The ALE system-matching game

Match the system description to the year(s) of its creation and win![1]

This is a game to get everyone thinking about the very different types of systems and programs that come under the umbrella of "Adaptive Learning Environments" and the different types of content that have been addressed over time. The goal is to read the descriptions, and then guess when the systems were created. There are six systems and six possible years/time spans.

The twist: Five of these are "real" systems, but one of these systems was *never actually constructed and tested*, it was only proposed on paper. Which one do you think it is?

Match these years/ time-spans to a system: 1977-9, 1984-6, 1996-2002, 2002-4, 2008-11, 2013

SYSTEM A:

This program tutors students in physics problems (generally at first-year university level), and was designed to closely mimic paper-and-pencil assignments and to supplement a standard lectures-and-textbook course. To solve their teacher-assigned problems, students perform the same on-screen actions as they would on paper (such as defining variables and drawing vectors). However, now they receive feedback after each problem step, based on the program's representation of physics principles. For example, the system might flag the use of an undefined variable or offer a hint about which principle to apply. Students can request help when they are not sure why the system flagged something as wrong, or are not sure what step to take next. This generates a sequence of successively more explicit hints.

SYSTEM B:

This program supports preschool-aged children in improving their "number sense", or the ideas that numbers relate to quantities, the relative meaning of quantities, and similar pre-mathematical skills. The program is cartoon-like and relies on visual metaphor of an elevator to indicate relative number quantities. Playing the game requires children to interact with and teach an animated panda character about number sense skills. Their panda must help a bird return home to its nest by taking the "elevator" up to the right tree branch. This is the principle of learning-by-teaching, in which users improve their own knowledge by taking responsibility for teaching (and testing) someone else. In order to help their character, children themselves must learn and practice the skills.

SYSTEM C:

This system targets geographical knowledge through a dialogue-based tutorial session. It receives typed natural language input from the student and responds in the same manner (i.e. in full English sentences). The session represents a broadly Socratic philosophy of teaching by asking the student questions (e.g. about cause and effect) rather than just drilling a set of facts. Specific dialogue strategies were developed by studying tutorial dialogues between human teachers and

[1] Win the admiration of your classmates, your lecturer, and maybe even your mum.

students, and using these to derive rules for the system's conduct. The system can "diagnose" erroneous student knowledge, prioritise which misconceptions are most important and should be corrected first, and then pursue a variety of strategies to correct those misconceptions, such as by offering a counter-example.

SYSTEM D:

This system is not a single program, but rather a suite of devices, activities and strategies that students use "in context" in order to learn about ecology. The goal was for pairs of students to engage in, and reflect on, scientific enquiry as they explore a real woodland environment, supported by interaction with devices. This approach was built on the idea of adapting e-learning to a mobile context and combining it with a fairly unstructured, student-led version of a field trip. The goal for the devices was not to provide a constant stream of information like a mobile "tour guide", but instead to provide intermittent information or action prompts depending on the student's position and actions in the physical world. For example, the "probe tool" allows students to read light and moisture levels in parts of the environment and stores this information for later inspection. The PDA might provide contextually relevant (location-relevant) information about abstract processes such as photosynthesis, or might prompt learning actions like reflection, and pair discussion. The system was completed by several environmental "stations" for listening to recorded sounds, such as bird song, and viewing videos, such as the woods' seasonal changes.

SYSTEM E:

This program is targeted at middle school science students (i.e. approximately 11-13 years old) and covers a range of microbiology topics. It was designed to have student learning and student engagement as equal goals. It is built on a video game platform, and offers the students/player a chance to explore a virtual world and interact with other characters and in-game resources in order to solve a "science mystery" about the source of a disease. The immersive graphics and mystery narrative are meant to draw students in, maintain their attention, and better motivate them to learn the program content (compared to a traditional lecture). Through their character interactions and more explicit in-game resources, students learn concrete facts about viruses, parasites, and bacteria. The actions required to solve the mystery (gathering evidence, hypothesis formation and testing) help students to practice steps in the scientific method, another curricular goal for this age group.

SYSTEM F:

This system tutors students in understanding electrical circuits, with particular focus on troubleshooting and on prediction/explanation of circuit behaviour. It uses a combination of graphics and text explanation to support students in developing "runnable" circuit models and solving problems. It qualitatively models students' understanding of the topic, and the system's model successively changes and becomes more complex as the students' reasoning evolves. This "progression" of models drives the system's choice of problems, as the goal is to move to the next "stage" of the model (i.e. closer to an expert-like model). The system has several modes: student-directed (s/he chooses problems and sets own curriculum), problem-driven (system assigns problems and offers help when student appears to be in trouble), and example driven (worked examples followed by exercises). These modes provide more flexibility in how the system is used.