Interactive Adaptive Learning Management System (IALMS)

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Abstract: Many institutions are adopting online learning systems in order to create equal learning opportunities for every learner around the globe. Adaptive learning management systems were designed to capture the learning styles and behaviors of students. However, these adaptive learning systems failed to sufficiently capture students' learning styles, and also lacked interactivity. Therefore, there is the need for a new system which would capture the learners' styles via a static and automatic modelling approach and also boost interactivity, which is the focus of this study.

IALMS model was proposed using the interactive design technique. The prototype of the model was developed using the ADDIE model and Felder and Silverman learning style which was used to capture users learning style. Apache WAMP server, Moodle and the Grapple gale were used to develop the IALMS.

The implementation of the IALMS system provides a platform for students to learn course content according to their learning style, interact with other users through the online chat and forum platform, the system also awards badge to students after the completion of a course.

In conclusion, the use of the IALMS will improve student engagement by increasing self-assurance, decreasing frustration and inspiring productive learning habits.

Keywords: Learning Style, ADDIE Model, Learning Management System, Adaptive Learning Management System, Felder and Silverman Learning Style.

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I. INTRODUCTION

Learning is a procedure where humans retains data, remembers and processes it for further utilization [1]. There are tons of things we learn everyday unknowingly and utilize diverse approaches to learn it [2]. There is no correct technique to acquire knowledge in a precise condition, everybody has his/her own style of acquiring knowledge which varies from each other. In this age of globalization, information and learning are viewed as essential components for acquiring humble and preferred standpoint [3,4]. With recent technological advancements in Information Technology (IT), firms and organizations have remarkable prospects to convey tutoring and diverse training techniques. Learning management system (LMS) is one of the prospects of conveying tutoring, it has a framework that supports the learning procedure and management. The LMS offers significant services and features which improves e-learning; however, LMS does not support the adaption and personalization of courses. LMS present same course content for every learner without thought of a learners' learning style and behavior.

The adaptive learning management system was then developed to bridge the gap between research prototype of adaptive systems and the current use of commercial LMS. A number of adaptive learning system has been done and most have failed to capture students learning style, cognitive skills and behavior. The existing adaptive systems have also failed in attracting students due to lack of user friendliness of the system and also lack of interactivity. Hence, there was a need to remodel the existing models of the adaptive learning management system, as to solve the existing problems and also create a good graphical user interface (GUI) with interactivity tools.

The research main objective is to model and create a prototype interactive adaptive learning

management that will capture learning styles of students and enhance interactive learning. The specific objectives are to propose and model an IALMS, develop an IALMS and evaluate the application.

A prototype model of the IALMS was proposed through argumentation and a fluid iterative cycle of awareness, suggestion, development, evaluation and conclusion [5]. The research work adopted the ADDIE model of software development which is divided in to five stages; analysis (analyzing the learners' skills and needs), design (learning objectives and assessment instruments, exercises content), development (create and assemble the content assets created in the design phase), implementation (transforming the system into a real scenario), and evaluation (ensuring the system meets the users' need and provides a feedback on their conviction about the software). The programming environment includes wamp server (a package which comprises of the windows, apache, mysql, php), moodle (a learning management system) and grapple gale (communication bus). The developed system was tested to ensure that the system works as a whole and ensure it delivered on the stated objectives.

The IALMS enables students learn with respect to their learning style and interest; it would also improve student engagement by increasing self-assurance level, inspiring productive learning habits and therefore decreasing distress and frustration amongst students.

II. OUTCOMES

A. Model for the ALMS

An adaptive model consists of 3-tuples (domain model, user model, and adaptive model). The Architecture of the Adaptive Learning Management System is shown in the Figure 3.4; it consists of different components working as a whole. The adaptive learning environment component (ALE) is responsible in adapting content in all of the dimensions of adaptation. The LMSs have different functionalities like course management, learner's management and content management like uploading resources, creating course contents and assessments. The ALE would need the information about a learner or group of learners that can be provided by an LMS to update the learner model. Other resources acquired from the LMS can be used to search resources and activities personalized according to the learner's representation of the domain model.
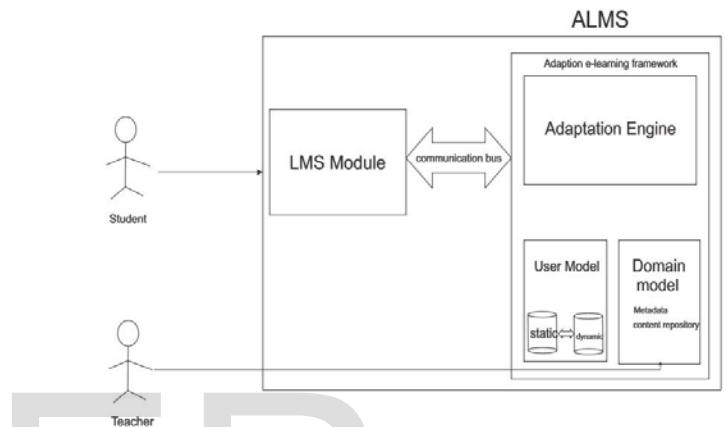

Figure 1 – Architecture of the Adaptive Learning Management System [6]

The domain model encompasses the information about knowledge domain of course to support adaptive course delivery. The user model contains information about the learner such as the personal information (name, address, etcetera), preferences, knowledge of the learner and the detection of learning style which can be static i.e. through the use of questionnaire and automatic i.e. through frequently visited contents. The adaptive engine deals with the automatic production of an adaptive content that will be presented to learner through the LMS interface.

B. Design of the Application
1) *System Flow Chart of the IALMS:* system flowchart is a pictorial representation of the categorization of steps and decisions needed to perform a process. Figure 2 and Figure 3 depicts the visual representations of the sequence of steps that can be performed by a student and a teacher.
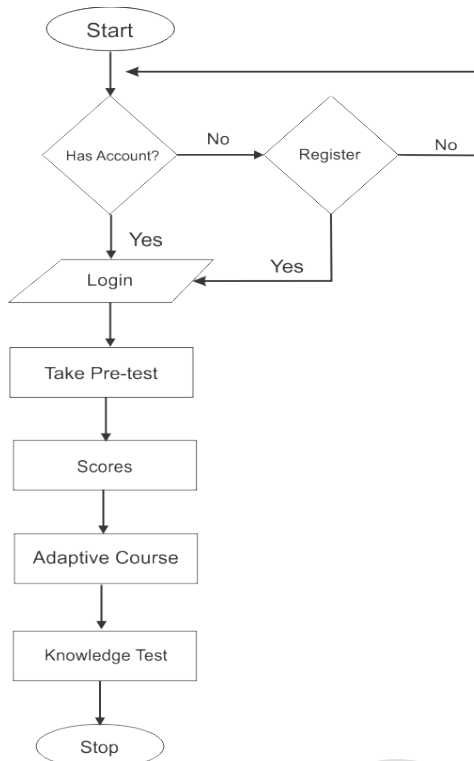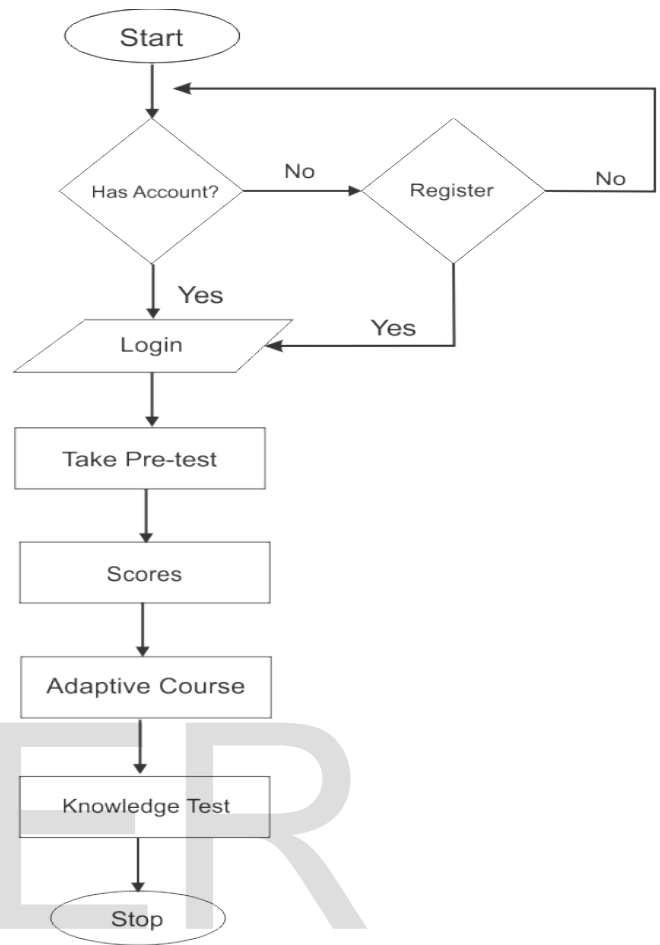
Figure 2- Student's Flowchart

Figure 3 - Teacher's Flow chart

2) ***Working Scenario of the IALMS
   System:*** The IALMS system is
   designed with basic operations for
   the learners and the instructor. The
   instructor prepares a course and sets
   up different course content to detect
   adaptivity. The creation of different
   course content makes it easier for
   learners to learn according to their
   various learning style. The student
   model is initialized during the first
   logon of the student, the student is
   asked to take a pre-test (ILS
   questionnaire), so as to determine
   their learning style. The activity of
   the student is also tracked with time

in order to determine whether the students learning style has not changed. The instructor adds a course, sets up learning content, gamify courses, assignments and give examination after the completion of a course. The system provides facility like the forum and online chat for interactivity.

C. The application

1) *Adapted framework of the IALMS*: Figure 4 represents the newly proposed model for the interactive adaptive learning management system which six (6) major components in the system database to ensure its achieves its objectives. Course content holds information about the course like course description, syllabus etcetera. Index of learning questionnaire is used to capture the learning of every learner and each learner are take the pre-test at the first login. Learner's activity information holds data about all the activities that has been performed by the user on the system. the gamification of courses is process of awarding badges to learners after the completion of a particular course. The feedback platform entails two technologies the forum and chat room. Learning style and content recommendation would be used to capture the student learning style. Learning style and course recommendation would be used to store learning styles and recommend courses to the student. There are four major components of the adaptive framework which includes the adaptive engine, intervention engine, dashboard and the predictive model. The predictive model is first initialized after the learner submits the pre-test questionnaire which captures the learners' learning style. The adaptive engine works with the predictive model to suggest learning content based on the learning style of a learner and also track the

learning activity information of students to detect any change in learning style. The intervention engine permits the instructor to propose learning contents to learners after monitoring students learning styles form the dashboard. The dashboard allows faculties and the administrator to monitor the students learning styles.
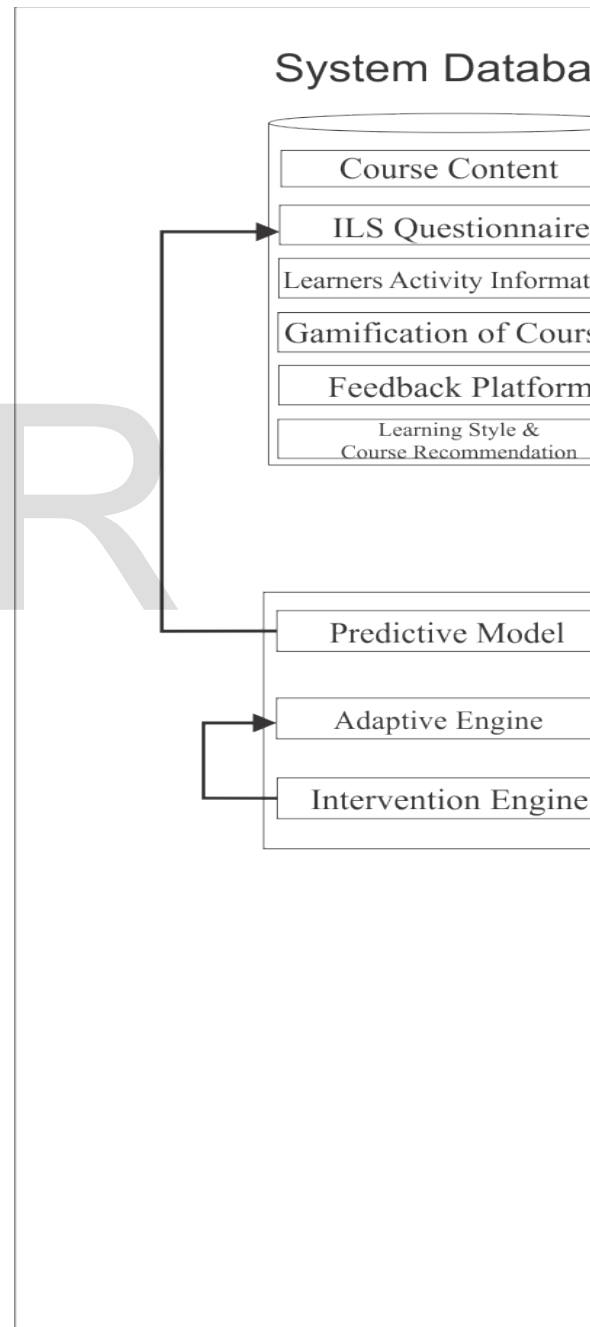
Figure 4 – The Adaptive Learning Management System Model[7]

2) **Snapshots of the IALMS**: 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 [1]. Figure 5 depicts the visual representation of the homepage which entails the login button, available courses and other vital information of the available courses.

Figure 5 - Homepage

Figure 6 is the login page which acts an access control mechanism to prevent unauthorized access to the system. The user and password is given by the administrator.
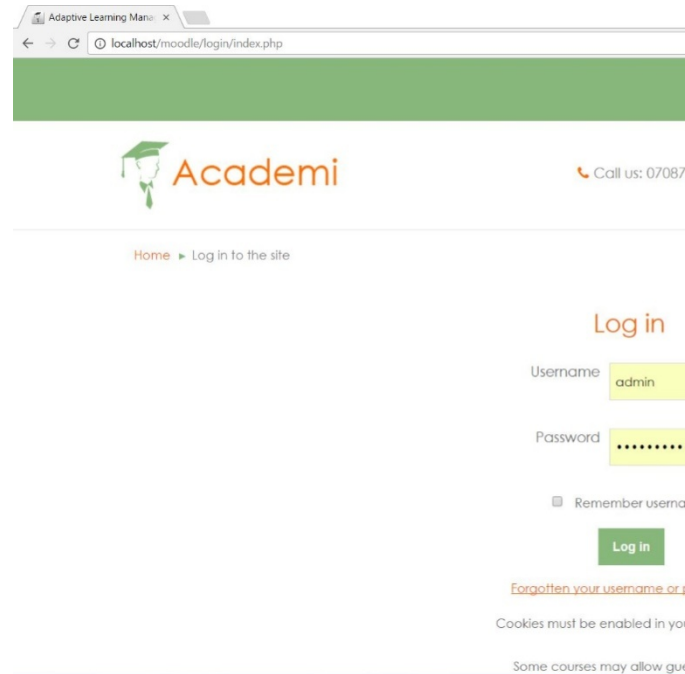

Figure 6 – Login Page

Figure 7 shows the pre-page which contains the ILS questionnaire which consists of 44 questions and two options which the user would check, at the end of the test the system displays the user's learning style.
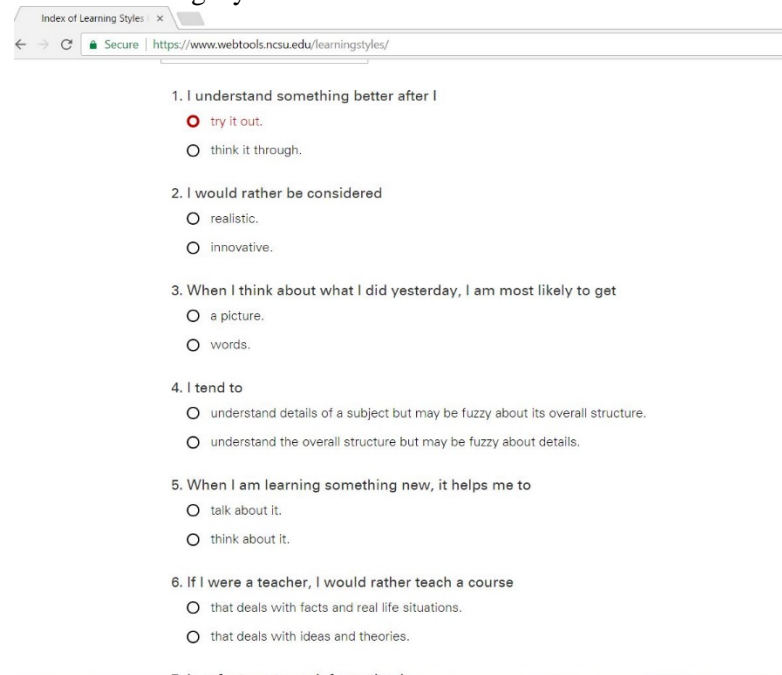

Figure 7 – Pre-test Page

Figure 8 depicts the main page of the lecturer which allows the lecturer to manage courses, enroll students, upload test scores, create forums, monitor students' activity.
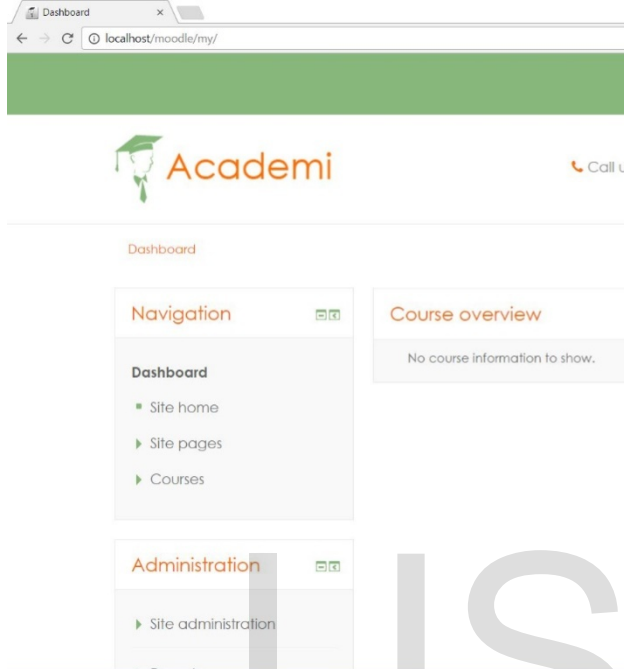
Figure 8 – Lecturer Main Page

Figure 9 depicts the main page of student which allows the students to access enrolled course, submit assignment, chat, access the forum, view badges and view course progress.
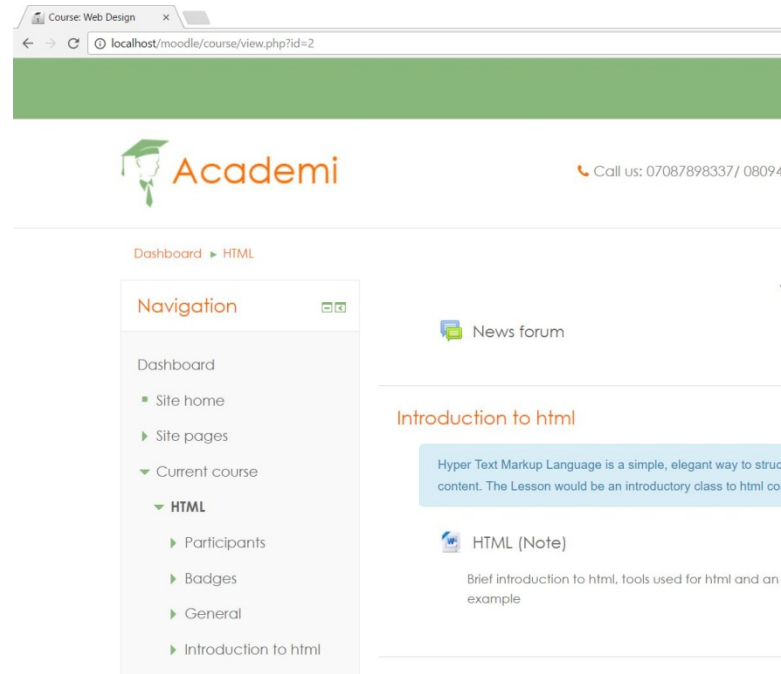
Figure 9 – Student Main Page

Figure 10 shows the gamification page which contains badges, the badges are awarded to students after the completion of a course in order to motivate them to enroll for another course.
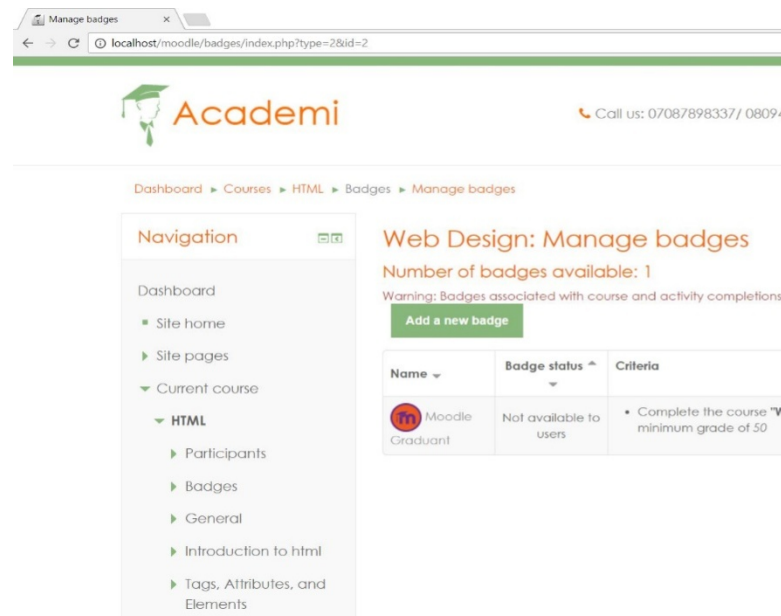
Figure 4.11 - Badges

III.   RELATED WORKS

A. Pedagogy

Pedagogy can be defined as the art of teaching and it refers to the strategies, methods and styles of instruction [8]. True pedagogy is far more than someone instructing, pedagogy is leading people to place where people can learn for themselves and also harness their abilities [9]. 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[10].

Pedagogy and software design are closely intertwined in online learning – the 'shape' of the software can help or hinder the teacher's way of conveying a message. Rich, student-centered learning environments that engage learners in meaningful discourse with their peers [11] and require them to solve real world issues using technologies as cognitive tools [12].

Many educators believe learning should be opened and social and increasingly teachers and learners are showing a greater interest in social web technologies as they can support self-governed, problem-based and collaborative activities in a better way [13,14,15,16,17]. Social web technologies such as blogs, wikis, social media and social networking sites provide ways for learners to express themselves and get to know their fellow learners, which can lead to more comfortable, supportive and interactive learning environment.

B. E-Learning

E-learning can be described as the conveyance of preparing and training through organized intuitiveness and distribution technologies [18,19]. E-learning has been portrayed in numerous ways utilizing various diverse advancements and approaches for distribution. However, e-learning framework can be analyzed as an ingenious method for conveying, learner-centric, collaborative and simplified learning environment to wherever, whenever and whomever by exploiting the elements and assets of diverse digital advances alongside different kinds of learning resources suitable for an open, disseminated and adaptable learning situation [20].

E-learning has used in conveying an extensive range of uses and procedures such as virtual learning environment, computer based training, online learning and computerized collaborations. E-learning delivery of learning materials can be synchronous or asynchronous depending on the facilitator. 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 [21].

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 [22].Interactive learning environment tends to change the traditional way of learning by introducing different mechanism for learners, mainly for interaction and also sharing ideas. 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].

C. Learning Styles

Learning styles is defined as the cognitive, affective and physiological factors that serve as relatively stable indicators of how learners perceive,

interact with and respond to knowledge environments. Learning styles are based on study results of cognitive psychology about processing data, active learning and structure of information [11]. The learners prefer spontaneously some forms of information and precise way of action over others when reaching quality learning [24]. There many types of learning styles models which are designed to capture learning style of different learners in different areas of study.

Proponents of the use of learning dimensions in education recommend that teachers evaluate the learning styles of their students and adapt their classroom methods to best fit each student's learning style. Learning styles are not stern and do not outline each other, which means that a person might prefer some learning style over others but also use aspects of other styles. Learning as a process involves understanding and skillful performance after learning [25]. There are four factors that determines the learning process which are cognitive, affective, physiological and psychological [9]. This four factors help to determine the learning dimension of user.

D. LMS

Learning management system (LMS) is a software that permits the administration and facilitation of a variety of learning and training events and amenities [26]. In traditional instructive scenery, learning management systems can help enhance the speed and efficiency of the instructive procedures, interaction within learners and also between teachers and learners [27]. LMS aims at streamlining the administration of learning/training curricula with an organization.

Moodle, also known as modular object-oriented dynamic learning environment is an open source software designed using comprehensive academic ideologies that intends to benefit instructors to create online learning groups. Moodle has gained widespread acceptance, and is used globally as an e-learning platform strictly related with a social constructivist learning model. Moodle is referred to as the best user-friendly and flexible open source LMS available. Moodle has gained widespread acceptance, and is used globally as an e-learning platform strictly related with a social constructivist learning model. Moodle is referred to as the best user-friendly and flexible open source LMS available. Moodle can run on any framework, it uses the Apache web server, MySQL database and PHP as scripting language [28].

Fedora, a general repository service mutually developed by the University of Virginia and Cornell University. The aim of the Fedora project was to provide an open-source repository package that could be used as a foundation for future information management systems. Fedora reveals how distributed digital information management can be deployed using online technologies, including XML and web services.

Sakai, a collaboration and learning environment (cle), was developed by a community of academic institutions, commercial organizations and individuals. Sakai is used for teaching, research and collaboration document distribution, a grade book, discussion, live chat, assignment uploads and online testing [22].

E. ALS

Adaptive learning system (ALS) is an educational innovation that can retract to learners' communications simultaneously via consequently delivering the learner with personal backing. A learning setting is considered to be adaptive if the system could: check

the events of the learners; understand the learners' activities on the basis of domain-specific models; inferring user requirements and preferences out of the interpreted activities, correctly representing these in associated models; and finally, acting upon the existing knowledge on its users and the current topic to dynamically simplify the learning process [29]. ALS

The ALS can adjust to the requirements of the student dissimilar to the conventional LMS which acts as a fountain of knowledge and a way for training administrator to allocate segments and trail development. ALS allocates segments which depends on student needs/styles/capability level etcetera.

The adaptive learning management system aims to dynamically adjust to the level or type of course content based on an individual student's abilities or skill attainment, in ways that it helps accelerate a learner's performance with both automated and instructor interventions. ALS achieve its objectives by varying student learning ability, diverse student backgrounds and resource limitations. The challenges of the ALS include: the development and research of adaptive learning systems are quite expensive, the teacher/faculty proficiency in successful adoption and use of adaptive system implementation.

IV. CONCLUSIONS

Learning is an important routine in our daily activities; no one is an island of knowledge. We acquire knowledge on a daily basis. The developed IALMS would help students with different learning styles be on a leveled term, where each student picks course content that suits his/her own learning dimension.

The IALMS system would be the way adaptive learning system are being modelled and developed. Moodle is a good lms for the adaptive environment but has some restrictions attached to it like the upload limit which does not allow the faculty upload lengthy videos. The IALMS system is a perfect example of how interactivity and adaptivity can be achieved.

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