

Hemlock: An on-line learning system that remembers the best way to teach you.

One of the biggest challenges to learning is finding out what you don't know. For example, if you are trying to teach a high school student how to solve linear equations then they should have the prerequisite knowledge of the X and Y coordinate system in order to fully understand what they are doing. Likewise, trying to explain to undergraduate biology students what a gene is, is of little meaning until they have understood that genes encode for proteins. **A second challenge** is trying to plan your time when tackling a new topic and trying to estimate how long it will take you to learn something.

A good teacher recognizes the ability of the student they are teaching and adapts to suit his or her needs. When teaching a large number of students, such as a lecture, it is often difficult for a professor to get feedback from students and adapt the material that they are teaching to the class. The majority of education is currently **"broadcast learning"** rather than **"personalized learning"**. Personalized learning is available, but at a high cost such as paying a good teacher for on-to-one tuition.

Two assumptions are made here; that a good teacher adapts his or her material to suit the student's ability and that one to one question and answer with a teacher is the best way of learning. It is also supposed that because these two things take up a lot of teacher's time then they are also expensive to provide. By teaching a computer to do this, and distributing the one-to-one contact between all learners, it is hoped to **"personalize learning"** for any individual who sits down at a computer to learn.

System Requirements: *The system could be a stand alone application or a Firefox plug-in that lays over a web page (see figure).*

1. Question and Answer System (Similar to Yahoo Answers uses: tagging)

Imagine typing a question into Google, if the question has been asked before, then the system responds with the answer automatically, but if not, then Google contacts an expert in the subject and returns an answer to you. When you click on or ask a sub-question the system remembers which question was linked to the next question and builds up a map of your knowledge, storing it for future reference like Google stores the ads that you click on.

If the question has not been answered before, then the system notifies a virtual TA (another user of the system) to help answer your question. As you start typing, faces start to appear showing you the people logged in who are best suited to answer your question. As more questions are asked, matching questions to answers becomes easier. The system then links up questions and answers and the users tag them with subjects and keywords. As more questions are asked, a pathway of knowledge is stored and created which can be followed in the future by other students asking similar questions (an algorithm could track this). Each answer is timed so that an estimated time required to learn a particular topic can be given.

2. Virtual Teaching Assistant. (Communications: Googletalk meets Facebook)

A system for user profile matching and intelligent distribution of questions and answers. This sends the questions coming in from the Q&A system above and distributes them to the best TA's capable of answering the question. It then allows the two users to communicate with each other via instant messaging or voice.

The system tells what you know from your own questions, it can profile you as a biologist, computer scientist, historian etc. Based on what you know, it allocates you to new questions that you can answer as others ask them. All users can be asked to help answer new questions and the more you answer, the more credit you build up in the system. By this way, you share the knowledge that you are learning with others. Credits could also be used to buy things, or the government could pay teachers to be on-line and answer questions.

Example 1, Teaching high school algebra. Enter questions into the system from a math text, let students answer them and see how the subjects connect up. See which areas students find difficult and help them learn the prerequisites needed.

Example 2, Teaching undergraduate cell and molecular biology

Ask students to ask as many questions as possible about each class they have, then ask them to tag and link the questions up in a logical order. Once they start asking novel questions not covered previously, turn this into a homework assignment to find the answer.

Hemlock screenshot, a Firefox plug-in lays over a page on Wikipedia

