Integration of Social Simulations into a Task-based Blended Training Curriculum

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ABSTRACT

Military success cannot be accomplished through kinetic warfighting skills alone. Often, it is the appropriate application of mission-critical communication skills that ultimately determines mission success. Training simulations are proven to be highly-effective in preparing trainees for real-world success in missions and tasks that involve non-kinetic interaction with locals. It is unclear, however, how simulation technologies can best be integrated into a task-based curriculum for the development of mission-critical language and culture skills. To this end, the Australian Army Simulation Group and the Defence Force School of Languages (DFSL) have partnered with US-based Alelo Inc. to develop instructional social simulations to address this training gap.

1. Introduction

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Training simulations are proven to be highly-effective in preparing trainees for real-world success in missions and tasks that involve non-kinetic interaction with locals [1,2]. It is unclear, however, how simulation technologies can best be integrated into a task-based curriculum for the development of mission-critical language and culture skills. To this end, the Australian Army Simulation Group and the Defence Force School of Languages (DFSL) have partnered with US-based Alelo Inc. to develop instructional social simulations to address this training gap. This paper details the ADF's need for instructional simulations, introduces the TI Simulator, and highlights a number of cutting-edge technological advancements that were done to meet the specific needs of the ADF.

2. Alelo Social Simulation

The roots of Alelo and of Alelo's social simulation technology lie in the Defense Advanced Research Projects Agency

(DARPA), where US DoD investigated the application of modern video game technology for the effective teaching of foreign languages.

Today, Alelo is a leading provider of language and culture training solutions to military personnel worldwide. Alelo's award-winning products employ a task-based approach to language learning [3], and focuses on those communicative skills necessary to successfully perform tasks.

Contextualized practice and assessment of skills is provided via 3D virtual training environments that facilitate transfer of skills to real-world situations, in accordance with theories of situated cognition [4] and constructivist learning [5].

Alelo's social simulations are designed to promote and maintain learner motivation and are designed to optimize learner confidence, sense of control, level of challenge [6].

The principles and design of game-based learning [7, 8] are employed to increase training effectiveness, increase time-on-task, and lower attrition rates.

Alelo Research continues to investigate how developing learning technologies can be applied to language learning. Publications can be found on Alelo's Research Publications website [9].

3. Australian Army Project

The initial need for simulation software to support language and cultural training was identified by the Land Headquarters in 2007 to meet existing and emerging operational needs. After feedback from existing users such as the United States Marine Corps and United States Army, and based on succesful initial trials, licences were urgently procurred of the Alelo Inc Tactical Language products to support operations in Iraq and later Afghanistan.

The relative success of this initial use, and the identification in the Army Future Land Operating Concept for increased cultural and language awareness for all Army troops led to a follow on project that included the development of the Tetum language (one of two official languages of Timor) to support the ADF presence in Timor.

Initially the project planned to only develop a product similar to the existing Tactical Languages made by Alelo Inc, such as Tactical Iraqi, Dari and Pashto. However, the DFSL was embarking on a process of operationalising their language training and the opportunity was taken by the project to align in support of this work, while still providing a Tactical Tetum product, through the reuse of the 3D content and scenarios.

The agile development process utilising engagement with key end users has enabled several similar but different needs to be accomodated in the one project resulting in reuse and long term savings to the ADF.

4. DFSL LOTE TI Course

A key component of the ADF Languages for Special Purposes Training Suite is the DFSL Languages Other Than English (LOTE) Tactical Interaction (TI) course. The LOTE TI course was recently developed to streamline language teaching across curricula of all languages of operational interest to the ADF and to ensure that the linguistic forms and functions taught in those curricula meet the trainee's needs for conducting tactical interactions during deployment.

Part of this initiative was the identification and documentation of Tactical Interactions (TIs) which represent the most common interactions that trainees in a LOTE course must be prepared for regardless of language or region of deployment.

The software incorporates cutting edge learning technologies including: 3D virtual training environments, speech understanding, artificial intelligence, dialogue modeling, and game-based learning.

31 Tactical Interactions are included in the

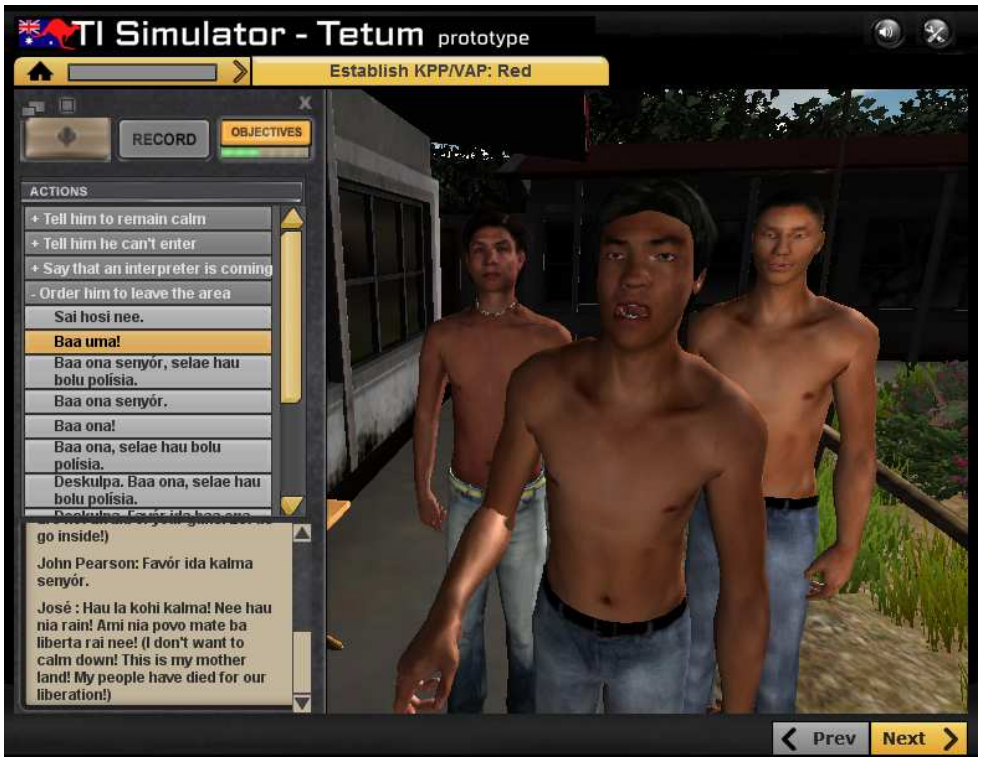

Figure 1: Red scenario in Tetum TI Simulator

5. TI Simulator

5.1 Overview

The TI Simulator is a computer-based software solution that serves as a supplemental instructional tool, and provides DFSL students extended opportunities for contextualized practice and assessment of their skills during their training in a LOTE TI course. Figure 1 is a screenshot from one of the hostile scenarios in the Tetum TI Simulator.

course, spanning common military tasks such as: Curfew Enforcement, Vital Asset Protection, Vehicle Checkpoint, Soft Knock, Humanitarian Aid, and Medical Assistance. This operational focus is quite rare among language training solutions that are currently available to ADF personnel. By focusing the simulations on specific tactical interactions, trainees receive the most targeted and effective form of training possible.

5.2 Target Audience

The primary audience for the TI Simulator is ADF Service personnel who are ready-

ing for deployment in tactical roles and who are enrolled in the ADF LOTE TI Course at DFSL. Trainees will be able to utilise the simulations throughout their training at DFSL and will be prepared for formative and summative assessments at the appropriate points in the curriculum. Upon successful completion of the LOTE TI Course, trainees will maintain their skills by using the scenario simulations remotely.

The secondary audience is ADF Service personnel who do not receive training at DFSL, but who deploy to the same areas of responsibility and conduct similar tasks and duties as Service personnel who have completed DFSL courses. These trainees, who do not have access to live instruction, will receive critical exposure to the target language, and will be able to learn basic survival language skills.

5.3 Hostility Levels

Simulations in the TI Simulator break new ground by addressing the full range of hostility levels ADF personnel encounter so they will be prepared to handle any level of hostility that may arise. As a result, simulations portray much higher levels of realism and effectiveness than was previously possible.

Simulations are coded Green (when locals are compliant), Amber (when complications arise), or Red (when interactions become hostile).

In terms of complexity, Green scenarios are the shortest and simplest, and contain very few dialogue exchanges. Red scenarios are more complex in that they feature more action, props, and animations, but like Green scenarios, they do not involve more than a handful of verbal exchanges between trainees and Non-Player Characters (NPCs). Amber scenarios, by contrast, are very complex both in terms of action and visual interest as well as number of dialogue exchanges. Further, Amber scenarios contain added complexity because interactions can turn into Red or Green scenarios (and can do so very quickly), depending on the decisions made by the trainee (see
Table 1).

5.4 Variability in Simulations

Trainees will apply their operational, linguistic, and cultural knowledge in the simulations to make appropriate decisions about how to respond to prompts from NPCs and the environment. Each choice a trainee makes results in a response, either verbal or behavioural, from the NPC. The choices a trainee makes create different paths in the scenario, and ultimately leads to a variety of different success or failure states for the simulation.

Variability like this in simulation-based training is essential for both effectiveness as well as long-term usability of the training. The TI Simulator introduces two new types of variability into Alelo's simulation design.

One new type of variability is 'tenor', which will challenge trainees to use different linguistic forms appropriately in different situations. For example, a trainee may need to tailor his/her speech depending on the age, status, or gender of the NPC.

The second type of new variability is by varying lexical content across simulations. For example, in one simulation an NPC can use the word "car", and in another the NPC can use the word "truck". The overall intent remains the same, but trainees are exposed to a greater range of vocabulary and they need to learn to recognize a range of vocabulary to maintain awareness of what is going on in the simulation.

Increasing variability in the social simulations also helps keep training fresh

with trainees, because each pass through the simulation will be somewhat different, even if the trainee makes the same decisions throughout.

5.5 Walk-through

The basic elements of game-play and features included within the TI simulations are as follows.

Upon launching a simulation, trainees see a briefing screen, which summarizes their task in the simulation, and states the objectives they must accomplish for success in the interaction.

Once inside the simulation, trainees are presented with the choice of multiple Actions (see *Figure 3*) at each state of the dialogue. Actions are suggestions of things to say and do next, of which some are typically more appropriate than others.

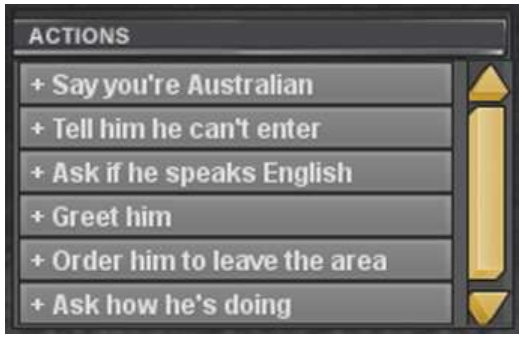

Figure 3: Actions Selection Window

Upon completion of a simulation, a Post-Action Report screen appears (see *Figure 2*), which details the trainee's performance during the simulation. The Post-Action

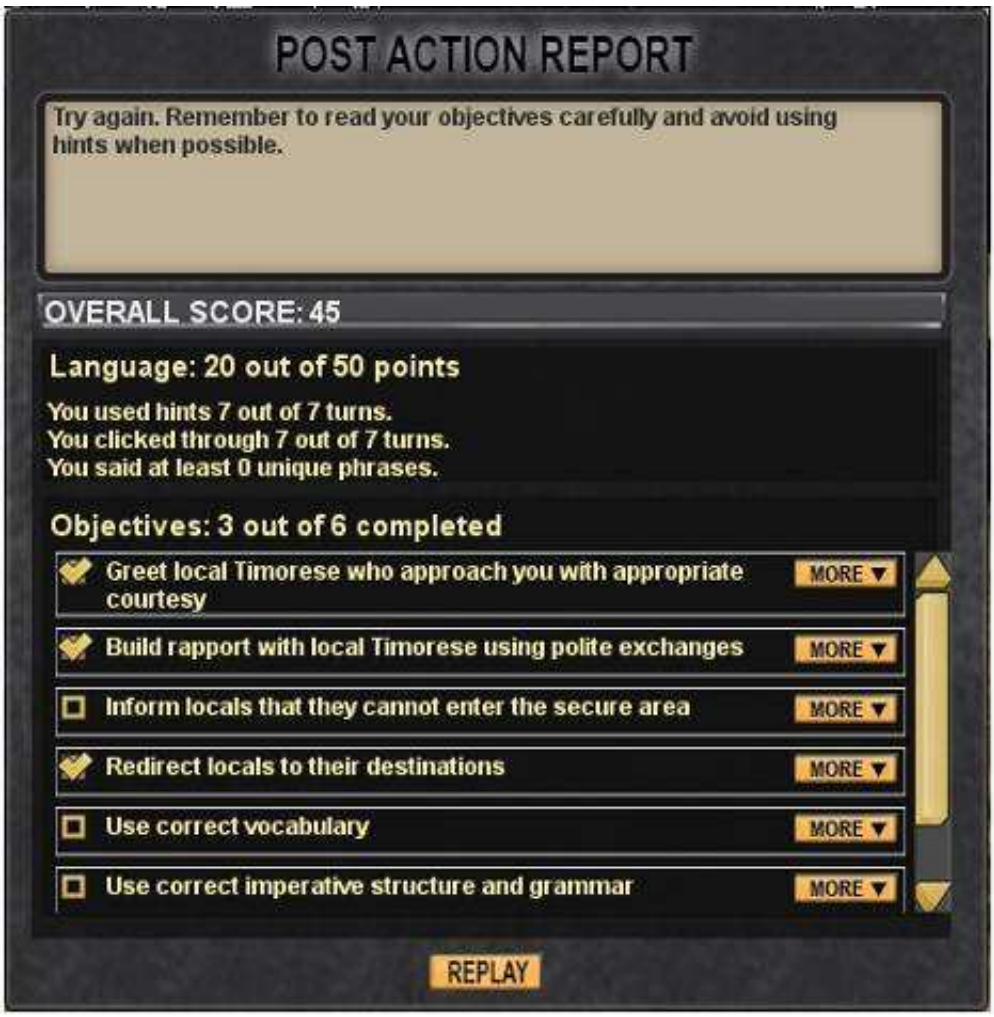

Figure 2: Post Action Report

Report includes the overall score achieved, a breakdown of the score along several evaluative criteria, and feedback explaining the specific mistakes the trainee made.

5.6 Difficulty Modes

At the beginning of each simulation, trainees are presented with a choice of difficulty level: Easy, Medium, or Hard. The three difficulty levels should not be confused with the three hostility levels described above, however. Difficulty levels refer to linguistic difficulty in the simulations, and apply to all hostility levels. The three levels are as follows:

Easy:

- Dialogue history is visible and translations are provided.
- Actions and phrase hints can be viewed.
- Viewing hints decreases the trainee's score

Medium:

- Dialogue history and translations are NOT visible.
- Actions and phrase hints can be viewed.
- Viewing hints decreases the trainee's score

Hard:

- Dialogue history, actions, and phrase hints are all NOT visible.

To motivate trainees to replay scenes and achieve success at higher difficulty levels, trainees will earn stars based on their score and the difficulty level of the simulation, with an additional star awarded at each difficulty level.

Game-based features such as this can strongly impact the trainee's motivation to continue their training. The replayability of the scenarios leads to increased time-on-task, which is a critical element for successful acquisition of linguistic skills.

5.7 Assessment

One of the primary benefits of simulation-based training is the ability to get a quick assessment of a trainee's skills and abilities. All scenarios in the TI Simulator require trainees to accurately apply linguistic and cultural knowledge and skills gained in the LOTE TI Course to succeed.

In each scenario, a number of objectives (ranging from 3-5) are displayed to help guide trainees in their efforts (see *Figure 4*). Objectives represent steps that must be performed in order to successfully complete the scenario. Objectives are appropriate operational directives, but do not reveal the linguistic or cultural knowledge necessary to pass the scenario. Trainees are expected to perform all necessary steps by communicating using the appropriate vocabulary and grammatical structures of the target language. Suggestions of phrases that can be used are available at any time by double-clicking on an Action. However, reliance upon these hints are monitored, and the use of hints will detract from the trainee's overall score in a simulation.

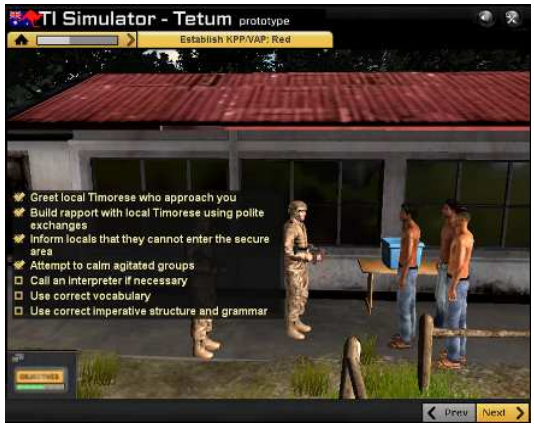

Figure 4: Scenario Objectives

Completion of objectives is tracked throughout simulations to help trainees

gauge their progress. Objectives can be failed in a number of ways:

Linguistic errors

- Using incorrect vocabulary or grammatical structures
- Using structures that are inappropriately aligned to the situation, such as overly harsh or overly polite directives.

Cultural errors

- Making errors of tenor, whereby terms of address and grammatical structures are technically correct but inappropriate for the particular situation, perhaps due to the age, gender and/or status of the person you are communicating with.
- Foregoing the objective entirely could indicate a lack of cultural understanding and be treated as a cultural error, such as failing to build rapport in a situation that calls for it.

- In cases of extreme cultural or operational blunder (i.e., cases which have the potential to cause serious offense or even incite violence), the simulation may end immediately. In these cases, the trainee forfeits his or her chance to succeed in any subsequent objective and fails the simulation. The Post-Action Report screen provides feedback to the trainee regarding the nature of the blunder. The trainee is then invited to replay the simulation and attempt to reach a better outcome.

Poor operational decision-making

- Failing to issue a directive or declarative statement, or by not providing information sought by the NPC where appropriate
- Failing to use the appropriate imperative structure (such as inclusion of softening elements in circumstances that call for them), for a given directive
- Resorting to force or failing to resort to force at the proper times
- Resorting to or failing to resort to the use of an interpreter at the proper times
- Failing to maintain control of an amber situation to prevent an escalation in hostility
- Using incorrect or inappropriate vocabulary to convey a particular meaning

Formative feedback is given to trainees on their use of pronunciation, grammar, word choice, operational decisions, and even cultural decisions that they make. This feedback is given to the trainee in a variety of ways.

First, trainee performance in the scenario is signalled via direct feedback from the NPC during the simulation. For example, a puzzled look or a suddenly-angry NPC will let trainees know that they made a misstep in the simulation.

Second, mechanisms for conveying ensuing action beyond the scope of the scenario premises are used when deemed helpful or appropriate, such as with the use of text pop-ups (see *Figure 5*).

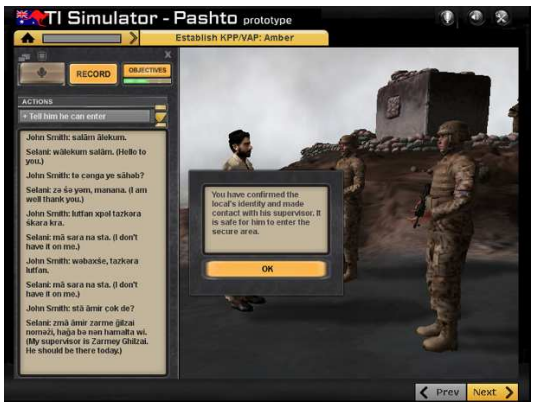

Figure 5: Text pop-up

Finally, direct feedback on performance is provided to the trainee via an After Action Review at the end of each simulation. The After Action Review restates the objectives in the simulation and indicates which were passed and which were failed. Trainees will have access to additional information explaining the relevance and importance of each mistake.

In addition to qualitative feedback detailing trainee performance on each objective, trainees receive a numerical score indicating their overall performance as an aggregate of several factors. The most important factor determining the numerical score will be the percentage of objectives passed. An additional factor that impacts the numerical score is the use of hints in the simulation, where points are deducted for each time a trainee accesses this added assistance.

Trainees also have the option to select target language phrases as an input mechanism, rather than record them using the speech recognizer (see *Figure 6*). Should trainees choose to forgo speaking in the simulations, further points are deducted from their score.

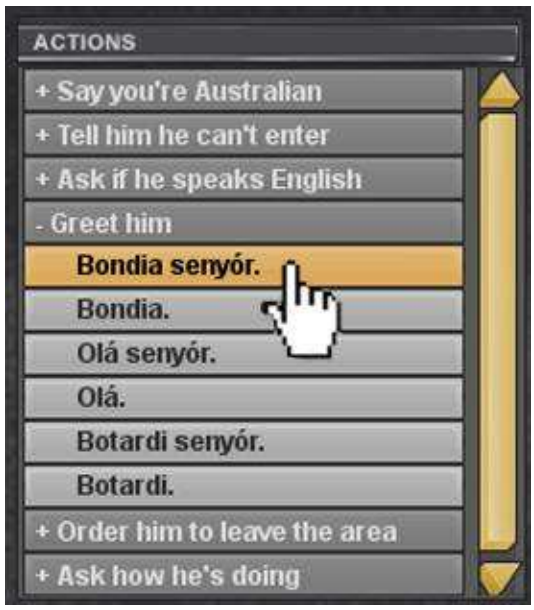

Figure 6: Use of Hints

5.8 Blended Instruction

Assessment of trainee performance in the TI Simulator has been designed to complement and potentially supplement the formative and summative assessments conducted via role-play with live instructors, through the incorporation of the DFSL assessment criteria. According to DFSL assessment rubrics, successful completion of Green, Amber, and Red scenarios hinge on:

- instructions with correct imperative structure
- accurate and appropriate vocabulary and grammatical structures
- proper opening and closing of exchanges
- task-relevant and operationally aligned language
- appropriate linguistic response to changes in complexity

By providing both live in-class instruction to trainees as well as computer-based social simulations, DFSL is offering the best of

both worlds to their students. This blended instruction has a number of tangible benefits both to trainees as well as to the instructor, including:

- Additional opportunities for role-playing practice prior to final in-class assessment
- Instructor evaluation of trainee readiness for final in-class assessment
- Priming trainees at the start of a new course module.
- Focused skill-building tailored to needs of individual trainees. If individual students are having trouble with any specific language form or function, instructors can assign activities in the Alelo course that practice that form or function as homework to bring the student's skill in that area closer to that of his/her classmates.
- Continuing education after initial DFSL coursework is complete. Soldiers can access course materials anytime after the original course is completed to refresh and sustain skills.

5.9 Availability

The first TI Simulator course focuses on Tetum, the primary language spoken in East Timor. Development in other languages is planned for the future. To check on current project status, or to download courseware that is freely available to ADF personnel and Commonwealth employees, one can contact DFSL or visit Alelo's ADF support site (adfsupport.alelo.com).

Table 1 – Tactical Interactions Hostility Levels

	Green	In these situations there are no difficulties in undertaking TI tasks and the local people comply with instructions.	Example: Deployed staff encounter a local man who is simply unaware of the time. After being told to return to his house the man simply complies.
	Amber	In these situations something unexpected happens. There may be a need to explain what deployed personnel are doing and to keep people calm.	Example: Deployed staff encounter a local man who is drunk and refuses to go home.
	Red	These are emergency situations or situations where the response is aggressive. In these cases deployed personnel use their operational training skills for dealing with such situations while insisting that instructions are followed.	Example: Deployed staff encounter a local man who is aggressive and staff suspect he is from a criminal gang.

6. References

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

[2] J. Vogel, D.S. Vogel, J. Cannon-Bowers, CA Bowers, K. Muse, & M. Wright, Computer gaming and interactive simulations for learning: A meta-analysis, Journal of Educational Computing Research, 34, 229-243, 2006;

[3] R. Ellis, Task-based language learning and teaching, Oxford University Press, USA, 2003;

[4] J. Lave, Cognition in practice, Cambridge University Press, New York, 1988;

[5] L. S. Vygotsky, Thought and Language, Cambridge, MA, MIT Press, 1986;

[6] M.R. Lepper, Motivational considerations in the study of instruction, Cognition and instruction, 289-309, 1988;

[7] J.P. Gee, What video games have to teach us about learning and literacy, Computers in Entertainment (CIE), 1(1), 20-20, 2003;

[8] M. Prensky, Digital Game-Based Learning, Columbus, OH, McGraw-Hill, 2001;

[9] Alelo Research Publications, http://www.alelo.com/alelo_inc_research_publications.html