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Intelligent learning management system starters

Adebayo a. O.[1], Oyewale, a. E.[2]
[1,2]*School of computing and engineering sciences, babcock university, ilishan, ogun, Nigeria*

Abstract:- learning management system (lms) is increasingly gaining popularity in the academic community as a means of delivering e-learning contents. Simply placing lecture notes and videos among other contents on lmss do not particularly train the best. This situation could be improved with intelligent tutoring systems (itss) integration into preferred lms to make it more adaptive and effective, through enhanced student participation and learning. This work aims, therefore, to create a starter model and a model java its integrated preferred lms. The its integrated lms starter model was proposed through augmentation and a fluid iterative cycle of awareness, suggestion, development, evaluation and conclusion. Known open/inexpensive, tried and tested popular lmss were evaluated at cms matrix site, and complemented. Java its integrated moodle (preferred), employing certain architectural framework of its integrated lms, was created following the spiral model of software development.

Keywords:- integration model, intelligent tutoring, pedagogy, learning management, starters

I. INTRODUCTION

Teaching and learning process is being more supported by technological resources that offer different ways of interaction between entities, using sophisticated educational software applications. Various learning environments and other categories of educational platforms are very common in schools and universities [1], but have only been basically used as a source of storage for plain educational contents [2]. These contents, which include portable document format and powerpoint slides, are not fully providing the high quality educational assistance that technologies could enable [3]. Leaning management systems (lmss) enable delivery of online contents to and monitoring of learners. The system misses providing immediate and customized instructions to learners without human intervention. Unidirectional teaching has been proven to be grossly ineffective and rife with a lot of deficiencies [4]. It is important and essential to make lmss more "adaptive". This situation can be remedied with integration of intelligent tutoring system (its) into lms. Indeed, increasing the quality of interaction during tutoring is one approach to increasing the effectiveness of tutoring systems beyond the interaction plateau [5]. There has been increasing interest in developing learning systems which promote not just learning of the domain skills being taught directly by the system, but also promotes "robust learning," [6].

There are its integrated lmss [3], but none suggested determination of preferred open tried and tested popular lms before the its integration. It is important that the preferred lms be employed for optimized gains. Examinations of lmss had also been done severally [7], but were not done for the purpose of its integration consideration, and there is the need for a current re-examination rather than taking published results as granted. There is, therefore, the need for a starter model for its integrated lms, the need to determine the preferred open/inexpensive tried and tested popular lms, and the need to actualize model its integrated preferred lms, which this research focused upon.

A starter model its integrated lms was proposed through augmentation and a fluid iterative cycle of awareness, suggestion, development, evaluation and conclusion [8]. Known open/inexpensive, tried and tested popular lmss were evaluated at cms matrix site [7], and complemented with ingenuity. Java its integrated preferred open/inexpensive, tested and popular lms was created following the spiral model of software development (repeatedly passes through identification, design, construct or build (user feedback at this stage of the life cycle helps to effect the necessary adjustment in the construction or building of the software) and evaluation and risk analysis (user evaluates the software and provides feedback on their conviction about the software)). The programming environment includes wamp server (a package which comprises of windows, apache, mysql, php), macromedia dreamweaver and telligent systems. Developed system was tested to ensure proper communication between the system and the databases, that the various tools that the student will need when making use of the system were working perfectly, and that the system as a whole works.

The starter model would give a basic procedure to follow towards its integrated lms. The determination of preferred open/inexpensive tried and tested popular lms, and the model its integrated preferred lms are contributions towards engendering better interaction between the system and learners, to achieve optimal learning outcomes.

I. OUTCOMES

A. Starter model for its integrated lms

Figure 1 presents the proposed starter model for its integrated lms. The preferred lms is determined. Its is integrated into the preferred lms. The its integrated lms is utilized for personalized tutoring and learning, in order to achieve improved learning outcomes.

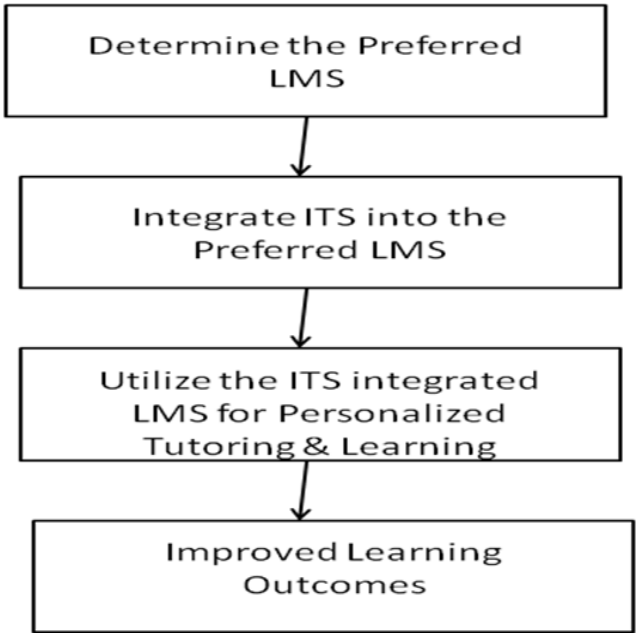

Figure 1 - starter model for its integrated lms

B. Preferred open/inexpensive tried and tested popular lmss

Moodle, sakai, dokeos, and edu.20 were the chosen open/inexpensive, tried and tested popular lmss. The evaluation criteria were security, performance, support, interoperability, flexibility, ease of use, management communication tool, administration tool and course delivery tool [7]. Table 1 presents comparison of their security features (1=it exists, and 0= it does not exist or it is inadequate or there is insufficient information to draw contrary decision).

Table i: security features comparison of the lmss

Feature name	Moodle	Sakai	Dokeos	Edu 2.0
Audit trail	1	1	0	0
Email verification	1	1	1	1
Granular privileges	1	1	1	1
Login history	1	1	1	1
Some authentication	1	1	0	0
Problem notification	1	1	0	1
Sandbox	1	1	0	0
Session cmd. Management	1	1	1	0
Versioning	1	1	1	0
Advanced caching	1	1	1	1
Percentage positive	**100**	**100**	**60**	**50**

Performance features include database replication, load balancing, page caching, and static content export. Database replication (snapshot, merging or transactional) is frequent electronic copying of data from a database in one computer or server to a database in another so that all users share the same level of information [9], without interfering with the work of others. Table 2 shows comparison of performance features.

Table ii: performance features comparison of the lmss

Features	Moodle	Sakai	Dokeos	Edu 2.0
Database replication	1	1	0	1
Load balancing	1	1	0	0
Page caching	1	1	0	1
Static content export	0	0	1	0
Percentage positive	**75**	**75**	**25**	**50**

Support features examined include code skeleton, develop community, online help, pluggable api, public forum, public mailing list, and user conference. Dummy code is inserted in a program skeleton to simulate processing and avoid compilation error messages [10]. Pluggable api provides a logical divide that allows for changes on one side of the interface without affecting the other. User conference is a forum for participants to interact. Table 3 shows support features comparison. Figure 2 depicts summary of the comparisons of the lmss. Moodle is adjudged the preferred environment.

Table iii: support features comparison of the lmss

Feature name	Moodle	Sakai	Dokeos	Edu 2.0
Code skeleton	1	1	1	1
Develop community	1	1	0	0
Online help	1	1	1	1
Pluggable api	1	1	1	1
Public forum	1	1	1	1
Public mailing list	1	0	0	0
User conference	1	1	1	1
Percentage positive	100	85.71	71.43	71.43

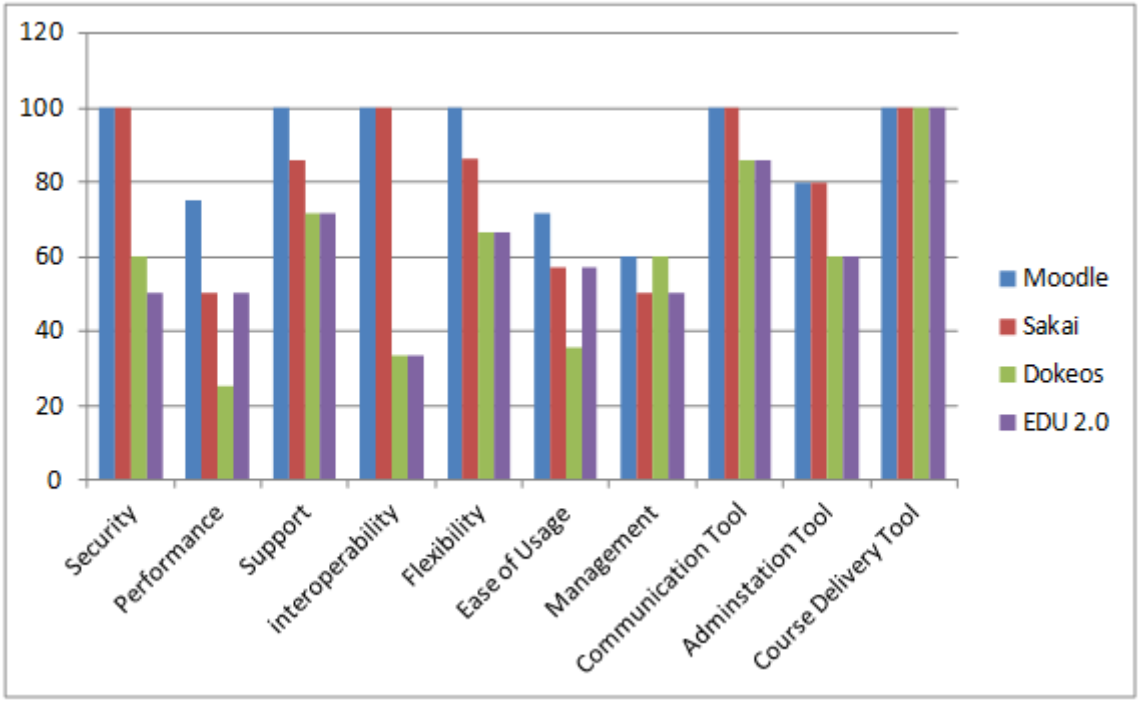

Figure 2 – pictorial summary of the comparisons of the lmss

C. The application

1) Adapted framework for integrating its into lms: figure 3 shows the adapted framework of its integrated lms [11], employed in creating the java its integrated lms. There is a knowledge base that contains the rules and data for the its. The rules in the knowledge base are in forms of selection constructs. There is a classification algorithm section that contains the algorithms used by the system to provide the requisite intelligence. In addition, there is a knowledge pre-processing section that comprises four layers, namely:

knowledge identification/pre-processing layer, knowledge synthesis layer, knowledge formalization layer, and knowledge alignment layer.

The student module comprises of three distinct knowledge databases (kdbs), which are personal information kdb (stores students' personal data to monitor their access to the system), learning kdb (deals with the accumulation of constraints such as tests and exercises, which are to be administered, as well as duration to answer each question of the tests and exercises), and profile kdb (stores the students preferred learning style or skills and the level each attains as the curriculum progresses).

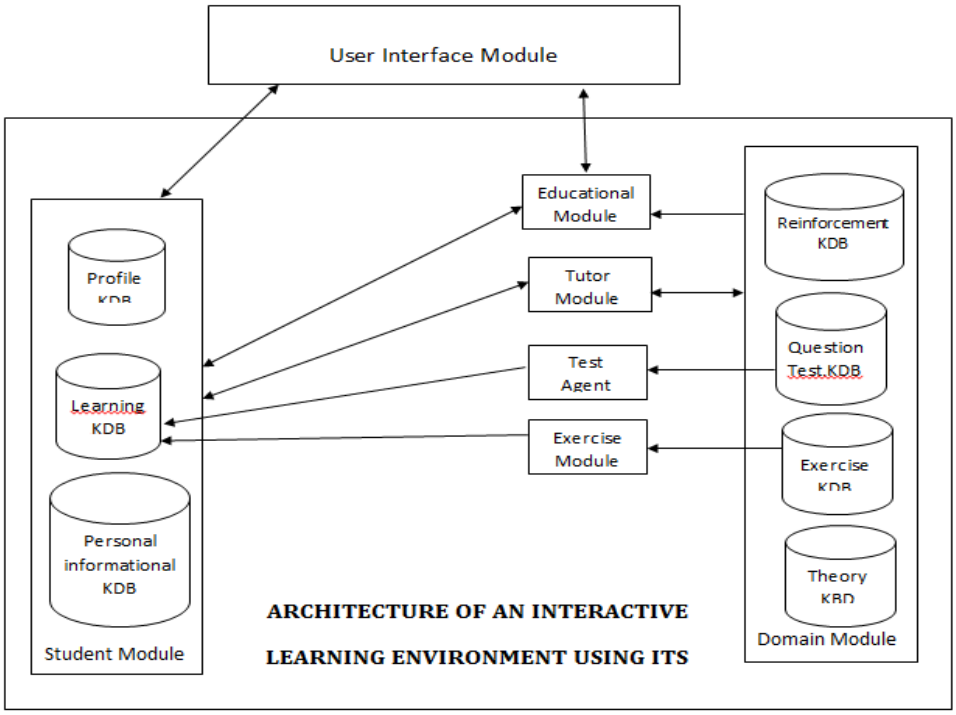

Figure 3 - architectural framework of intelligent tutoring system for interactive learning (adapted from: [11])

The reason for collating information regarding the students is to ascertain the academic level and preferred learning style or technique of the learner. The primary function of the student module is to develop a learning design adjustable to the learner, and to serve as an assistant to answer learner's problems. It is responsible for organizing and managing the information of each learner.

The tutor module controls communication with the student, centred on its teaching knowledge and comparisons between the student model and the domain knowledge. The tutor module comprises of various information taken into account. This information includes diverse tutoring tactics, strategies and schemes, which are stored in the student module. In order for the tutoring system to make educative actions like provision of feedbacks and remedial instructions, necessary and accurate information must be provided to the student module.

The domain module, a typical module in its, is responsible for providing the knowledge that is to be taught. This model consists of four kdbs, which are theory kdb (combines the pages of theory that have been primed for instructions on the subject matter), question test kdb (stores the battery of test questions related to the subject matter), exercises kdb (stores the related exercises on the subject matter), and reinforcement kdb (contains the information used by the pedagogic module to prepare the material to be shown when a learner needs to be assisted).

The user-interface module ensures interactions between the intelligent system and the users, and would establish communication with all the modules of the its. An its is as effective and efficient as all the modules it solely depends on to suitably model the student, expert, tutor, and domain modules.

2) snapshots of the model java its integrated moodle: adaptive learning is seen to be the process of spawning a unique learning experience for each learner based on the learner's disposition, interests and performance with the intention to achieve goals such as learners' academic improvement and satisfaction. There is the need to gather some learner characteristics before tutoring session begins, to initialize the student model. The information is gathered by giving a pre-test to the students before the start. The test includes short-answer

problems similar to the problems within the tutoring session. This helps determine which skills a student initially has mastered so this information can be used to discern the best policy for optimizing learning [12]. Feedback is most efficacious when it can provide information about the progress of these learners or information that can help them to advance in their studies [13]. Figure 4 shows the pre-test page, which is the first assessment interface. The learner is presented series of likely questions relating to the domain been taught to determine their cognitive stage/ level in partaking in that course.

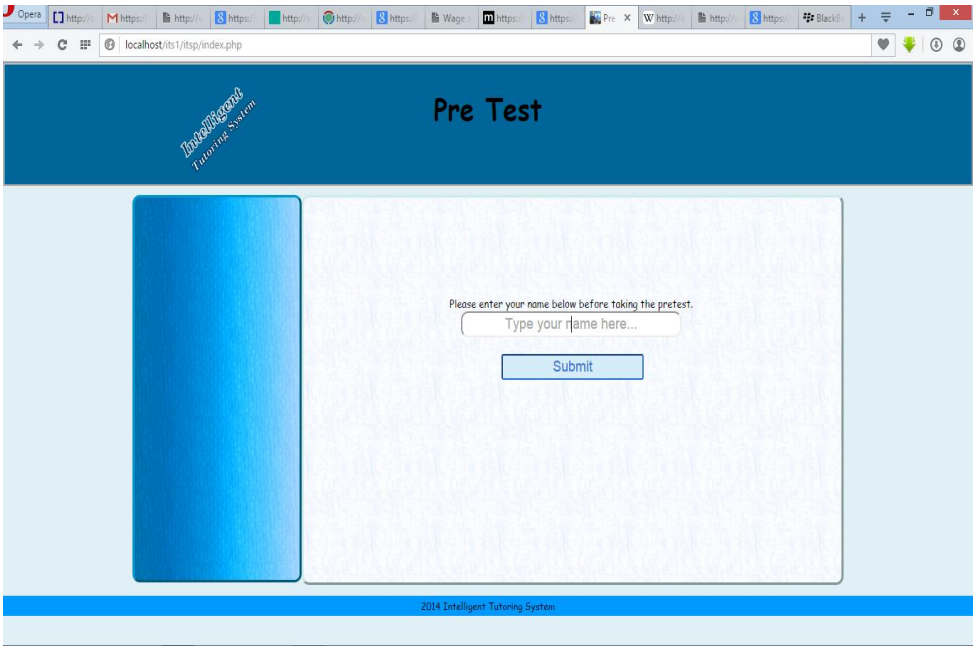

Figure 4 – pre-test page

Figure 5 shows the homepage, the main page of the intelligent tutoring system. Here the user could view all available classes, read instructions for using the system, and link to other pages, among others.

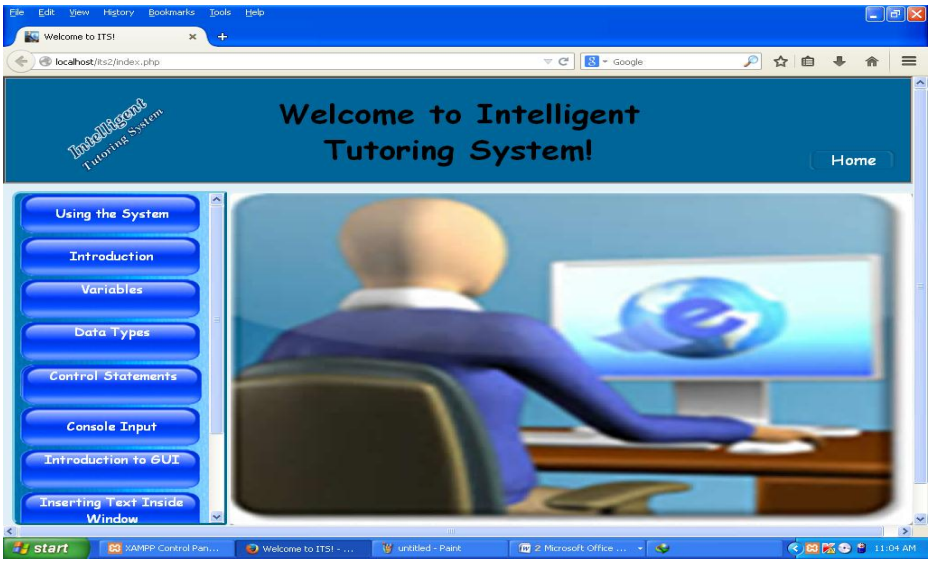

Figure 5 – home page

Figure 6 shows the introduction to course java page. This is the first class of the actual course. The learner is introduced to the course. It states tools needed for the course, and the applications needed to be installed. The java course consists of seven classes; variables, data types, control statements, control inputs, introduction to graphic user interface (gui) using awt/swing, creating a simple application with class j component, and e-learning activities. Figure 7 shows the variable start page, where the first java lesson begins.

Figure 6 – introduction to java page

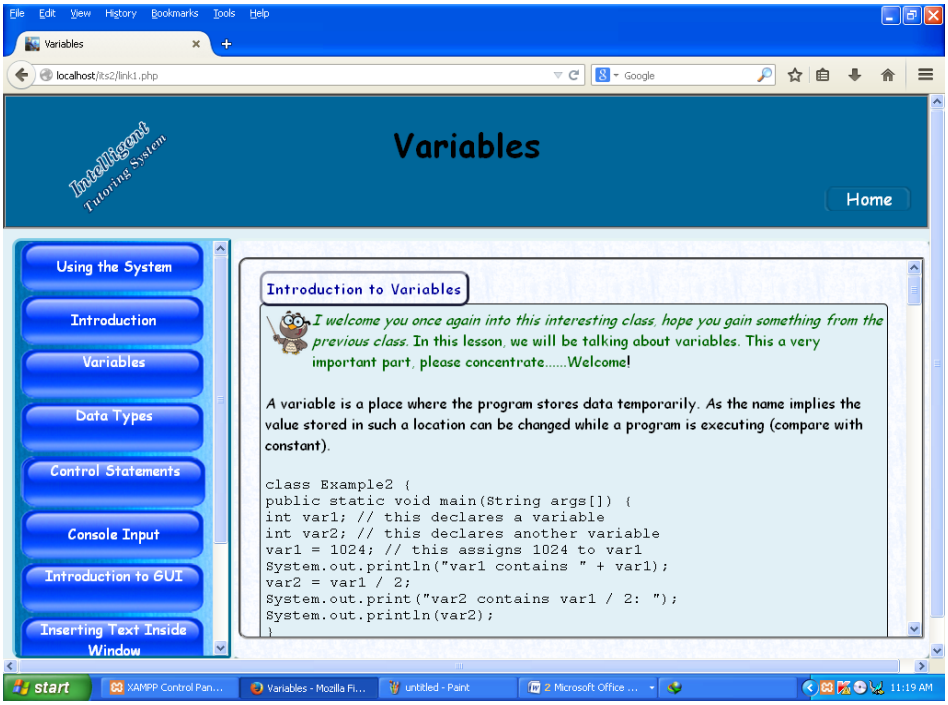

Figure 7 – lesson java variables start page

Figure 8 shows the e-learning activities page. On this page, the learner can start evaluation of their progress after the completion of each class. Each activity displays random questions, to inhibit familiarization with the questions. The learner simply logs in to partake in the activity test that is presented for each stage of the classes. Figure 9 shows the activity questions start page.

Figure 8 – activities page

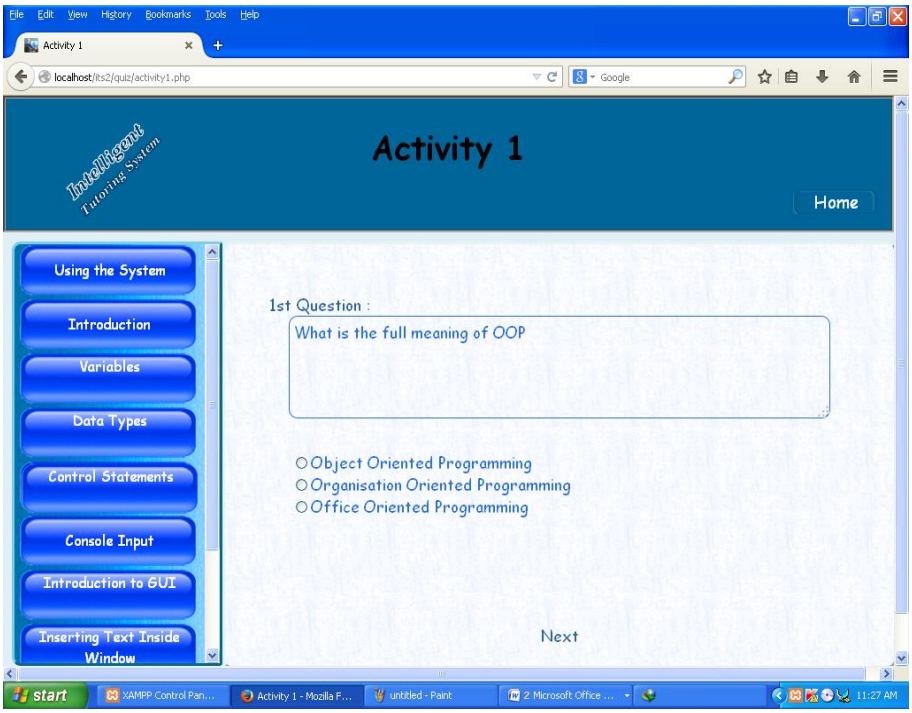

Figure 9 – activity questions start page

The administrator page is the avenue through which the system administrator manages the system. More questions could be uploaded for the activities, existing questions could be deleted, and learners' scores could be managed, among others. The facilitator is given the privilege to control user interaction and to keep track of students' participation. Figure 10 shows the edit questions initial page, after a successful login.

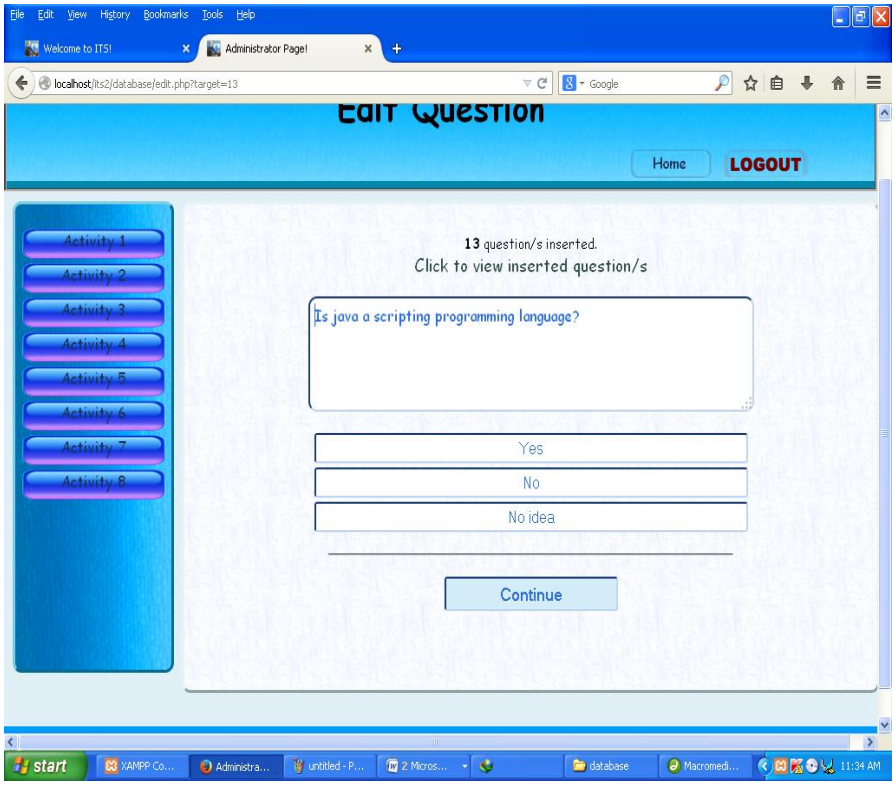

Figure 10 – edit questions initial page

II. RELATED WORKS

A. Pedagogy

Pedagogy is principally a combination of knowledge and skills required for efficient teaching [14]. It includes the function or work of a teacher (teaching), and the art or science of teaching (education and instructional methods) [15]. It also includes strong models of teaching and learning, which are authorized and enhanced or accelerated by progressively more ubiquitous digital tools and resources, that evaluate, measure, and support education and knowledge at various levels of the education system [16].

Technology has been layered on top of content delivery and used primarily to support students' mastery of required curricular content [17]. Four learning environment perspectives are required to support learner's needs. They are learner-centred (encourages attention to fixed ideas and preconceptions, and begins instruction with what students think and know), knowledge-centred (focuses on what is to be taught, why it is taught, and what mastery is to be achieved), assessment-centred (emphasizes the need to provide frequent opportunities to make students' thinking and learning visible as a guide for both the teacher and the student in learning and instruction), and community-centred (encourages a culture of questioning, respect, and risk taking) [18].

The building of genuine educational competence, or professional expertise, is based on the integration of different types of knowledge and skills during the life-long learning process. In the development of educational expertise, this kind of knowledge base is built from: theoretical, conceptual and existing knowledge; practical and empirical knowledge (skills); knowledge and skills related to self-regulation (students' ability to regulate their activities and learning independently); and socio-cultural knowledge [19]. Development of professional expertise is achieved through proper guidance for studies and learning, and research-oriented and developmental learning, in a congenial environment [20].

B. E-learning

Distance learning is based on an educational model or pattern in which teachers/lecturers/facilitators and students/learners are not physically present at the same place. Older examples of this kind of learning were the tele-school and teaching by mail [21]. A very significant feature of traditional formal education transferred into distance learning is unidirectional teaching methodology, with limited student participation and flexibility in their learning process. The effect of limited student participation in learning is limited understanding due to unenhanced leaning process [22].

In e-learning, the facilitator uses electronic means to communicate (synchronously or asynchronously) with the learners, and, in most scenarios, there are no intermediate face-to-face interactions. Three categories of e-learning are on-line teaching with synchronous moments, mixed on-line teaching, and computer based teaching [23]. In online teaching with synchronous moments, teacher-student interaction needs simultaneous moments which include internet relay chat (irc) and videoconference, and in some cases tele-immersion. Mixed online teaching encompasses real-time and face-to-face interaction, which can also be referred to as blended learning. In computer based teaching, contents are made readily available on cds and on the internet without the teacher synchronous presence. In this kind of e-learning, the contents are independent of time and space. The efficiency of the learning system can be determined using the following: learners read theory, assessed knowledge through practices or exercises, and answered tests. By adapting modern computer technology into education, students' performance in education will increase [24]. A learner, using the web as a means of knowledge acquisition, needs the following instructional helps and supports: access to learning materials; strategies for learning; time to learn; advices on what to learn; feedback on progress; involvement and interactivity [25].

Interactive learning environments are instructional methods aimed at strengthening the learner's knowledge, through the interactive effort, providing an environment that fuels and enriches the process that allows learners to interact to solve a problem. Interactive learning, involving social networking and urban computing, started to be important by the policies defined by the governments of the most developed countries [23]. Companies and other organizations also paid attention to these technologies because it allows easy information access in asynchronous way. More involved learning environments are lmss, such as moodle and blackboard, which are built to deliver contents and monitor the progress of learning of individual learners. Monitoring of individual student's progress in an interactive learning environment is essential [11]. It is also important that the tutoring and learning environment be adapted to fit individual learner's disposition, interests and performance, through integrated its.

C. Open/inexpensive tried and tested popular lmss

Lmss are created for course content delivery or training, and for managing learners and tracking their progress. They are usually not used to create course contents. Interactive learning is embedded in open tested and popular lmss as forums and discussion groups.

Moodle, originally an acronym for modular object-oriented dynamic learning environment, is a course management system designed to help educators create quality online courses [26]. Moodle can be installed on any computer that runs php and supports an sql database type. It runs on windows and mac operating systems, and many flavours of linux. A growing number of people (including system administrators, teachers, researchers, instructional designers and course developers) are contributing to improve moodle in different ways [27].

Sakai, a collaboration and learning environment (cle), was developed by a community of academic institutions, commercial organizations and individuals. Sakai cle is used for teaching, research and collaboration [28]. The sakai software includes many of the features common to course management systems, including document distribution, a grade book, discussion, live chat, assignment uploads, and online testing [29]. Its core tools could be augmented.

Dokeos, an open source e-learning solution with facilities for content developers, only available in the cloud, offers an integrated, powerful and easy-to-use service. It contains additional features and services, such as screenwriting learning, conversion of powerpoint presentations into training modules, video conferencing, organisation of certification evaluations, and examinations. Dokeos offers, under a common interface, an effective and ergonomic learning environment, now adapted for mobile media, for producing online contents [30].

Edu 2.0 is a simple, powerful learning management system hosted on the amazon. It has many features that would typically require several products to be purchased and integrated. The user interface is elegant and intuitive, and makes the whole experience of using the site more productive and enjoyable. Beyond all these aspects, the main advantage of edu 2.0 is that it provides a reliable, secure, and comprehensive lms at a cost that is significantly less than any other learning management system [31]. It is designed with built-in redundancy to ensure a 99.99% uptime and zero document loss. It is being continuously monitored to be bug free. It offer support for instructor-led, blended, and self-paced classes. It also offer support for co-teachers and time-based student deactivation. The edu 2.0 has built-in support for wikis, blogs, chat rooms, groups, and forums. These collaboration tools can be used privately in a class or within a group whose members span classes.

D. Its

The activity of tutoring, from inception, was assumed to be supervised by a tutor, not the learner. Itss developments then consider a co-operative approach between the learners and the tutoring system. The system partakes with the learner in the learning process and simplifies knowledge acquisition through interactions under

the control of the learner [32]. Itss are computer-based systems that personalize instructions based on the background and progress of individual learner [33]. Itss attempt to gather information about a learner's learning status, and having this information, try to adapt the instruction to fit the learner's needs. Itss belong to an interdisciplinary field, a true intersection of computer science, cognitive psychology and educational research [33], that investigates how to devise educational systems that provide instructions tailored to the needs of individual learners. Itss provide students with experiences similar to those provided by a personal tutor, but at a fraction of the cost [34]. Itss assist learning using artificial intelligence, based on cognitive theory embedded in computer programs [35]. A system created with artificial intelligence techniques allows both teachers and students to learn in a better manner.

An expedient strategy of itss is to observe how individual learners solve, or attempt to solve, a set of test/exercises, pinpoint problematic areas, and focus on improving the problem solving skills in those areas only thereby making students learn from their mistakes and build knowledge in an individualized manner [36]. Learner assessment, which is the detection of students' knowledge states, is a critical aspect of any tutoring system [37], [38]. An understanding of the learner's skill level will aid the problem and hint selector of the its [39]. Assessment can be classified into three categories: diagnostic assessment (strives to identify students' competencies, and assigns them to different groups or learning levels), formative assessment (with the goal to collect data during the teaching and learning process so as to guide it), and summative assessment (simply measures the results of a process which is usually supervised at the end of the assessment) [13]. Its chooses the next activity or task for the learner to work on based on a model of the learner's current competence, affect and interest by conducting a stealth assessment [22]. Its studies have repeatedly and consistently shown substantial learning gains [4], [40], [41], [42].

Some challenges of itss should be noted. Itss have security issues (no person present to supervise or invigilate the students creates room for malpractices). Itss immediate feedback and hint sequences may be abused (students may immediately turn to the hints before attempting to solve the problem or complete the task). Itss may also be too "instructivist" and removing intrinsic motivation, social learning contexts, and context realism from learning [43].

III. CONCLUSIONS

Learning environment blending successful most ancient learning traditions with the most innovative intelligent tutors would have a huge positive impact on learners, and subsequently on the society at large. Learners would benefit from a learning environment that is engaging and adapting to their different learning styles and life circumstances. Learning and other desired outcomes would be achieved in a more comforting manner, and learning would become more interesting.

Tutoring and learning should improve following the proposed starter model. Moodle is adjudged the preferred open lms for certain societies. Integration of its into moodle would make the environment more suitable for tutoring and learning. A detailed framework for achieving this is desirable. The given intelligent java tutoring system on moodle platform is an example of benefits that should accrue.

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