levels, pre-knowledge student, learning styles, psychology characteristics, etc. in order to improve the self-adaptability and pedagogical effects of the system. The student model distinguishes the information about user and what a pedagogical model. Using intelligent tutoring system to develop web-based learning communities a highly re-usable ITS framework suitable to web-based course with a set of “intelligent” functions allowing student modeling and automatic curriculum generation.

4.1 Details Features and Components of (WITS.php)
4.1.1 LEARNERS
Accessibility: WITS was designed with accessibility as a priority. A wide range of features ensure assistive technology users can participate fully in learner, instructor, and administrative activities. DIV based themes are available for added accessibility. WITS conform to international accessibility standards. IMS/ISO Access for All support allows learners to configure the environment and content to their specific needs.
Social Networking: All WITS users can develop a network of contacts, create and join interest groups, set up a network profile, and link any of the thousands of remote gadget applications into their networking environment. Photos can be shared across courses, or through the social networking area.

Things Current: When a student or instructor logs into My Start Page, a list of all current information is presented, providing quick access to ongoing activity in their courses.

Security: Login passwords are encrypted. Forgotten passwords must be reset, rather than retrieved by email, removing the possibility they might be intercepted when being sent over the Internet.

My Courses: Instructors and students can manage the WITS courses they teach and/or are enrolled in. When a student registers they are automatically logged into My Courses.

Inbox/Messaging: All users on a WITS system have an Inbox, through which they can send and receive private messages from other users. Messages sent are saved to Sent Messages, which remain for a set period before being deleted. Messages can be exported and saved externally.

Student Profile: Students can add personal information about themselves for others to see, and include a profile picture, which is also displayed with forum posts. The photo gallery can be used to create a profile album, where a collection of profile pictures can be stored.

Adaptive Navigation: Learners can move through WITS content using global, hierarchical, or sequential navigation tools. Navigation elements can be hidden to simplify the environment.

Work Groups: Learners can collaborate with others on course projects; communicate as a group through the forums, share resources using the File Storage utility, and work together authoring project documents. Exercises or assignments can be submitted to a group leader, or course instructor.

File Storage: All users on a WITS system have their own file storage utility. File storage areas can also be shared across groups, or an entire course. Version control can be enabled to keep track of drafts or changes to documents.

Group Blogs: Each group has access to their own blog, to which they can post public messages, available to all course member, or private messages, available only to group members and instructors. Add Latex formatted mathematical notation and multimedia objects to blog postings.

Feedback: Following an action (such as saving preference settings, or posting a message), feedback is given on the status of the operation. This could be a success message, warnings to consider, or errors to fix.

Preference Settings: Learners can control WITS features and the theme WITS is presented in. Students can control visual display settings, content adaptation settings, navigation controls and learning tools settings. The Preference Wizard is available from anywhere in WITS, to make quick adjustments to preference settings.

Communication Tools: Learners can communicate with others through their Inbox using WITS's private mail, through the discussion forums, the chat rooms, or the "User's Online" tool. Threads and messages can be sorted in a variety of ways. Students can communicate with those in other courses through shared forum, or a community forum, or through networking contacts or groups. Subscribe to forums or topic threads to have messages sent by email. Students can edit their forum posts for a specified number of minutes, and can search through messages in the current course, enrolled courses, or all available courses.

Content Package Viewer: Standard Content Packages can be exported from WITS to be viewed offline in the accompanying viewer.

Content Tracker: Learners can keep track of the content pages they have visited.

Test Manager: Learners can take tests, review test results, and keep track of their scores. Course Guests can take practice tests. Students can return to a test previously started but not completed, and begin where they left off.

Glossary: Words and phrases added to the glossary by the instructor can be accessed from terms embedded within content pages, or viewed alphabetically in their entirety using the Glossary tool.

Links Database: Each course, and groups within courses, has a tool for collecting links to Web-based information. Both students and instructors can add links. Instructors can manage course links, and students can manage group links.
Course Search: A search engine allows learners to search course content, and search for courses in the course catalogue.

Content Repository Search: Learners can search the Content learning objects repository for content related to the topics they are studying, and download content packages for viewing offline.

4.1.2 INSTRUCTORS

Social Networking: Instructors have all the networking features learners have. They can turn on social networking within courses and create course networking groups to enhance class interaction.

Instructor WITS Handbook: Instructor documentation is linked from each section of the handbook to the screen WITS it refers to. A link to the full Handbook is available on every screen. The handbook can also be searched or browsed. If enabled, instructors can add their own notes to the handbook.

Guest Access to Courses: Guests can be granted access to private courses through a guest URL, sent to them by a course instructor. Guests can view, but not post content to a course.

Course Tool Preferences: Instructors can choose from the available course tools and menu modules, and configure them for each particular course. Optionally display tools in the main navigation bar, or link them into the course home page for quick access. Tools can be located on the course home page, or moved to a separate Student Tools page. Drag-and-drop course tools to arrange their order.

Course Manage Page: All WITS tools can be accessed quickly under Manage tab.

Content Usage: Individual usage statistics can be reviewed to identify gaps in content coverage and the learning tendencies of each learner.

Work Groups Manager: Instructors can manually create, or automatically generate work groups for a variety of purposes. Groups might be used to provide a private area where students can work, to create an assignment submission area, to assign a test to specific students, or for a variety of other possibilities.

File Storage: In addition to the File Manager, which contains files associated with WITS content pages, the File Storage utility can be used to store private files, to shared files with course members or group members, or used as a place to collect assignment submissions.

Assignment Drop Box: Extending the File Storage, instructors can create file folders for collecting assignment submissions, collected from all course members, from group members, or from individuals. A collection of assignments can be zipped together and downloaded. Comments can be made on each submitted assignment for review by the submitter.

Content Editor: Instructors can create content in HTML or plain text. This content can be imported from a local editor, or edited directly online. Release dates can be set to control when content is viewable to learners. Content pages can be rearranged within a course. Related pages can be linked to content as references or relevant information. Use the File Manager while creating content to upload and link in resource files. Click on the Insert button next to a file in the file manager to embed a link or an image in a page while authoring content. Add Latex formatted mathematical notation and multimedia objects to content pages. Content authors can include scripts and style sheets to control the functionality and appearance of content. IMS/ISO Access-For-All support allows content authors to create adaptive content to match student needs. Tests can be associated with content for quick access to a test after completing a learning unit. Tests can also be setup as prerequisites, so students must pass a test before accessing new content.

Visual Editor: A JavaScript based WYSIWYG editor is available as an extension of the Content Editor so content creators can format course materials without knowing any HTML. Using the Visual Editor, paste a MS Word document to have it converted to WITS content.

Accessibility Checker: The Checker Web service has been integrated into the Content Editor to allow authors to review the accessibility of their content to people with disabilities who may be accessing WITS using assistive technology. A variety of standards are available for an international audience. AChecker automatically identifies known accessibility problems, and allows authors to make decisions on potential problems that Checker cannot identify for certain. Accessibility reports are saved in the Checker database, and allow ongoing monitoring of accessibility as content evolves. The Checker Web service is also available as a plug-in for TinyMCE, so content can be assessed for accessibility directly from within the editor.
**Interoperable Content:** Instructors can export content from WITS as IMS/SCORM conformant Content Packages that can be viewed offline in the accompanying viewer, or imported into WITS or another conformant e-learning system. Entire courses or individual course units can be packaged for viewing or redistribution. Content from other compliant systems can be imported into WITS. Import and export complex content such as Java applets, Flash content, and other embedded programmed objects. Content packages can be imported and export with QTI Tests, and Access-For-All adapted content together in a single package. IMS Common Cartridges can be imported, authored or modified, and exported. Access-For-All adapted content can also be imported and exported with common cartridges.

Reading List: Instructors can gather a list of resources (books, papers, url’s etc.) related to topics in a course, and create a Reading List based on those resources.

Content Learning Objects Repository: Search the Content repository for course related materials. Download conformant content packages or common cartridges from the repository for viewing, or to import into a course. Export content from WITS into the repository, or export content from WITS or from the repository to be used in other learning environments.

**Backup Manager:** The entire content and structure of a course can be backed up and stored on the WITS server, or downloaded and saved to your local computer for safe keeping. Create a copy of a course as a master for future sessions, or move a course to a new location. When creating a new course, choose from the available backups to populate the course.

**News & Announcements:** Instructors can post messages to the course Home Page to guide learners through the course. News can be used for weekly introductions, announcing important dates, or posting critical information. The announcements page is always the first page a learner visits when they log into a course. An RSS feed can be turned on to display course announcements on other Web sites, or through news feed compilers.

**File Manager:** Instructors can upload and manage course related files. Directories can be created to sort files; zip archives can be uploaded and unpacked. A popup file manager can be opened alongside the Content Editor or test question editors. Course files can be easily linked into content pages or test items as they are being created. Text or HTML files can be created or edited online. Rename files, or batch move or delete files.

**Test Manager:** Instructors can create tests with multiple choices, multiple answers, true/false, ordering, matching, drag and drop, and a number of open ended question types. M/C, M/A, ordering, matching, and T/F questions are marked automatically. A test release window can be set to make a test available for a certain period, feedback can be customized, and test results can be archived. Self-marking tests can be created to provide students with instant feedback. Create surveys and link them to the course home page. Select from a pool of questions to generate random question quizzes. Assign tests to groups of students. Add questions to a Question Bank, then select questions from it to assemble a test or quiz. Create image based test items, and arrange items horizontally or vertically. Questions can be arranged in any order or presented in random order. A test property can be set to allow guests to take tests. Add Latex formatted mathematical notation and multimedia objects to test questions. Test questions can be presented all on a single page, or one at a time. Data from guest test takers can be collected.

**FAQs:** Instructors can create a collection of Frequently Asked Questions to provide additional documentation for students.

**Forums:** Instructors can create and manage multiple forums for each of their courses. Messages can be edited, deleted, locked from reading and/or replying, and "stuck" to the top of a thread list if a message is important. Administrators can create forums shared across multiple courses. Subscribe to forums, or to topic threads to have messages sent by email. Instructors can set a time limit for editing forum posts, so messages can be corrected if errors are made in the original post. Add Latex formatted mathematical notation and multimedia objects to Forum messages. Past forum discussions can be archived.

**Course Email:** Instructors can send bulk email to course members, assistants, or both. Insert tokens to customize messages for each individual user.
**Course Properties:** A default display language can be set for each course. Assign a course as public, protected, or private, or hide a course while it is being developed. Control student access to content packaging. Turn on an RSS feed for course announcements, and display them on other Web sites. Set the start date and finish dates for a course, during which it is available to students. Create a custom splash page for each course. Upload a custom course icon as a visual representation of the course. The course directory name can be customized to extend Pretty URLs (described for Administrators) creating a unique URL for each course.

**Enrolment Manager:** Instructors may import a comma separated list of students to enrol in their courses, or export an enrolment list for staff keeping or to import into other systems. Create an enrolment list online to add new students to a course. Automatically generate login names and passwords for students and send them by email when a student is enrolled in a course. Assign students as Alumni so they can participate in discussions for future course sessions. Filter enrollees by login, first or last name, or email address.

**Privileges:** Through the Enrolment Manager, instructors can assign course members access to various instructor tools, creating teaching assistants or co-instructors.

**Add on Modules:** Google Search, RSS Feeds, EWiki, SCORM Player, Payments, Certificates, Open Meeting and Adobe Connect, and many other modules are each available with a quick installer to extend the functionality of WITS. Add-on modules can be found on the WITS.ca Module Site.

### 4.1.3 ADMINISTRATORS

**Module Manager:** Administrators can install modules, enable and disable them, and define a default set of modules and menu blocks for new courses. Types of Modules administrator, instructor, group, course, and public modules, as well as fully integrated feature extensions, or third party add-on software. Modules can be imported directly from a central module repository, and can be automatically uninstalled.

**Social Networking:** Administrators can link to their own social networking ShinDig server, or use social.WITS.in.

**Security:** Administrators can enable CAPTCHA and email confirmation features to ensure the validity of those registering on the system. SSL can be enabled to encrypt all information passing between WITS and a user's browser. All data passed through forms, or through URL variables are validated to ensure security.

**Administrator's Home Page:** All administrator tools can be accessed quickly from a central Administrator Home Page.

**Patcher Module:** Administrators can install patches issued at update.WITS.ca to keep their WITS system up-to-date, and secure. The Patcher can also be used to share custom features across multiple installation.

**Administrator WITS Handbook:** Administrator documentation is linked from each section of the handbook to the screen WITS it refers to. The Handbook can be translated, and multiple translations managed for each WITS installation.

**Multiple Administrators:** Create multiple administrator accounts assigning specific privileges to each.

**Pretty URLs:** Administrators can turn on Pretty URL to have URLs with variables attached, rewritten in a more readable form. When turned on, public courses in WITS can be indexed by search engines.

**Master Student List:** Require newly created student accounts to be authenticated against a custom imported student ID/PIN paired list.

**Themes Manager:** Easily create a custom version of WITS by modifying an existing theme, or creating a new one. Import third party themes directly from the WITS.ca Web site using the Theme Manager (see Themes). Assign themes to categories of courses to give all related courses the same look. Export a theme to share with others. Login to submit themes to WITS.ca to make them available to the community. Theme designer documentation is available in the WITS Handbook. No programming is required beyond HTML and CSS to create themes.
Automated Installer and Upgrade: A fast and easy way to install or upgrade WITS! In most cases it only take a couple minutes, with little need for technical knowledge. Support is available through WITS.ca if you need help installing or upgrading.

General Statistics: View system login statistics.

Secure Course Content: Secure course content directory to prevent unauthorized access to course files.

Instructor Request: Review requesting instructors' personal information, and assign instructor status so they may create courses. Administrators are informed by email when new requests are made.

User Manager: Users on a system can be sorted, personal information can be viewed, and access privileges can be modified. Send announcements to all users on an WITS system, or to students, or to instructors. Search through the users database using a variety of search strategies to find individual students, or a group of students. User accounts can be batch managed to rapidly add, modify, or delete accounts.

Enrolment Manager: Administrators have all the same tools for managing course enrolments as instructors do, with the ability to manage students in any course. Create an enrolment list online to add new students to a course. Automatically generate login names and passwords for students and send them by email when a student is enrolled in a course. Assign students as Alumni so they can participate in discussions for future course sessions. Filter by login, first or last name, or email address.

Course Manager: Much like the User Manager, courses on a system can be sorted, their properties modified, and their instructors managed. Create new courses and assign an instructor. Use course backups to generate initial content for a new course. Create shared forums for select courses, or create a community forum for all courses. Easily jump between the administration section and courses without having to re-login each time. Administrators can create an enrolment "trigger" link, that when followed, students are enrolled in specified courses automatically when they register.

Backup Manager: Generate backups of courses to create master copies. Download backups for safe keeping or to move courses to another WITS server. Use backups to generate new courses.

Cron Utility: Optionally schedule scripts to run at specific times. Use the Cron Utility to run the Mail Queue every few minutes. Write custom scripts to generate statistics, create a system backup, or to send system reminders, etc..

Course Categories: The WITS course browser includes a course category browser, so courses can be sorted into a custom defined set of categories, perhaps by department or topic or grade level. Themes can be assigned to course categories so all courses within a category look the same.

Language Manager: Import language packs directly from WITS.ca, or upload them into the system from a downloaded language pack. Once imported, edit languages as needed. Create an WITS Language Pack by exporting the language from your WITS system. Make the language pack available to others, and submit it to the WITS. Translation Formulas is an attachment to have it added to the central language repository. Easily search through the text of the language to quickly find and customize interface, feedback, and module language. All languages are available in UTF-8, and courses can display multiple languages at the same time.

4.1.4 DEVELOPERS

Developer Documentation: Guidelines, instructions, recommendations for those who wish to develop WITS core features, is bundled with each WITS distribution.

OAuth API: When integrating WITS with other systems that support the Open Authentication Protocol, single sign-ons can be developed using OAuth.

Networking Gadgets: New tools can be developed for WITS based on the OpenSocial gadget standard.

Networking API: Information from the networking features in WITS, can be accessed through external applications by developing an client application using the WITS Social Web services.

Module Developer Documentation: Developers can create integrated and third party feature modules for WITS to extend its functionality. Guidelines, instructions, recommendations for those who wish to develop WITS Modules, is bundled with each WITS distribution. Install the phpDocumentor module to generate API documentation. Modules can be exported from the module manager to be shared or redistributed to other WITS systems.
Hello World Template Module: A sample module that implements all potential module features (in a simple manner), can be used as a template for creating new WITS modules.

Theme Designer Documentation: Guidelines for developing themes are included with the WITS Handbook. Theme designers can export themes to share or redistribute them. Only HTML and CSS knowledge is required for developing themes.

Patcher Module: Developers can use the patcher module to create patches to fix bugs, or to add new features or feature adjustments to WITS, and submit them to be added to the WITS public distribution.

WITS SVN Code Repository: Developers can check out the live evolving WITS source code from a public Subversion repository. With approval, developers can commit their features to the repository to be included in the WITS distribution.

WITS Bug Reports: Developers can keep up on bug fixes using the WITS Bug Tracker. With approval, developers can report to, and provide comments on, bugs listed in the tracker.

5. Proposed System

A web-based, adaptive and intelligent tutor is an E-learning system based on web which can be used remotely and ETEW. It can determine learner type (especially in aspect of learning style), learning content and presentation technique adaptively. So that it be updated automatically with learner’s characteristics and behavior. This system uses traditional intelligent E-learning. The first E-learning system which is web-based and intelligent, has been reported on 1995[5,18]. Learning all courses is customized well at home via web in this system. So learners can solve some examples and proper exercises ETEW. Finally he can attend in course examination which would be virtual or physical. Figure 2 shows the elements of intelligent tutor.

![Fig. 2. Elements of Intelligent Tutor](image)

5.1 Learning Environment

Learner can visits website of intelligent virtual school by authentication and logging in the system. An intelligent Graphical User Interface (GUI) is an interface between learners and intelligent tutor. This section of system can affect learning efficiency. An intelligent virtual class has some properties like graphical properties, audio and video to make learning attractive. Moreover, some tools are available to simplify learning process. Learners can communicate well with this inanimate and non-physical system by these tools. Some facilities are:

- Computer games- preferably intellectual games and commensurate with the level of learner
- Frequently asked questions (FAQ)- which consists of commonly questions and proper answers
- Video chat and email- for visual communication between tutor and learners

5.2 Training Method

Knowledge of expert tutor includes of two parts, course knowledge (learning content) and learning technique. Course knowledge is theoretic information, technical content and probably experiments which expert tutor notes. Learning technique is some experiences which he have got during teaching years [19]. An expert tutor determines learner level in according to IQ, understanding, behaviors, talent and individual characteristic like physical class. Learner level consists of “weak”, “slow learner”, “smart”, “genius” and so on. Tutor teaches educational content corresponding to learner level in proper method such as film, dynamic view, and game and even bringing up puzzle while he
get feedback from learner during training. So learner level may be changed. Tutor helps learner to learn by “the best way” in proposed system.

The expert tutor offers an education method based on learner’s type. Furthermore each course section has individual significance which is different with the others. Tutor often determine different scores for variant sections according to education method. Moreover he marks highest score to the most important section of course in all education methods.

There are two approaches in E-learning development. In the first one, a problem comes and some examples would be solved then. Finally the learners try an exam. In second approach, content is divided to some parts such as chapter, section, important subsection and so on. The learners take an exam at the end of learning. It is clear the second approach is more effective and has higher level than the first one. In this paper, the proposed system uses the second approach. The smallest part of any topic which can’t divide more is called “concept”. It is usually equivalent a lesson in physical class. Educational concepts transfer to knowledge base in this system. Then the system can distinguish all concepts and relocate all parts. Sometimes a lesson is needed to repeat, relocate or even remove for a learner. Most of available systems guide a learner to a special aim intelligently in learning process. While only a few intelligent systems provides selecting subsections of a concept for a learner.

This system uses a three layered structure to offer and implement a concept:

1. Pre-test
2. Learning concept
3. Post-test

The pre-test includes of some questions planned by an expert tutor to determine learner’s primary knowledge level. The learning concept depends on learner level. So the best method to train a learner is determined. Then learning process starts up. After learning is done, a post-test evaluate the learner by some questions. Figure 3 shows block diagram of proposed system.

5.3 Learning Styles

Learner evaluation is significant. It has two levels, conceptual and objective. Evaluating in concept level refers to learner understanding of lesson concept and evaluating in objective level denotes to learner understanding of lesson topic. Knowledge level of learner is determined with concept level and objective level. The tutor can extract proper questions from question base through an expert system, pre-test and post-test. He notes that a specific score is given to each question.

![Fig. 3. Block Diagram of Proposed System](image)

Selecting question should satisfy some rules. First, the questions should not be repetitious even if a learner would be trained one concept several times. Second, the question must be planned for all sections of a concept entirely. Third, expert tutor plans questions in all level. Sequence, number and level of questions are determined according to learner level and learning type intelligently. Sum of scores is calculated and learner level is determined after answering the questions.
Table 2 presents five categories of learner’s knowledge level about a concept [20, 21]:

<table>
<thead>
<tr>
<th>Knowledge Level</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>86 and above</td>
</tr>
<tr>
<td>Very Good</td>
<td>75-85</td>
</tr>
<tr>
<td>Good</td>
<td>56-75</td>
</tr>
<tr>
<td>Average</td>
<td>35-55</td>
</tr>
</tbody>
</table>

Table 2: Categories of Knowledge Level

This system updates the learner’s model during progress of question answering. This system can also save last academic status of learner and all his learning records.

6. Conclusion

A web-based, adaptive and intelligent tutor by expert system was presented in this research. Previous E-learning systems offer predefined and static learning concept sequentially to learners. While proposed system can adapts with learning styles (i.e. Sensation Seeking, Goal Oriented achievers, Emotionally Intelligent Achievers and Conscientious Achievers), aptitude, characteristics and behaviors of a learner. It acts as an intelligent tutor which can perform three processes - pre-test, learning concept and post-test - according to characteristic learner. This system uses expert simulator and its knowledge base as well. It is also web-based which leads to be simple learning, low-cost, available everywhere and every time. Consequently thousands of students can learn simultaneous and integrated efficiently. Presently the most educational systems try to be electronic, online, intelligent, adaptive and dynamic. The proposed system tries to get these properties. Moreover it doesn’t have any drawback of previous system and human expert tutor. It can improve efficiency of pedagogy and education too. In other words, it helps learners to study in “the best way”.

References