

## **Overview**

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The goals and key features of adaptive learning tools are [Brusilovsky 1996, Weber]:

- Adaptive Presentation: Adapting the content based on the learner's goals, knowledge, experience and other information stored in the student model
- Curriculum Sequencing (Instructional Planning Technology): Providing an individualized "optimal path" through the learning material
- Adaptive Navigation Support: Displaying hyperlinks adaptively to better help navigation
- Intelligent Analysis of student solutions: Providing comprehensive feedback about problems/exercises that a student has completed and updating the student model accordingly
- Interactive problem solving support: Provide hints and intelligent help to students depending upon their performance
- Example based problem solving: This also provides intelligent help but in the form of examples from previous materials/questions already covered

The advantages of using such tools are:

- Helps pace the same course appropriately for novice and advanced students presenting content they would enjoy
- Adaptive navigation helps novices find their way in hyperspace and prevents them from getting lost
- Courses adapt to student's background and knowledge enabling quicker completion for advanced students
- These systems are mostly web based and have a familiar interface to internet web sites helping easy use by novices

The disadvantages of using such tools are:

- The course material needed is much more since it is adaptively presented to the learners
- The tools are complex to develop and deploy and the technology is new and currently under research and development
- Course setup requires much effort and preparation by the teaching staff since difficulty levels of the materials and questions, course structure and content need to be rigorously defined

## **Literature Review**

### **Adaptive Learning/Hypermedia**

There are a number of Adaptive Learning System technologies both experimental and commercial. [Conati 2001] describes SE-Coach and its adaptive user model based on Bayesian Network. SE-Coach provides guidance for “self-explanation” and relies on a probabilistic model using explicit and implicit reasoning gathered from the learner. Another system is AHA! [De Bra 1998] and it maintains a user model and provides adaptive link annotation, hiding and disabling. Apart from use as an educational tool the authors also suggest its use in an information kiosk.

InterBook [IB] is another such tool and it for “authoring and delivering adaptive electronic textbooks” online though its used for course delivery as well. It provides tools including its own HTTP server and provides adaptive guidance, navigation and help. MetaLinks [ML] is similar and supports “focused and exploratory” learning. It is dedicated more for adaptive books and provides active reading (high level reading, searching and problem solving), multi-level books (same book for beginners as well as experts), multi-themed books (a book that would cover different aspects and traditionally requiring multiple books), deep content representation (different ways to show the contents), avoiding hypermedia side effects (allowing users to jump between pages and making sure they are not lost), evolving content and student modeling.

NetCoach [Weber 2001] is also an adaptive learning system and is designed to enable authors to develop a course without programming knowledge. It can adapt to user knowledge, goals and preferences and provides curriculum sequencing and adaptive annotation of links. The adaptive behavior of the system is specified by providing pre-requisites and inferences among various course concepts and test groups. It can also present interactive exercises and tests in different formats. Communicative elements include email, chat and discussions.

### **Good Course Design**

[Parker 2002] lists eight steps for online course preparation involving researching and learning best practices, determining course content, determining and learning delivery method, developing/adapting older learning units and tests and determining grading criteria. In best practices for online courses [Chickering 1996] describes how new technology can be applied to their original “seven principles” for traditional classes. It describes how computers can be used cost-effectively to advance the seven principles.

For adaptive systems [Cristea 2002] suggests an incremental model to gather the required concepts for the course. A concept based system of authoring using a five step procedure is outlined. The steps are writing the content sequentially, dividing it into a concept structure, applying adaptive features; define styles, alternative and conditionals, and creating a lesson map.

Adaptive courses have many unique features and according to [Manuel] a given concept may be reachable through different paths in different contexts, this makes a hierarchical index inefficient in covering all these alternate paths. A course design methodology is also provided.