

Artificial Education: Expert systems used to assist and support 21st century education.

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Abstract- This paper offers a new concept called in education called Artificial Education. Though the term artificial education might disturb many educators, parents and students, it is important to understand what it is and the potential it has for the educational success of all learners. Artificial education refers to using artificially intelligent systems, also known as expert systems, to educate students and teachers. This is a short introductory article on what artificial education refers to, and how intelligent or expert systems can assist students and teachers at the elementary level.

This paper introduces a new concept known as artificial education (AE). Artificial education refers to using artificially intelligent systems, also known as expert systems, to educate students and teachers. Artificial intelligence is a branch of computer and information science that focuses on creating hardware and software systems that solve problem and accomplish tasks that humans are capable of doing. The International Artificial Intelligence in Education (AIED) Society supports and funds research in developing expert systems and machines. An expert system is an area of artificial intelligence that explores whether or not it is possible to computerize the expertise of a human expert (Moursund, 2006). In education, AE can refer to the use of expert systems or machines to assist in the education of students and teachers in multiple subjects, areas and academic levels.

There is plenty of software that teaches curriculum/subject content, but many of these programs do not take into account the individual user. Expert systems, developed to educate students and teachers should be able to adjust instruction based on the educational needs of the user. An expert system consists of four major parts. The first part is the knowledge. In AE, knowledge would include knowledge of pedagogy (teaching practices and beliefs), curriculum, and knowledge regarding the individual student's needs, assessments, evaluating, and more. The second part is problem solving. The expert system, through a combination of algorithms and heuristics utilizes the knowledge base to solve problems within the context. In artificial education, it would take the data regarding the student, and curriculum the student should be learning based on grade, age, level, past exams, it would look at past successful and unsuccessful pedagogies used with individual student, and it would be able to present instructional material to that specific student in a way the benefited him or her individually. The last two parts

include the communicator, which facilitates actions between users and developers of system, and explanation and help, which provides users explanations of actions (Moursund, 2006). In education, the last two sections are geared towards educational professionals and administrators and work towards justifying educational plans and improving the expert systems capabilities through continuous feedback. Once these systems gain initial knowledge by human experts, the system can be trained and learn through experience.

With a variety of technological tools, both mobile and stationary, and web-based applications, students are able to learn curriculum through expert systems. The expert system can be access over the Internet or installed on multiple tools such as computers, netbooks and other hand-hand devices. At the elementary level and higher, students can have the opportunities to use expert systems called Intelligent Tutoring Systems (ITS). These software or web-based programs provide content based on the user's data and personal routines with program. ITS use artificial intelligent techniques to provide students with materials that are neither too easy nor too hard. It provides differentiated instruction that can adapt learning content to student performance (Jeremic, Z., Jovanovic, J., & Gasevic, D, 2009). Well created ITS should provide students with good modeling, motivation, interactivity, feedback, consistency, and access to learning (Wijekumar, 2007). These intelligent tutoring technologies have been implemented at all grade levels and in grade areas.

Aside from ITS, another frequently heard term in artificial education are expert systems called Intelligent Computer-Assisted Learning (ICAL) tools (Moursund, 2005). The idea of computer-assisted instruction (CAI) has been around since the beginning of computers. In 1965, Patrick Suppes presented a paper on Man-Machine Communication that addressed the possible educational benefits computer assisted instruction could have. He foresaw that the programs would be able to correct student responses, keep records, and educate students in curriculum content. Suppes believed that CAI programs would be able to address the diverse needs of students. CAI could work at all academic levels and improve attentions rates of individual students. "Computer technology provides the only serious hop to the accommodation of individual differences in subject-matter learning," (Suppes, 1965, p. 12). Today, Patrick Suppes' view is a reality, and there are programs using artificially intelligent technology to assist individual students based on academic strengths and weaknesses.

An example of an Intelligent Tutoring System is AnimalWatch. According to their website, "Animal Watch

is a web-based tutoring program for algebra readiness, including computation, fractions, and pre algebra topics such as ratios, proportions, decimals, unit conversion, and others,” (http://animalwatch.arizona.edu/about_animalwatch). Based on previous evaluations of AnimalWatch, they found that students academically improved based on pre- and post-tests, English learners showed significant improvement, the computers makes it easy to review lessons and concepts, and the web-based program allows students to choose help when they need it, (<http://animalwatch.arizona.edu/results>).

Aside from using intelligent tutoring systems in various curriculum content, there has been success in using expert systems in the learning of languages for both language learners and students with special needs in speech. These programs are often referred to as intelligent computer assisted language learning (ICALL) programs. These programs allow for remediation, repetition, and skipping ahead based on user performance. These intelligent programs are dynamic and respond to the individual user based on his or her actions and create learning content for the individual user.

An example of ICALL is a system called JUGAME in which users learn the Japanese language, specifically the kanji idioms. The software was able to generate adaptive puzzle patterns that focused on the knowledge level of the specific user (student). Through this research, the authors found the program provided a new and motivational learning environment for foreigners learning the kanji idioms (Toshihiro & Yoneo, 1994).

ICAL has worked with children of severe speech delays. The ICAL approach has produced better results than individual instruction provided by speech therapists. A popular system used by students with speech delays is called FastForWord®, developed by Scientific Learning Corporation. It contains a series of training programs that are designed to improve oral and written language, comprehension and fluency,” (Tallah, 2004). Dyslexic students used this training program and became better readers after eight weeks, (Trei, 2003). Nevada Department of Education conducted a comparative study in three schools. They found an increase in “student reading achievement by an average of 22.2 percentage points” (<http://www.scilearn.com/alldocs/cp/research/NevadaDOEBriefing.pdf>). There has been multiple studies conducted on Fast For Word across the country. For more information visit <http://www.scilearn.com/results/scientificallly-based-research/fast-forword-results.php>.

It is clear the expert systems have the potential to help students at all academic levels, and through time these systems will continue to be developed and made better. Aside from assisting students, artificial education can apply to the educational leaders, administrators, and teachers. Expert systems to help teachers learn, evaluate, and make logical educational decisions regarding the individually differences of students. In 1965, when technology was just being introduced, Patrick Suppe said, “For the first time, we

shall have the opportunity to gather data in adequate quantities and under sufficiently uniform conditions, to take a serious and deep look at subject-matter learning,” (Suppe, p. 17, 1965). And now, according to the US Department of Education’s National Education Technology Plan, published in 2011, “technology should be better used to measure students achievement in more complete, authentic and meaningful ways,” (Allen, 2011). The New York City Department of Education’s Achievement Reporting and Innovation System (ARIS) provides a web based location educators and parents can use to accelerate student learning. The academic information provided is based on the state tests. Educators and parents can log on to the system, access specific student information, and gather data and instructional material on what the individual student academically needs. ARIS is not an expert system, but in the near future, and possibly now, these large database systems will have the abilities to provide more detailed information to enable educators to create a more successful learning environment. Dede, an advisor to National Education Technology Plan (NETP) believes computers and mobile devices will be able to collect student work and provide ‘cognitive audit trail’ that can be analyzed to show how students think and what they understand (Allen, 2011).

On a smaller level, there are intelligent computer-assisted tutoring programs that can assist classroom teachers and or tutors with the individual assessment of student progress and academic needs. An example of this type of program is called Alphie’s Alley. This program provides reading teachers with animated activities for students, assessment tools and professional development. This program assesses students and then provides a tailored plan based on this assessment. Alphie Alley was designed to support the teacher. It contains a complex database that allows the computer to make ‘intelligent’ decisions on teaching interventions, based on individual student performance, (Chambers, et al, 2005). The 2005 study of Alphie Alley used with first graders, it found that if the program enhanced the performance of the teachers, it showed promise in improving the reading performance of at-risk students (Chambers, et al, 2008).

Though there exists links in academic success with ITS, computers should not replace the bond and relationship students and teachers form at the elementary school level. ITS can and should be used to assist teachers and students in learning, but not replace. At the elementary level, the bond between teachers and students assist in creating the learning environment. According to Thompson, Greer and Greer, they found 12 characteristics that indicated highly qualified teachers. The characteristics included a fairness, sense of humor, respectful nature, positive attitude and a personal touch that includes calling students by their name, smile often, ask about students feelings and opinions, and an acceptance of students for who they are (Thompson, et al, 2004). It would be difficult to create an ITS system that can effectively contain these attributes. “No computer can

perceive children's difficulties, explain concepts or motivate children like a caring capable tutor" (Chambers et al 2008).

This paper provides a limited overview of how intelligent systems are being used at the elementary level. These systems offer much potential for students and teachers in the assistance of learning and effective teaching. Students and teachers are able to learn through specific intelligent machines, expert systems, and intelligent web-based programs. Through continued developments and research in the area of Artificial Education, innovative expert systems will be able to advance the academic success of all students with differing academic strengths and weaknesses.

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