Realizing the Potential of AIED

Lewis Johnson

Alelo Inc.

Abstract. This is a time of opportunity and promise for AIED as a field. The field has had some major successes, and is having an impact with significant numbers of learners. Now that Big Data has arrived in education, opportunities are opening up to generate analytics from that data and use it to personalize learning. There is however potential to have an even greater impact on education, and make greater use of AI technologies. The field should focus on realizing this potential, and not divorce itself from either AI or Ed. Achieving impact will require more effective dialog and collaboration with educators, learners, and people in industry.

Keywords: Educational impact, partnering with education, partnering with industry, participatory design, technology transfer

1   The Time for AIED has arrived

These are exciting times for learning technologies. Technology is becoming integrated into education at all levels, as online learning, blended learning, and smart classrooms are becoming the norm. The global market in technology-enabled learning is projected to grow at an annualized rate of 20.3% to $220bn in 2017 (MarketsandMarkets, 2014). Large as this is it is still a small fraction of the $5.89tr that is projected to be spent on education in 2015 (Next Up Research, 2010); this suggests there will be even greater opportunities in the future. Technology-enabled education is enabling and fuelling demand for personalized and adaptive learning and assessment (Borden, 2011; Getting Smart, 2012), capabilities which AIED systems are well positioned to provide.

AIED-based systems are contributing to this innovation in learning. Alelo's language and culture training systems (Johnson, 2010; Camacho et al., 2009; Johnson et al., 2012) are in widespread use throughout the world, with well over 100,000 learners to date. They have had a significant effect on the cultural and linguistic competence of the learners who use them. For example the 3rd Battalion, 7th Marines, the first American Marine unit in the Iraq war to complete their tour of duty without any combat fatalities, learned Iraqi Arabic language and culture using Alelo's Tactical Iraqi learning environment (Marine Corps Center for Lessons Learned, 2008). Another AIED success story is the ASSISTments system, which is being used throughout the United States by nearly 20,000 or more students per year (Gelfand, 2011). And perhaps the biggest success so far has been the Carnegie Learning curriculum and software, which

as of 2010 had been used by over 500,000 students (Institute of Education Sciences, 2010).

The workshop call for papers questions whether the ideas of AIEd are influencing AI or Education in any major way. The above examples illustrate that it is AIED is in fact having an impact. One could perhaps argue as to whether they are having a major impact, but they certainly intend to do so.

Yet these examples are just the beginning, and AIED has the potential to have an even greater impact on education in the future. The challenge for the AIED community is to realize that potential. It needs more success stories – examples of AIED research that is having an impact. The more instances there are of research that is having an impact, the more impact the field as a whole will have.

I regret that other obligations do not permit me to participate in person in the workshop in Madrid. However remote participation is becoming commonplace in technology-enabled learning, so I hope it is also possible for a major international conference on technology-enabled learning such as AIED. In any case I feel compelled to contribute this position paper and hopefully offer some constructive suggestions.

2   Connect AIED to Educational Problems

I have a number comments on the questions posed in the call for papers, but I will focus here on just one: the extent to which the results of AIED research are meaningful to real educational practices. Or to put it another way: What steps can people in the AIED community take to ensure that their research has meaningful educational impact? Here are some recommendations.

Talk with educational leaders. More than individual teachers, educational leaders and managers have a broad view of how where the unmet educational needs are, and may be open to innovative approaches that can meet those needs. Many of these are needs that AIED technologies can address. If you have a promising AIED technology, show it educational leaders and listen to what they have to say. They might help you make the connection to education needs, or if not you will come away with a better understanding of what the critical educational needs really are. They may be able to put you in touch with schools and teachers that are receptive to innovative solutions.

Talk with people in the edtech industry. There is not enough dialogue between AIED researchers and people in the edtech industry, which leads me to suspect that that there may be an insufficient appreciation of what researchers can learn from such dialogue. People in edtech have an understanding of what it takes to make a real impact on real educational problems with technology. They may be aware of educational problems that they themselves are not in a position to address, but they wish someone else would.

Engage in effective iterative, participatory design. The workshop call for papers suggests that participatory research is often a matter of rhetoric rather than practice. The question as I see it is how to make such participatory research achieve more effective results. Dialogue with educational leaders prior to the start of the design process can help, to make sure that the design is focusing on the right problems. So can iterative participatory design, in which researchers show teachers and learners

partial prototypes and ask for input on how to improve it. Participatory design can be very effective when people have something concrete to respond to.

Learn from research programs that value educational contributions. The US National Science Foundation's Cyberlearning program is an example of research program whose projects address learning research questions as well as learning technology questions. The program requires research teams to carefully evaluate the educational impact of the designs that they develop, instead of simply focusing on technology development. Other AIED researchers can draw useful lessons from this and similar programs.

The RALL-E project (Alelo, 2015) is an example of an exploratory AIED research project that has undertaken each of these steps. With funding from the National Science Foundation's Cyberlearning program, we have developed a lifelike robot that can converse in Chinese, using the Robokind's Zeno-R25 robot as a platform. We developed the concept with advice from the Virginia Department of Education, which made us aware of critical needs in their state such as the lack of availability of qualified language teachers in many schools and the lack of access to high-quality interactive learning materials in many of those schools. We designed RALL-E as an interactive language-learning tool that students can use to develop their conversational skills, with or without the presence of a teacher. The Virginia Department of Education introduced us to the principal of a receptive test site, the Thomas Jefferson High School for Science and Technology (TJ) in Alexandria, Virginia. We have developed the robot iteratively, and have conducted a series of focus group tests with students and teachers at TJ. This has helped us refine the technical concept, as well as develop a better understanding of how it might be used in an educational context. This gives us confidence that students and teachers will respond positively to the completed solution. And finally, we talk with other people in the edtech industry, to determine how this technology might be relevant to educational needs that they see.

As more AIED projects draw lessons from projects that have had good impact, it will help the field overall to realize its potential of improve education. The rapid increase in availability of computing resources is multiplying the opportunities for the field to make a difference. If we seize these opportunities the prospects for the future of AIED are bright indeed.

Acknowledgments

References

1. Alelo (2015). Alelo Develops an Interactive Robot for Learning Chinese. Retrieved March 16, 2015 from http://www.prweb.com/releases/chinese/robot/prweb12538156.htm.

2. Borden, J. (2011). The Future of Online Learning. *eLearn Magazine*, August 2011. Retrieved March 16, 2015 from http://elearnmag.acm.org/featured.cfm?aid=2024704.

3. Camacho, J., Johnson, W.L., Valente, A., & Bushika, M. (2009). Cultural training: The Web's newest gaming frontier. In Proceedings of I/ITSEC 2009.

4. Gelfand, A. (2011). Unleashing the Potential. *Worcester Polytechnic University Annual Research Magazine*. Retrieved March 16, 2015 from http://www.wpi.edu/research/magazine/unleashing.html.

5. Getting Smart (2012). New Survey Shows Demand for Personalized & Adaptive Learning Assessments. Retrieved March 16, 2015 from http://gettingsmart.com/2012/02/new-survey-shows-demand-for-personalized-adaptive-learning-assessments/.

6. Institute of Education Sciences (2010). Intervention: Carnegie Learning Curricula and Cognitive Tutor® Software. Retrieved March 16, 2015 from http://ies.ed.gov/ncee/wwc/reports/hs_math/cog_tutor/info.asphttp://ies.ed.gov/ncee/wwc/reports/hs_math/cog_tutor/info.asp.

7. Johnson, W.L. (2010). Serious use of a serious game for language learning. Int. J. of Artificial Intelligence in Ed. 20(2), 175-195.

8. Johnson, W.L., Friedland, L., Watson, A.M., & Surface, E.A. (2012). The art and science of developing intercultural competence. In P.J. Durlach & A.M. Lesgold (Eds.), Adaptive Technologies for Training and Education, 261-285. New York: Cambridge University Press.

9. Marine Corps Center for Lessons Learned (MCCLL) (2008). "Tactical Iraqi Language and Culture Training System" *Marine Corps Center for Lessons Learned Newsletter* 4 (8), 4.

10. MarketsandMarkets.com (2014). Smart Education & Learning Market by Hardware (IWB & SBL), Software (LMS/LCMS, Open Source & Mobile Education Apps), Educational Content (Digital Content, Test And Assessment & Digital Text Book) - Global Advancements, Market Forecast and Analysis (2014 - 2019). Retrieved March 16, 2015 from http://www.marketsandmarkets.com/Market-Reports/smart-digital-education-market-571.html.

11. Next Up Research (2010). NeXt Knowledge Factbook 2010. Retrieved March 16, 2015 from www.kellogg.northwestern.edu/faculty/jones-ben/htm/NextKnowledgeFactbook2010.pdf.