Simulation-Based Training and Assessment: From the Military to Virtual Schools

W. Lewis Johnson Ph.D., President and CEO, Alelo Inc.

1 INTRODUCTION

The military has long played a leading role in developing and adopting technology-mediated learning (Fletcher & Chatelier, 2000). Online learning is now an integral component of military training, and many online courses are mandatory for military personnel. The military engages in an extensive program in training research and development to develop new training methods and evaluate their effectiveness.

The military has been particularly active in the use of simulations and games (Fletcher & Tobias, 2006). Simulations offer a number of advantages as learning tools. They give learners opportunities to learn in context, which helps with retention. Learners who practice in simulations of real-world situations can easily transfer their learning to those situations (Hahn, 2010). Moreover, they gain self-confidence in their ability to apply their knowledge in real-world settings. Game-based approaches to simulation, if done properly, have the added advantage of promoting learner engagement and motivation.

Simulation-based assessments also offer advantages as assessment tools. They have a high degree of validity, compared to conventional tests, because they allow one to see how the learner can apply his or her knowledge in practice. Moreover, they make it possible to assess learners consistently, to make sure that learners' performance meets a common standard.

The instructional advantages of simulations and games can also apply readily to education. The research and development that the military has made into training technologies and methods can be easily adapted for use in virtual schools and other online education contexts, particularly in science, engineering, and world languages.

This presentation will illustrate this adaptation potential, in the context of Alelo's simulation-based training methods for world languages and cultures. This work started as a university research project funded by the Defense Advanced Research Products Agency (DARPA) (Johnson, 2010). It has since been further developed and applied in a variety of military training courses in the United States and other countries. It is applicable in a variety of educational contexts, including virtual schools.

2 EXAMPLE: VCAT

The Virtual Cultural Awareness Trainers (VCATs), developed by Alelo for Joint Knowledge Online (JKO) in Suffolk, VA, are good illustrations of effective simulation-based military training (Johnson et al., 2011). VCATs train military personnel in the critical intercultural skills that they require when they are deployed overseas. VCATs are being developed for a number of countries in Africa, Asia, and Latin America. In just a few hours of training learners acquire enough cultural knowledge and skill to make a difference in the learners' overseas job performance.

VCAT training has been extremely well received, so much so that the US Southern Command has designated VCAT training as mandatory for upcoming missions in Latin America. This demonstrates the

high level of confidence within the Department of Defense (DoD) in the value and effectiveness of VCAT training.

VCATs are effective because they are specifically designed to prepare learners for the situations that they are likely to encounter overseas, where they must interact with and work with the local people. The centerpiece of this training is what we call *social simulations*, in which learners role-play interactions with simulated non-player characters, controlled by artificial intelligence. Learners must apply their knowledge of the local culture and language as they decide what to say and do in the simulation. The non-player characters react to the learners' actions in a culturally appropriate way, providing immediate feedback.

VCATs employ simulations for both learning and assessment. In Practice Scenarios learners apply their intercultural skills and receive targeted feedback, including recommendations of specific learning materials they should review in order to improve their skills. In Test Scenarios learners must demonstrate that they have mastered the requisite skills and are able to complete the scenario successfully without assistance.

VCAT courses have been developed for use on the Web and on mobile devices. The mobile solution is particularly attractive because it enables learners to learn and practice at their convenience. Both solutions employ an automated speech understanding (ASU) capability, which enables learners to engage in spoken conversations with the non-player characters in the simulations.

Alelo has developed a sociocultural research and instructional design methodology that is specifically designed to support the development of VCATs and similar courses. We interview subject-matter experts to develop a detailed understanding of how cultural skills apply in specific situations. This provides us the information that we need to create simulations of those situations, as well as other supporting learning materials. We cross-validate materials to make sure that they are accurate and reflect current conditions in the country in question.

We have conducted studies to evaluate both the immediate and long-term effectiveness of VCAT training. Surveys of learners and their supervisors, conducted after the learners had deployed overseas, indicated that the training had long-term benefits.

3 EXAMPLE: TI SIMULATOR

The TI Simulator (Tactical Interaction Simulator) is Alelo's best example to date of serious gaming and social simulations applied to language and culture training (Emonts et al., 2012). Developed for use by the Australian Defence Force School of Languages, the approach has broad relevance for learning communication skills. The design integrates simulations and game mechanics for the purpose of achieving learning objectives. Trainees learn as they play the game, they are motivated to keep playing to achieve higher levels of attainment, and they learn outside the game in order to perform better within the game.

The TI Simulator includes a collection of simulations of common interactions learners might have with local people. Each can be played at different levels of difficulty. Color codes are used to indicate the difficulty level. Red (i.e., hostile) encounters have the lowest level of linguistic complexity – the trainees mainly give orders to bring the situation under control. Amber encounters have the highest level of complexity – the attitude of the locals is uncertain, and might become friendly or hostile depending upon what the learner says and does. Providing multiple levels of difficulty helps to ensure that learners are

playing at a level that is neither too easy nor too difficult for them, so they are motivated to master the current level and then progress to higher levels.

As the learners practice the simulations the system performs a detailed assessment of learner performance along multiple dimensions. Learners receive points for accomplishing each communicative objective in the scenario. They fail to gain points if they fail to communicate effectively, e.g., by failing to properly answer a local's question, by resorting to an interpreter, or by provoking a hostile response. Learners are scored for using linguistic forms that are appropriate for the situation, at the appropriate level of politeness or directness. They gain points when they employ a wide variety of vocabulary. Learners get immediate feedback through the responses of the non-player characters, as well as feedback at the end of the scenario. The detailed assessment helps learners understand clearly where they need to improve, so that they are motivated to improve.

The game challenges learners to keep practicing until they have achieved a maximum score at each level, so that they can progress to higher levels. This provides a strong motivation to learn. We predict that learners will be motivated to learn outside the game, e.g., to learn new words and phrases, so that they can achieve higher scores within the game.

4 APPLICATIONS IN VIRTUAL SCHOOLS

The instructional methods described above, developed for military use, are beginning to be applied to nonmilitary use as well. For example, Alelo has developed an English language-learning Web site for Voice of America called goEnglish, which is available in five languages and has over 100,000 registered users worldwide. Alelo has partnered with the Virtual Virginia Online School to develop and test a pilot Chinese course that employs social simulations (Johnson & Zaker, 2012).

These examples only begin to realize the potential of using assessment, feedback, and scoring to promote learning. By incorporating more advanced methods, as illustrated in the TI Simulator, it will become possible to implement significant changes in the way instruction is managed and delivered – to "flip" the classroom. Learners will be able to achieve higher levels of performance outside the classroom, so they will come to class better prepared. This could result in higher student performance and lower student attrition. It can reduce the burden on teachers and empower them to be more effective.

5 REFERENCES

Emonts, M., Row, R., Johnson. W.L., Thomson, E., Joyce, H. de S., Gorman, G., & Carpenter, R. (2012). Integration of social simulations into a task-based blended training curriculum. In Proceedings of the 2012 Land Warfare Conference. Canberra, AUS: DSTO.

Fletcher, J.D. & Chatelier, P.R. (2000). An overview of military training. Institute for Defense Analyses Document D-2514.

Fletcher, J.D. & Tobias, S. (2006). *Using computer games and simulations for instruction: A research review.* Paper presented at the Society for Applied Learning Technology Meeting, Orlando, FL, 2006.

Hahn, S.H. (2010). Transfer of training from simulations in civilian and military workforces: Perspectives from the current body of literature. Advanced Distributed Learning, www.adlnet.org.

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

Johnson, W.L., Friedland, L., Schrider, P., Valente, A., & Sheridan, S. (2011). The Virtual Cultural Awareness Trainer (VCAT): Joint Knowledge Online's (JKO's) Solution to the Individual Operational Culture and Language Training Gap. In Proceedings of ITEC 2011. London: Clarion Events.

Johnson, W.L. & Zaker, S.B. (2012). The Power of Social Simulation for Chinese Language Teaching. *Proceedings of TCLT7*. Honolulu, 2012.