Adaptive Learning Systems: A Tool to Personalize Learning

By
Sarbani Mukherjee
Principal Learning Designer

Sections

I. We, the People
II. What is an Adaptive Learning System?
III. What are the Components?
IV. Adaptive Learning Systems: What are the Design Implications?
V. Design Implications: Corporate vs Education
VI. Putting It All Together
VII. Summary
1. We, the People

The domain of learning has traditionally been teacher-centric. The approach, perhaps, is attributable to social hierarchy that dictates learning has to be driven from the ‘top’ by a teacher or mentor. While this may well be effective, besides being tried and tested, it often fails on one count – it’s assumption that one size fits all.

Teacher-centric models traditionally follow a ‘take it or leave it’ philosophy, where the student group is often considered to be a homogenous entity with similar learning styles, levels of competence, learning needs and motivation levels. The results:

- No variation in content
- Learning restricted to a select group
- Lower motivation levels
- Lower return on investment – whether tangible investment like dollars spent, or intangibles like a teacher’s effort

The need, thus, is for a paradigm shift – to a student-centric model – by leveraging technology. While a student-centric model may not be the panacea for all-things-wrong in the teacher-centric approach, it is a response to an increasing call to give the power to the people. The power which allows the use of technology to achieve the following:

- Have more diversity in content
- Make content more accessible to learners
- Allow learners to determine their learning path
- Account for different skill/competence levels among learners

Enter Adaptive Learning Systems!
2. What is an Adaptive Learning System?

An Adaptive Learning System (ALS) is a Learning Management System (LMS) that, quite simply, can adapt to the needs of the learner. Unlike a traditional LMS, which acts as a repository of information and a tool for the training administrator to assign modules and track progress, an ALS assigns modules based on learner needs/styles/competence level/etc. And there’s more. It has the ability to assess learner progress and account for this while creating the learning path.

A Web search throws up a definition (http://en.wikipedia.org/wiki/Adaptive_learning): “… presentation of content according to a student’s learning needs, as indicated by their responses to questions and tasks.” “… also referred to as Intelligent Tutoring Systems… applied in education and corporate training.”

An ALS is based on adaptive learning theory, that recommends use of the following dimensions to ensure an effective and personalized learning path:

- Multimedia for the enhancement of sensory perception
- Learning models for the enhancement of cognition
- Interactivity and feedback for the strengthening of neural pathways
- Knowledge construction through social networking

The 10 principles (www.youtube.com/user/sonwalkar7) which form the basis of an adaptive learning environment design are:

» One-size fits all doesn’t work
» Information is not education
» Learning requires a cognitive process; it’s not enough to provide multimedia elements
» Learning styles vary with learners and the content; a learner may be a deductive learner in math, but have a different style in history
Current system forces people to learn in an artificial timeline

Individualized learning is the best way to ensure completion - face-to-face teaching, ‘traditional’ online learning, are not effective

Learning is multi-dimensional, so we need:
  a. Multimedia content
  b. Cognitive strategies

Assessment is effective only if it improves learner’s competence; the current system is a ‘punishing system’ and not a ‘rewarding system’

Anyone can reach a learning competency with the appropriate strategy

Content should motivate people to learn rather than score

3. What are the components?

An ALS may have one or more of the following components or models:

- **Expert model:** This has information which is to be taught. It stores tutorials, lessons, answers to questions, etc. It is often clubbed with the instructional model.

- **Student model:** This component determines the student’s skill level through Adaptive Testing methodology. Students are presented with questions based on level of difficulty, as determined by their skill/competence level. As the test proceeds, the computer adjusts the score based on the answers, refining the score by selecting questions from a narrower range of difficulty.
» **Instructional model:** This model incorporates tools like multimedia elements. In a Computer Adaptive Testing-style student model, the instructional model ranks lessons in correspondence with the ranks for the question pool. When the student’s level of competency has been determined, the instructional model provides the appropriate lesson.

The more advanced student models organize lessons by concept as well. The instructional model can be designed to identify the areas of weakness and tailor a lesson plan accordingly. When the incorrect answers are being evaluated by the student model, some systems look to provide feedback to the actual questions in the form of ‘hints’. As the student makes mistakes, suggestions pop up. This too can fall in the domain of the instructional model, with generic concept-based hints being offered based on concept weaknesses, or the hints can be question-specific in which case the student, instructional, and expert models all overlap.

» **Instructional environment:** The user interface for interacting with the system.

The implications of these components for an ALS can be summarized by the following diagram:

![Diagram showing the relationship between Expert Model, Student Model, Instructional Model, and the Instructional Environment](image)
4. Adaptive Learning Systems: What are the design implications?

Based on the components described earlier, an ALS should ideally be designed to include the following:

» Several discrete e-learning modules, which together form a training or educational eco-system: While it may not be feasible to specify a number, it’s important to note that the eco-system should at the very least cover ‘ALL’ concepts – going from simple to complex – and assessments which support development of a competence.

» Modules should be available in various instructional formats like case studies, simulation, games, straightforward tutorials, etc. Learners should have the option to select the format they prefer. And, as the learner progresses through the curriculum, the system should assign modules based on the learner’s initial selection.

» Assessment modules with adequate feedback to test competency and guide towards the correct learning path.

» Ability to draw content from a larger eco-system beyond the current one (for example, through connections with a Cloud-based network or even the Web).

» Ability to assess popularity and relevance of content based on peer usage and assign modules accordingly.

» Ability to include social networking features, which not just allow peer interaction, but development of higher-level cognitive skills like analysis and synthesis of information.
5. Design Implications: Corporate vs Education

The design implications of an ALS, for corporates and educational institutions, are similar. The difference lies in the choice of parameters while determining the logic.

For both, adaptation depends on:
» Learner’s knowledge of the subject
» Learner’s individual traits and preferred learning style

The sequencing of content can be active or passive:
» Active sequencing:
  • goal-driven expansion of knowledge/skills
  • aim is to achieve an educational goal
  • predefined (whole course)
  • flexible (set by a teacher, a student, or dynamically by the system)
» Passive sequencing (Remediation):
  • sequence of actions to address lack of knowledge or reinforce information

The points of difference are as follows:
For Corporate, an ALS should be based on:
» Learner’s job role in the organization
» Learner’s current and desired level of competence for the job role
» Competencies required for future roles
» Rating of content in different subjects
» Popularity of content in peer group
» Ability to access relevant information from outside of the organizational network

For Education, an ALS should be based on:
» Requirements of the curriculum
» Learner’s proficiency in different concepts related to the curriculum
» Predominant learning styles of the target group
» Conceptual knowledge required to climb a higher cognitive level with regards to a particular concept
Rating of content in different subjects

Popularity of content in peer group

Ability to access relevant information from outside of the current network

<table>
<thead>
<tr>
<th>CORPORATE</th>
<th>EDUCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job role description needs to be the basis for structuring modules</td>
<td>Curriculum requirement is the driving factor</td>
</tr>
<tr>
<td>Skills should go from Basic to Advanced</td>
<td>Concept-based rather than skill-based</td>
</tr>
<tr>
<td>Skills/Competencies which define framework of ALS needs to have a clear connect with career path; learning path controlled by desired skill sets</td>
<td>Concepts/Competencies need a connect with the curriculum goal; learning path controlled by curriculum requirement</td>
</tr>
</tbody>
</table>

6. Putting It All Together

Whether it’s for Corporate or Education, the key stages involved in the instructional design of an ALS system are:

<table>
<thead>
<tr>
<th>STEP 1</th>
<th>STEP 2</th>
<th>STEP 3</th>
<th>STEP 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decision on what competencies to cover; links with existing modules</td>
<td>Decision on learning objectives to achieve competencies</td>
<td>Decision on formats to present content for each learning objective</td>
<td>Decision on criteria to determine learner progress, assign modules</td>
</tr>
</tbody>
</table>

Stage 3 involves mapping a unit of learning material (ULM) to a learning objective or a concept. Here, the goal is to provide as many formats of learning as is feasible:

- Text-based
- Animation
- Case study
- Quiz – Difficulty level low
- Quiz – Difficulty level medium
- Quiz – Difficulty level high
The last stage involves two critical tasks:

» Determination of logic to assign modules based on learner performance and level of required competency
» Decision on what modules to assign, beyond those that support development of the core competence

The design considerations go beyond the core system to allied systems. Since the objective is to give the learner an entire eco-system of content, the design process should also involve identifying the sources of content – beyond what is being developed. Here, the model can be similar to a hub and spoke concept. The core system, from where the learner accesses the content is the hub; the allied systems are the spokes.
7. Summary

We started by building a case for an ALS, on the premise that it shifts focus from the teacher to the student. Though this came with a disclaimer that the ALS isn’t a panacea for the drawbacks of a teacher-centric model, it did offer a framework for personalizing learning experience leveraging technology. This attribute of ALS – to personalize learning experience – has given ALS a new name: Personalized Learning Environment (PLE). The differences between the two are more a matter of semantics.

We conclude with a look at the process of due diligence while designing an ALS: while taking a decision on an ALS, one can consider the following questions. Answers to these questions will help articulate the things to consider while designing an ALS:

» What are my objectives for designing an ALS?
» Can I leverage existing knowledge assets to create an ALS eco-system?
» Does my existing system support an ALS?
» How important are learning styles for my target audience?
» What are my preferred ‘spokes’ for the ALS hub?
» How will I use the data from the assessment?
» What is my budget and preferred timeline for creating a robust ALS?

The business case for investing in an ALS will be the strongest if it is possible to leverage existing assets and minimize the initial cost. The reality, though, is that given the diversity of content standards and deployment tools few can hope to start with this advantage.

Our opening argument was that ALS is all about giving power to the people – albeit, for learning. The case for investing in an ALS may thus have to go beyond immediate economic benefits. The argument should circle back to the possibility of a greater good – empowerment, motivation, development of human capital. And like the proverbial pot of gold at the end of the rainbow, there are dollar benefits, in the horizon, from all of this.