



Learning Style detection Model using Questionnaire & Solutions

Mr.S.R.Jadhao* and Prof.M.A.Pund
Computer Science & Engineering Deptt
PRMIT & R
Badnera, Amravati, India
satishrjadhao@gmail.com*
mukeshpund@gmail.com

Abstract: E-Learning platforms are very successful in e-education but provide little Adaptivity. Personalized courses which adapt to the needs of each individual learner improve the learning progress. In this project we would like to discuss an integration of two different approaches, namely the CMS Moodle (Modular Object-Oriented Dynamic Learning Environment) and Adaptive/Personalized eLearning Service. Providing Adaptivity based on learning styles can support learners and make learning easier for them. However, for providing proper Adaptivity, the learning styles of learners need to be known first. In this we are using questionnaires in order to identify learning styles; we present student driven learning by a system which analyses the actual behavior and actions of students. Learning styles are learners' preferences in learning. Almost every learning style model has its own assessment tool in the form of a questionnaire. Adaptivity in VLE incorporating learning styles should be studied to detect more accurately students' learning behavior and develop VLE which adapts to students' individual learning styles.

Keywords: Learning Management System, e-learning, Moodle, VLE, Questionnaire

I. INTRODUCTION

Learning is a complex process where student's motivation, teacher, learning material and several other aspects interact with each other. Nowadays the traditional classroom teaching has changed more and more into a virtual environment where different issues about learning has to be taken into account. The students have to be motivated in the learning situation and the material has to be easily at hand.

e-Learning is defined as interactive learning in which the learning content is available online and provides automatic feedback to the student's learning. e-Learning systems are increasingly becoming a significant part of the strategy for delivering online and flexible learning. At present, an Explosion is occurring in the demand for e-Learning all over the world [22].

E-learning is defined as interactive learning in which the learning content is available online and provides automatic feedback to the student's learning activities [(Berry 2005), (Dougiamas 2007)].

II. LITERATURE REVIEW & RELATED WORK

This literature review is aimed at identifying the literature relevant to e-Learning, analyzing and evaluating existing e-Learning System. e-Learning supports the world-wide trend of offering online joint courses over the internet, which includes institutes in different countries.

e-Learning offers institutes a number of benefits, such as access anytime and anywhere, better integration of application technology tools, opportunities for independent learning, improved motivation, and access to novel learning styles [(Dougiamas and Taylor 2002), (Berry 2005)] [25].

e-Learning = *enhanced* learning,

There is no consistent stranded architecture for e-learning systems. All the available architectures depend on the kinds of e-learning products than an institute requires.

Some well known CMSs :

• BlackBoard • WebCT • Sakai • ATutor

In e-learning more generally, personalized and adaptive learning support is more important than in traditional classrooms. One of the key features of Adaptive Systems is that the system should be able to adapt accordingly for each individual user, thus offering a more personalized courses to a user [4].

People differ from each other in the way they prefer to learn. Some like to read things whereas others want to listen. Whatever the best way is it changes between situations and people use multiple learning styles. People differ from each other in learning styles but also in other areas incorporating learning. Some of these areas are motivation, self confidence and learning speed. An assessment tool will be developed in the form of a questionnaire to get information about students' interest and knowledge on learning styles. The questionnaire was tested in action when it was addressed to students. One aim of this project was based on to develop questionnaires for students about their studying habits and preferences. This was considered because of the interest in knowing better students' backgrounds and how they prefer to learn. The aim was to produce questionnaire for students which could be addressed at the beginning [3].

A. Learning style questionnaires:

Almost every learning style model has its own assessment tool in a form of a questionnaire. These learning style inventories include various amounts of questions about personality, study attitude and behavior. Learning style inventories help people to be more aware of their learning

style but it has to take into account that they have also limitations. One should not label his own style too narrowly [5].

B. Learning Style Models:

There are several theories pertaining to learning styles, such as

- Felder-Silverman learning style model (Felder 88),
- Honey and Mumford (Honey and Mumford 1982),
- Kolb's Learning style model (Kolb 1984).

Each proposes different descriptions and classifications of learning styles. In our work, we are focusing on the Felder-Silverman learning style model (FSLSM). Most other learning style models classify learners into a few groups, whereas Felder and Silverman describe the learning style of a learner in more detail, distinguishing between preferences on four dimensions [11] (active/reflective, sensing/intuitive, visual/verbal and sequential/global), so that each learner has a preference for each of these four dimensions[27].

C. Felder-Silverman model:

The Felder-Silverman learning style model (FSLSM) was created by Richard Felder and Linda Silverman in 1988. It focuses on aspects of learning styles on engineering students. The model had five dimensions in the original version but was changed to four when one dimension was deleted. The learning style dimensions according to Felder are:

- sensory/intuitive • visual/verbal
- active/reflective • sequential/global.

Sensory learners like learning facts and solving problems with known methods while intuitives prefer discovering possibilities. Active learners like to try things out or do something active. Reflective learners prefer thinking about things on their own. Sequential learners learn in small steps when global learners understand things in large steps. (Felder2002).

The Felder-Silverman learning style model (FSLSM) is considered the most appropriate to be used in a computer-based educational system (Carver 1999). Based on this model a corresponding psychometric assessment instrument was created. It was called the Felder-Solomon's Index of Learning Styles (ILS). It is a 44-item questionnaire where learners' personal preferences for each dimension are expressed with values between +11 to -11 per dimension, with steps +/-2. This range comes from the eleven questions that are posed for each dimension. (Gomez 2007; Graf 2007)[5]. That is why FSLSM, shown in Fig. 3, is most appropriate for educational systems; and our work is based on it.

Table 1. Felder-silverman learning style model

Dimensions	Definitions
Verbal	Require written or spoken
Visual	Remember what they have seen
Sequential	Learn in linear steps
Global	Holistic or learn in large leaps
Active	Learn by trying things
Reflective	Learn by thinking things out
Sensing	Learn concrete material and tend

Table III&IV shows the proposed groups as well as the related answers of ILS questions (Felder and Soloman, 1997) for each group. A question may appear twice in the table, if the two possible answers to the question point to two different groups.

The semantic groups within the dimensions provide relevant information in order to be able to identify learning styles. For example, if a learner has a preference for trying things out and tends to be more impersonal oriented, he/she would have a balanced learning style on the active/reflective dimension. However, a learner has also a balanced learning style if he/she prefers to think about the material and tends to be more social oriented. Although both learners have different preferences and therefore different behavior in an online course, both are considered equally according to the result of ILS. Considering the proposed semantic groups leads therefore to more accurate information about learners' preferences and to a more accurate model for identifying learning styles based on the behavior of learners in an online course [21].

Table. 2 Semantic groups associated with the ILS answers a

Style	Semantic Group	ILS Questions (answer a)
Active	Learn by trying things	1,17,25,29,5,9,13,21,33,37,41
Sensing	Learn concrete material and tend	2,30,34,6,10,14,18,26,38,22,42
Visual	Remember what they have seen	3,7,11,15,19,23,27,31,35,39,43
Sequential	Learn in linear steps	4,28,40,20,24,32,36,44,8,12,16

Table.3 Semantic groups associated with the ILS answers b

Style	Semantic Group	ILS Questions (answer b)
Verbal	Require written or spoken	3,7,15,19,27,35,37,11,23,31,39,43
Global	Holistic or learn in large leaps	4,8,12,16,28,40,24,32,20,36,44
Reflective	Learn by thinking things out	1,5,17,25,29,9,13,21,33,41,37
Intuitive learners	Learn concepts	2,14,22,26,30,34,6,10,18,38,42

D. Index of Learning Styles Questionnaire (ILS):

For each of the 44 questions below select either "a" or "b" to indicate your answer. Please choose only one answer for each question. If both "a" and "b" seem to apply to you, choose the one that applies more frequently.

To implement the Felder-Silverman Learning Styles Model we use a collection of rules where each rule proposes a set of teaching instructions for one learning style (Savic and Konjovic, 2009). Table 4 shows the rules.

Rules are conceptually easy to implement in tutoring systems. However, to apply these rules, every lesson of a course has to be converted into 8 different lessons according to the teaching instructions. This effort is justified if there are many potential students classified in each of the learning styles so that they can benefit of the personalized learning objects. Given the learning styles remains over the complete session, the learning style of a person is assessed once at the beginning of the course[30].

Table. 4 Rules of Teaching Instructions for each Learning Style in the Felder-Silverman Model.

Learning Style	Teaching instructions
Active	Show exercises at the beginning of the chapter because they like challenges and problem solving. Show less examples. They are not interested in the way others have done something, because they want to solve a problem by themselves.
Reflective	Show exercises at the end of a chapter. Show examples after explanation content, but before exercises. Show less exercises, because they learn better by thinking about a topic instead of solving problems actively.
Sensing	Show examples at the beginning of a chapter (before explanation content) because they like concrete content. Show exercises after explanation content, because they solve problems by already learned approaches.
Intuitive	Show less examples, because they like to discover topic application by themselves. Show examples after explanation content, because they like abstract content more than concrete. Show exercises before explanation content, because they like challenges. Show less exercises with a similar teaching goal because they don't like repetition.
Visual	If possible, show resources as a picture or a video.
Verbal	Show resources as a text or an audio.
Sequential	Show learning content in a standard sequence – explanation content, examples, exercises and summary, because they like linear approach.
Global	They are less interested in details, because they need to create a global picture of the topic. Show summary before examples and exercises, because summary helps you to create a global picture.

III. PROPOSED SYSTEM ANALYSIS AND DESIGN

A. System Architecture:

In the Proposed work Using Personalized Learning System; a learner model is normally generated for each user by first offering them a pre-test within the System itself. This is done by re-directing the user to a page with the appropriate questionnaire if he has not already filled it out on a previous

visit. If the latter, then the user is simply directed to his course and does not need to re-take the pre-test again (Unless of course he wishes to rebuild the course at any stage). As a step towards extracting away from the specific limitations of creating the learner model within the System, we looked at different ways of creating this model within Moodle.

Thus, by adding the pre-test and learner model to Moodle, instead of leaving it to the AHS to determine, we can greatly increase the information contained therein, and offer a more flexible approach to creating the adaptive course for the user. For implementation, the pre-test questionnaire will be implemented in PHP, and is offered within Moodle [1].

The results of this questionnaire are then checked and an output added to database and a personalized course is then generated. The reference literature identifies two main families of e-learning systems: the popular and feature-rich LMSs and the prototypal and experimental systems developed by universities which are focused on personalization and provide learners with an intelligent support throughout their learning process. The work described in this seminar is part of the Open Learning project, in which public and private stakeholders contribute by their different expertise in education and learning to help e-learning providers improve their learning offer by adopting an innovative learning content delivery system centered on the personalization of the learning experience. At first the learner performs a learning style test and gets an answer which tells what observation channels learners prefers to use in learning and what kind of learner one is. If a learner disagrees with the result s/he can read the test.

According to the result the learner can choose the most suitable learning objects and activities from the learning environment. The teacher should provide enough different learning materials in the e-learning environment so that all students are satisfied. The different learning styles should be taken into account also when making exercise works and exams [4].

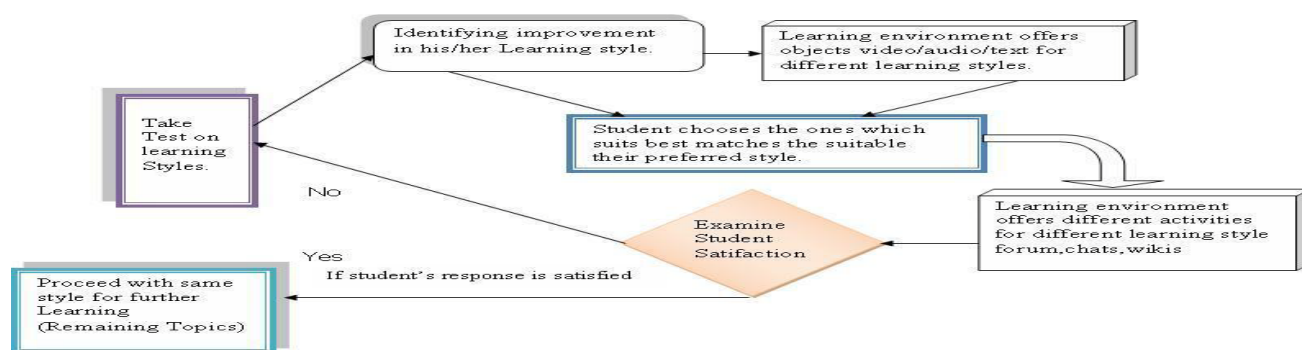


Figure 1: Learning Style Detection Model

The purpose of this Project is demonstrating that one of the most widely used LMSs, Moodle (www.moodle.org), can be integrated with a form of customization by creating personalized learning content sequences based on the learner's knowledge and learning styles. Personalization is obtained by combining Moodle [10].

Some of Activities or Learning Objects

- Forums • Assignment • Chat • Quiz • Wiki etc.

In Moodle, valuable support will be provided to learners by creating tailored courses, monitoring their progress and adapting their learning paths accordingly. Support for teacher comes in the form of automated sequencing of the content delivered to the students. Intelligent systems allow user modeling and can be adapted to the user's needs. Several methods have been proposed for modeling students and offering them personalized learning activities. A proposed

personalization technique is Course Sequencing, in which the learning activities which make up courses are sequenced based on key information about the student.

The personalization engine dynamically adapts the course to the student's needs. It adopts a three-step approach: i) modeling the learner according to his/her knowledge and learning styles ii) producing a personalized course and iii) adapting the course throughout the learning process.

The system allow teachers to provide and share documents, assignments, quizzes, etc. with their students, helping students to learn easily and teachers to create high quality online courses. It also gives easy access to the teacher and the student outside official working hours, as well as reducing the administrative burden of the curriculum through the exploitation of the means and tools.

The proposed model has four components, which are browser, server, login/registry and database. It will offer the exercise services for Moodle as a new activity to help students to train themselves anytime and anywhere. This section focuses on these components, as follows:

a. Browser:

In the exercise model, there are three main users: administrator, teacher and student. The first one, the administrator, has the ability to use almost all the functions on the system, such as add or remove student, lecturer and section etc. The second actor is the lecturer who can access specific functions of administration, such as add new section to

existing module. The third user is the student who can browse, answer the exercises, and update her /his personal information.

b. Server:

The server is the most important component in our model, which has modules and exercise services in Moodle. The exercise part is the part of the module that users cannot access directly. The proposed model offers users a list of modules, and allows them to choose a module that meets their needs. Then, the model directs the users to the exercise page, and allows them to begin the training exercise.

c. Login/Register:

The browser can log in as normal but if they do not have a username and password, then the system directs them to register before gaining access; they can then navigate to the exercises and visit the site as often as they wish. The system allows students to update and check their personal information including their password. Teachers cannot register themselves; the only person who can add teachers is the administrator.

d. Databases:

Moodle has a large database (approximately 200 tables) and is therefore complicated to deal with. Our system should only add new tables for exercise activities and these are purely related to exam exercises.

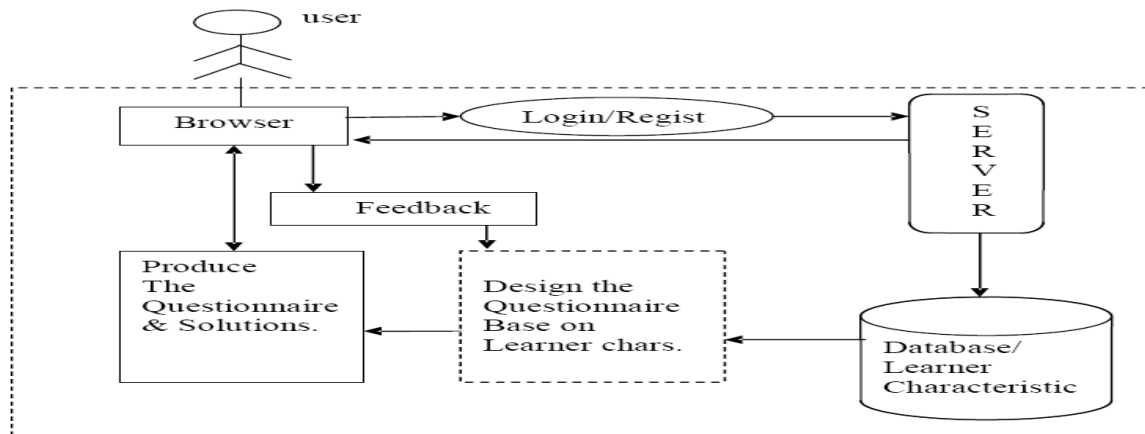


Figure 2: The framework for Questionnaire & Solution Services in Moodle

B. Method:

a. Learning – Style Inventory:

The Learning – Style Inventory describes the way a student learns and how he/she deals with ideas and day to-day situations in his/her life. Felder and Silverman formulated a learning style assessment instrument, consisting of 44 questions known as Index of Learning Styles (ILS) questionnaire (Felder & Soloman, 1997). It is a 44-item questionnaire where learners' personal preferences for each dimension are expressed with values between +11 to -11 per dimension, with steps +/-2. This range comes from the eleven questions that are posed for each dimension. (Gomez 2007; Graf 2007)[5].

b. Pre-test:

Participants were given a knowledge assessment test in order to determine their knowledge in the domain. They had to answer a total of ten questions concerning to the domain.

c. The Educational Material:

The educational material was based mainly on a chapter concerning domain. It was structured in independently accessible modules: (1) Theory (definitions, descriptions, conclusions), (2) Examples and Case Studies, (3) Self-Assessment Tasks (questions introducing or assessing the concepts), (4) Exercises and (5) Activities. All learners study the same knowledge modules; moreover this structure offers students the option of starting their studying from the

preferred module and following their own learning sequence throughout the educational material. Consequently, such a structure of the educational material is appropriate for personalized learning [28].

d. **Post-test:**

The post-test was the same as the pre-test. One score was extracted from the questionnaire intended to reflect students' performance after interaction with the system and after performing the activities requested.

e. **Procedure:**

The procedure included four phases: (1) In the *first phase* and after students logged on to Moodle, they were first administered the Learning – Style Inventory and next they were administered the pre-test. They were asked to read each question carefully and to select the correct answer to the best of their knowledge. (2) In the *second phase* the students worked with Moodle for about, studying the proposed educational materials and submitted the proposed self – assessment tasks, exercises and activities. (3) In the *third phase*, students were administered the post-test. (4) Finally in the *fourth phase*, students were administered the feedback. The pre- and post-tests included the same questions in order to compare students' performance before and after interaction with Moodle.

IV. DESIRED IMPLICATIONS

E-learning system supports following features:

Theory ,Exercises,Questionnaires & Solutions

In this proposed system we will implement the above given features. It creates a content that is common to both styles, Theoretical and Active. Concepts are represented by “theory”, “example”, “exercise”, and “activity”. The concept “exercise” consists of “text”, and a “solution” and depending on the style, the concept “solution” may have an “activity” associated to it. In summary, each style has a common and a specific content for every concept, and different paths of contents are generated to be visualized depending on the style. As Fig. 3 illustrates, the sequence for a theoretical student would be “theory”, and “examples”, with the option of also doing “activities”; however, the sequence for an active student would be “theory”, “exercises” with their “text” and “solution” (in case they want to access it), plus “activities” and the option of going to “examples”[5].

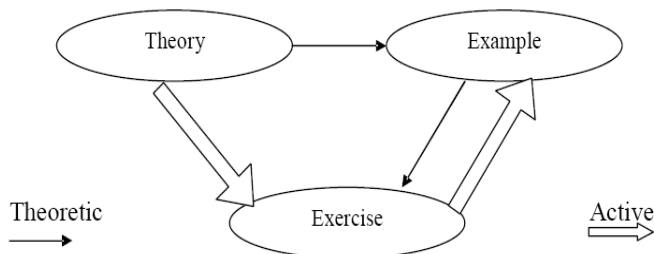


Figure 3: Sequence for theoretical and active learning styles

V. CONCLUSION

The following conclusions were made. VLE has to be clear and functional to obtain good learning results. The VLEs are successful in e-learning but take learning styles poorly into consideration. To make the VLE adaptive for different learning styles, learners' behavior in learning environments has to be studied. The challenge is to get enough information to process. With the obtained data, student models can be created and thereby find the students' learning preferences.

The proposed approach is based on the idea that students' behavior can give relevant hints for identifying their learning style preferences. Therefore, to obtain information about the learner's learning styles, learner's need to fill out a questionnaire.

Moodle can be developed further to be more adaptive to learning styles. With these add-ons or extensions students' learning styles can be defined automatically and taken into account by offering tailored courses in VLE. Moodle's adaptability is not a problem in developing it to better incorporate learning styles. The extensions are to be included to the VLE so it can be adaptable to different learning styles.

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