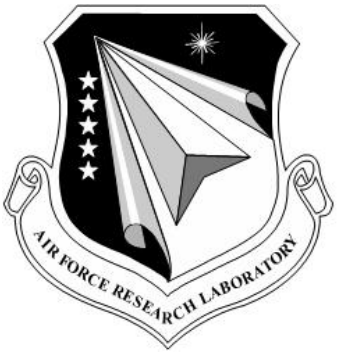

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Developing a Taxonomy of Characteristics and Features of Learning Systems and Internet Gaming Environments

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14. ABSTRACT
There is currently a substantial amount of interest in the exploitation of online interactive gaming environments for training across a number of applied domains including military operations (e.g., the DARPA DARWARS program; US Army Future Combat Systems training program). However, there are no standardized guidelines or specifications related to what the key characteristics of a learning environment must posses and what features of current online gaming environments could facilitate efficiently modifying them to be training and learning environments. This project involved a review of the extant literatures in learning environments and in gaming environment development and application to develop a taxonomy of the key characteristics of instructional environments and the manner in which these characteristics map to existing Internet game architectures. The project deliverables included a review of the pertinent literatures and the development of a research-driven taxonomy of characteristics and the definition of a process whereby a candidate gaming environment could be modified to function as a distributed training environment for a military application. Potential future work in the area is discussed in terms of using the taxonomy to aid in the development of an authoring system for adding instructional components to games as well as the development of a synthetic task gaming environment for military and academic experimentation.

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Part I: Review of Learning Systems

1. Learning Systems

Learning methodologies have been developed over a number of years and it has evolved as technologies advance and new learning theories emerge. We identified following list of learning systems that are used in history and today.

1. Apprenticeship
2. Mentorship
3. Tutoring
4. Classroom Lectures
5. Self Learning or Autodidacticism
6. Cooperative Learning
7. Collaborative Learning
8. Internship
9. Game Based Learning System or Serious Games
10. Distance Learning
11. Simulation Training
12. Online/Web-based Learning System or e-Learning Systems
13. CSCL: Computer-Supported Collaborative Learning
14. Internet Game Based Learning System

All above learning systems have their unique advantages. Choosing the best learning depends on personal needs and nature of learning goals. Some learning systems complement one another. An effective learning environment integrates multiple features of learning systems. Next, we briefly explain these learning systems.

1.1 Apprenticeship

Apprenticeship is ancient learning method where training is done on the job while working for an employer. It is still being used today in the modern form of internship and professional development.

1.2 Mentorship

Mentorship is one-to-one learning relationship between a more experienced professional and a less experienced learner. Mentoring can be formal or informal. It is being used for new-hires or high potential leadership roles.

1.3 Tutoring

A private instructor teaches a student one-on-one for the purpose of understanding the concepts faster and better than a regular classroom setting. Tutoring is done for students who need special attention or want to learn more advanced topics.

1.4 Classroom Lectures

Classroom is the most popular learning environment and classroom lecture is the most widespread learning system. Lectures are taught by a teacher in educational institutions. Many forms of teaching method can be used in a classroom. The classroom

methodologies included in this setting have been known for their usage in the classroom learning environment. Below is a formal comprehensive list of the many classroom methodologies:

- Pure lecture
- Lecture with discussion or demonstration
- Audio/video/slides aided lecture
- Computer aided lecture using software tools (Matlab, Maple Mathematical, Pro-E, etc.)
- Panel discussion/guest speaker
- Case study
- Small/big group discussion
- Supervised experimenting
- Survey or questionnaires
- Quiz or just-in-time examination
- Brainstorm session

1.5 Self-learning or Autodidacticism
In self-learning an enthusiastic person with high degree of self-motivation teaches himself/herself challenging subjects that are usually outside the conventional education.

1.6 Cooperative Learning
Cooperative learning is a teacher-centered style of learning that consists of a group environment of two or more students who work together to achieve a common goal. A detailed description of this learning style is described in the following sections.

1.7 Collaborative Learning
Collaborative learning is similar to cooperative learning, but it does not require teacher coordination. This learning style requires mature participants with strong motivations. A detailed description of this learning style is described in the following sections.

1.8 Internship
An intern is one who works a temporary job with an emphasis on education rather than merely employment. This is the modern form of apprenticeship. Internship usually is applies to college or university students.

1.9 Game Based Learning System
Also called serious games (SGs), it is a computer-based entertainment system with more important purposes of education and training. Unlike educational games which are targeted to teach children basic skills, SGs usually simulate real-world events and processes. This type learning may reduce the cost of learning by simulating an environment that would have been very expensive to build. This learning style is made possible by advancement of computer technologies.

1.10 Distance Learning
In distance learning, students are not physically on site. Students and instructors

communicate either synchronously (real time) or asynchronously. Technologies are developed to make a virtual classroom where distance learning almost the same as the traditional classroom setting.

1.11 Simulation Training

Some trainings use computer simulation to reduce the danger and cost of real world training. Trainees learn various skills in a virtual world that mimics the real environment.

1.12 Online/Web-based Learning

Web-based learning uses the Internet and web technologies to facilitate learning. Bulletin boards, chat rooms, video conferencing are common tools used.

1.13 Computer-Supported Collaborative Learning

This learning style enables collaboration with computer technology to make learning more productive and efficient.

1.14 Internet Game Based Learning System

Compared with regular game based learning system, it enables geographically dispersed individuals to cooperate, collaborate and compete in a game based learning environment in real time.

2. Learning Theories

Learning theories can be used to justify learning systems. Many theories are developed. We introduce significant learning theories in this section.

2.1 Behaviorism

Behaviorism focuses on observable behaviors. It advocates lecture-based teacher-centric and highly structured learning environment. Rewards and punishment are used to reinforce learning. Student learning is passive and knowledge is given from teacher to students. It does not account for processes taking place in mind that cannot be observed.

2.2 Constructivist

Constructivists view learning as a process whereby the learner is internally building an illustration of knowledge and personally interpreting experiences. This representation is continuously being modified; its structure and linkages forming the ground to which other knowledge structures are attached. Experiential learning is an active process that does not necessarily reject the existence of the real world. One of the core challenges of constructivism lie in the learning control shift from the teacher to the student. For constructive process to happen and transcend to environments beyond the school or classroom, learning must be placed in a context that is reflective of the real world. Thus, the key to success in this area involves mirroring the collaboration of real world problem solving and choosing the right tool from the arsenal of tools available in problem solving situations. The critiques of constructivism include its less rigorous learning and not fitting well with traditional classroom environment.

2.3 Cognitivism

Piaget believed that humans desire a state of cognitive balance or equilibration. As an example, when the child experiences cognitive conflict, i.e., a discrepancy between that the child believes the state of the world to be and what the child is experiencing, adaptation is achieved through assimilation or accommodation. Piaget maintains that learning follows development and that development is stimulated by cognitive conflict.

Cognitivism believes knowledge is stored cognitively as symbols. Learning is the process of connecting symbols in a meaningful way. It emphasizes on studies that can help facilitate the symbol connection process. This theory advocates inquiry-oriented projects, hypothesis testing and curiosity.

The critiques of Cognitivism include not enough individuality in the learning process and the belief that knowledge is given and absolute.

2.4 Social Learning Theory

Evolved from Cognitivism, social learning theory believes learning takes place through experiences and observation. In classroom, it encourages learning by observing experts in action and advocates group activity to learn from other students. Similar to Cognitivism, it does not account enough individuality and suggest students learn best as passive receivers of stimuli.

2.5 Social Constructivism

Vygotsky believed that a precursor to this life-long process of development was social interaction. That is, social learning actually leads to cognitive development. This phenomenon, termed the zone of proximal development (ZPD), is further described as the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable. Stated differently, should a student choose to perform a task either under adult guidance or with peer collaboration, the ZPD will effectively interject learning into the process to bridge the gap between the known and unknown.

Social Constructivism advocates experimental activities, personal focus and collaborative and cooperative learning. The critiques of constructivism include its less rigorous learning and not fitting well with traditional classroom environment.

2.6 Theory of Multiple Intelligence

Multiple Intelligence theory believes all people are born with eight intelligences. It suggests that teaching with multiple medium can make learning more effective. It also encourages student-centered classroom and self-directed learning.

3. Cooperative Learning

Cooperative learning is actually a type of collaborative learning that was developed by Johnson and Johnson in the 1960s and is still prodigiously used today. Cooperative learning is recognized as a style of learning in which positive interdependence is

enforced. Positive interdependence promotes an avid group interaction by incorporating cohesiveness. This cohesiveness is manifested in two parts where each individual invests in their own learning and where the entire team essentially functions as though each member is an essential part in the survival of that team. There are various definitions of this style of learning, but almost all maintain that cooperative learning is a teacher centered style of learning that consists of a group environment of two or more students who work together to achieve a common goal. Cooperative learning is a style of learning that gives a student an opportunity to demonstrate his or her strengths or weaknesses. Based on these strengths or weaknesses that are exhibited, group members are able to assist individuals in the areas that require special attention, which may often require help from the curriculum designer and instructor.

3.1 Elements of Cooperative Learning

The past two decades have witnessed many different approaches to cooperative learning. The three most popular approaches are those of David Johnson and Roger Johnson, Robert Slavin, and Shlomo Sharan and Yael Sharan. In order to create a general understanding of cooperative learning, the discussion that follows represents a Cliff Notes version of each approach.

3.1.1 Group Heterogeneity

With sizes ranging from four to five students, cooperative-learning groups are relatively small and are heterogeneous. To achieve desired heterogeneity levels, groups should contain a healthy mix of males and females as well as students of different ability levels, ethnicity backgrounds and social classes.

3.1.2 Group Goals/Positive Interdependence

In positive interdependence, a specific goal is put forth for the group to attain. Students are informed that the group goal can only be achieved if each member learns the material being taught, e.g., a task that culminates in an exam, or make a distinct contribution to the group's effort, e.g., a task that ends in a presentation/project.

3.1.3 Promotive Interaction

Positive interdependence is a precursor to promotive interaction. In promotive interaction, students are coached in the art of helping each other overcome problems and complete assigned tasks. Examples include peer tutoring, temporary assistance, exchanges of information and material, challenging of each other's reasoning, feedback, and encouragement to keep one another highly motivated .

3.1.4 Individual Accountability

The stated mandate here is that each member of a group is charged with making a meaningful and recognizable contribution to achieving the group's goal. Examples include achieving a minimal score on an examination, having the group's test score equal the sum or average of each student's quiz scores, or having each member retain responsibility for a particular part of a project, such as doing the research and writing for a particular part of a history report.

3.1.5 Interpersonal Skills

As one may assume, interpersonal skills of most students are neither fully developed nor matured. Therefore, the propensity for Positive Interdependence and Promotive Interaction to suffer is directly proportionate to the lack of a students' interpersonal (primarily face-to-face) skill-set. Given such a probably deficient interpersonal skill-set, most students have to be taught such basic skills as leadership, decision making, trust building, clear communication, and conflict management. A simple example can demonstrate the necessity of developing the requisite interpersonal skills: A conflict that arises over differences of opinion, for example, can destroy group cohesion and productivity if it results in students stubbornly clinging to a position or referring to each other as stubborn, dumb, or nerdy. Conversely, such conflict can be constructive if it is used as a catalyst to search for more information or to rethink one's position.

3.1.6 Equal Opportunities for Success

Contributing to ones own team is vital to a student's value. Therefore, implementing something as simple as an award system for a student's degree of improvement over previous test scores, or having students compete against comparable members of other teams in a game or tournament-like atmosphere, can greatly enhance their positive interdependence, and promote interaction, and individual accountability, thus increasing their chances of overall success. Because cooperative groups are heterogeneous (with respect to ability) and their success depends on positive interdependence, promoting interaction, and individual accountability, it is important that steps be taken to ensure that all students have an opportunity to contribute to their team.

3.1.7 Team Competition

Notwithstanding the previous assertions made herein concerning the ineffectiveness of competition as a spur to motivation, team competition may (at first glance) appear to be misplaced amongst the list of cooperative-learning components. Whenever competition occurs infrequently, is between adequately matched competitors and is done in the absence of any norm-referenced grading system, it can be an effective way to motivate students to cooperate with each other.

The use of critical thinking skills has been used in learning by accentuating eager, feelings of stimulation, and expression creatively problem solving. Cooperative learning promotes critical thinking skills by increasing the number of ideas, quality of ideas, feelings of stimulation, enjoyment, and originality of expression in creative problem solving. Cooperative learning involves working together jointly on a task by sharing information and supporting one another's efforts. In the cooperative style of learning, everyone is able to incorporate what he or she has to benefit the team. There may be roles assigned to individuals to add structure to the tasks on hand. Both the groups (as a whole and individual member's) are held accountable for completing the activities and demonstrating a satisfactory level of learning. Process skills are an important aspect of cooperative learning. For example, group members might each be asked to do different tasks such as reading or answering questions based on the information that each student reads. For this process to work, each individual must do his or her part to ensure a positive outcome.

3.2 Methods of Cooperative Learning

Equally important are the number of methods, which distinguish this style of learning. These methods make cooperative learning a significant and widely used style of learning. Some of these methods and functionalities are as follows:

Jig-Saw Method: The Jig-Saw Method was designed by Elliot Aronson. This method was used to assign students to teams where each individual receives different sections of work that is distributed among the whole group to work on. The method requires that each member works on the sections so that his or her designated sections can be taught to members within that group.

Student Teams Achievement Divisions (STAD*):* The STAD method was developed by Slavin, who states that "students should be assigned in groups of four which are heterogeneous." Slavin mentions that this method is suitable for teaching well- defined jobs. The STAD method involves students essentially demonstrating instructor-like characteristics. Students are taught a lesson, and from the lesson that they are taught they form a group to ensure that each student has mastered the lesson. Students then take individual quizzes to test their knowledge. The scores they receive on the quiz will be compared to past averages and points are awarded based on their performance. The team's scores are obtained by summing those points.

Learning Together/Learning Circle: The essential focus of this method seems to be largely on fostering group cooperation.

Team-Assisted Individualized Learning Method: The Team-Assisted Individualized Learning method was developed by Slavin in 1982. It was designed to be utilized in math class settings. Students work on individualized materials in small heterogeneous groups and check each other's work while helping one another progress through the material. The team's scores are based on the amount of work completed and the accuracy of the work.

Cooperative Integrated Reading and Composition Method (CIRC): This method was developed by Stevens, Madden, Slavin and Farnish in 1987. Like team-assisted individualized learning, this method is designed to accommodate a wide range of student performance levels in one classroom using both heterogeneous and homogeneous withinclass groupings. Both have been successfully researched in secondary education and are often used through the eighth grade.

Teams-Games-Tournaments Method: Teams-Games-Tournaments were developed by DeVries and Slavin in 1978. With this method lessons are presented to students. The students meet in groups of four to five and assist one another in the given material. In this method students compete with other teams who have similar achievement to earn points for their team. This model has shown to rate successfully high.

Group Investigation Method: The Group Investigation Method was developed by

Sharon and Sharon in 1976. This method gives groups of students different tasks in which students approach tasks/projects, and make decisions as how to approach the information, organization, and presentation. Furthermore, to structure lessons so students do in fact work cooperatively with each other requires an understanding of those essential elements or components necessary to make cooperative learning successfully work. There are five elements associated with cooperative learning.

3.3 Impact of Cooperative Learning

The impacts of the cooperative learning movement seem to have gradually spread to the higher education arena, thus largely allaying Slavin's major concerns. For example, in a 1995 faculty survey conducted by the Higher Education Research Institute at the University of California at Los Angeles indicated that, aside from lecture, topping the list of teaching methods used in all or most courses was cooperative learning, which showed a 9% increase from 1989 to 1995, followed by group projects with a 7% increase. Accordingly, the new millennium has witnessed cooperative learning become a mainstay amongst teacher conferences and faculty development efforts. Cooperative learning's impact can be transformational. Cuseo (1992) finds cooperative learning to be "the most researched and empirically well-documented form of collaborative learning in terms of its positive impact on multiple outcome measures (p. 3)." Among the many outcomes and impacts are:

- increased academic achievement
- increased self-esteem
- additional harmony in multi-ethnic classrooms
- higher attendance; and
- greater liking for the subject matter.

3.4 Critiques

Although cooperative learning is geared towards assisting students in their overall learning process, it is rather ironic that in the area of gifted education, criticism of cooperative learning and peer teaching practices resonates. Documented reasons to support the aforementioned contention include the assertion that gifted students typically prefer to either perform solo or with students displaying comparable gifted abilities, and view involvement in cooperative learning as stifling their intellectual prosperity. There is, therefore, a body of evidence lending credence to support the contention that gifted students prefer working in homogeneous groups and a competitive rather than a cooperative arena. As this area is currently not well-researched, consistently reliable evidence to support the assertion that peer tutoring and cooperative learning have a substandard or negative impact on the accomplishments or motivation of gifted children is lacking. In any implementation phase, these methods should therefore be carefully implemented with both gifted and non-gifted students.

A common criticism of cooperative learning is that it has no benefit for high-ability or gifted students. In their 1992 article, C.J. Mills and W.G. Durden present this viewpoint and go on to say that in addition to there being no benefits for high-ability students, "students in the lower tracks lose academic ground, self-esteem, and ambition". Other

criticisms of cooperative learning include off-task behavior and tendency toward disagreement among members of Cooperative Groups concerning the roles of each member. Research indicates that students "tend to have poor engagement levels in small group learning activities unless the teacher is actively involved in the session". Since the teacher cannot be present in all the groups at once, the groups fail to stay on task due to a lack of guidance from the teacher.

Critics of cooperative learning maintain that this grouping widens the gap between high and low ability students. If highly-able students are allowed to move ahead in their learning, the gap between them and the others in the class will widen to the point where heterogeneously grouped cooperative learning situations will no longer be educationally beneficial for any of the students involved. Students who are several grade levels apart in their learning of a subject are rarely able to contribute equally or feel engaged in a group endeavor. Cooperative learning, Mills and Durden contend, widens the gap between high and low ability students.

Critics of cooperative learning as a replacement for tracking suggest that it should not be considered a panacea. If cooperative techniques do nothing more than allow students to work on low-level tasks and worksheets together, they note, the techniques will do little to improve instruction. Put bluntly, poor lessons taught cooperatively are no better than poor lessons taught using more traditional methods. Others have suggested that while cooperative learning is valuable in certain situations, it is not always appropriate; it can be more effective, particularly with high-achieving students when used in conjunction with ability grouping. Critics of cooperative learning often insist that the strategy detracts from individual achievement and places the burden of learning on the most capable and hardest-working students, while others slide by without doing an appropriate share of the work.

4. Collaborative Learning

Collaborative learning is so similar to cooperative learning that making distinct differences between the two is difficult, and may result in the two styles being used interchangeably. Ken Brufee identifies that the differences in cooperative and collaborative learning were developed to specifically suit people of varying ages, levels of expertise and mastery of the craft of interdependence.

As in cooperative learning, some of the same elements are resembled in collaborative learning. Some of the elements that are associated with both learning styles are the CIRCCooperative Integrated Reading and Comparison; Group Investigation; Issues Controversy; Learning Together; TAI-Team Assisted Individualization; TGT-Teams-Games-Tournament ; and STAD-Student Teams Achievement Divisions, and the Jig-Saw Method which involves students becoming experts in a specific area and demonstrating their expertise by reversing the role of student to that of a teacher by teaching the topic to others in their group. Learning also utilizes positive interdependence which is also used in cooperative learning.

In cooperative learning, the teacher retains the traditional dual role of the subject matter

expert, and authority in the classroom (Cooperative vs. Collaborative, pg. 2). The teacher designs, and assigns group learning tasks, manages time and resources, and monitors students' learning, checking to see that students are on task and that the group process is working well. Students who use the collaborative learning style have complete control over their task, which implies that this style of learning is mostly utilized by mature individuals who are able to handle learning without a facilitator actively monitoring the groups to give advice or resolve group behavior.

Another underlying difference between collaborative and cooperative learning is the fact that cooperative learning deals exclusively with traditional (canonical) knowledge while collaborative learning ties into the social constructivist movement. Cooperative learning tends to use quantitative methods which look at achievement: i.e., the product of learning. The collaborative learning method takes a qualitative approach, analyzing student talk in response to the pieces of literature or primary source in history. The cooperative learning style is used best for those needing assistance with mastering foundational knowledge. Collaborative learning is used with students who have a firm foundational knowledge and who are able to discuss and assess already.

In order to efficiently implement collaborative and cooperative learning through student's, effective communication must take place. Results were taken from students and faculty at Wake Forest that showed that 87% believe that due to an increase in communication between professor-student and student-student significantly impacted learning effectively.

To shed the appropriate light on the magnitude of importance in this area, other terms that are used in conjunction with collaborative/cooperative learning include: team learning; problem-based learning (including guided design), case studies, simulations peer-assisted instruction (including supplemental instruction), writing fellows, mathematics workshops, discussion groups and seminars, learning communities, and lab work.

5. Comparing Cooperative and Collaborative Learning

As in cooperative learning, some of the same elements are present in collaborative learning. Some of the elements that are associated with both learning styles are the CIRCCooperative Integrated Reading and Comparison; Group Investigation; Issues Controversy; Learning Together; TAI-Team Assisted Individualization; TGT-Teams-Games-Tournament; and STAD-Student Teams Achievement Divisions, and the Jig-Saw Method which involves students becoming experts in a specific area and demonstrating their expertise by reversing the role of student to that of a teacher by teaching the topic to others in their group. Collaborative learning also utilizes positive interdependence which is also used in cooperative learning.

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While distinct in origin, the terms collaborative learning and cooperative learning are oftentimes interchangeable expressions. The justification withstands logic, as each discipline has an affinity towards undersized group dynamic participation over more passive, lecture-based teaching and each necessitates a defined undertaking to be completed. By its nature, each strategy underpins an approach akin to 'discovery based' learning. While the two methods pinpoint a variety of group roles, collaborative learning can contain a lesser number of assigned roles. Nevertheless, both situations require students to possess the requisite amount of group skills; although cooperative learning may be more inclusive and treat this as an instructional goal. Regardless of the plan, a workable group activity framework emerges, yet in the final analysis, cooperative learning more often than not emerges as more structurally defined than collaborative learning.

However, commentators point out that these two terms are different. Rockwood, for example, states that the difference between these methodologies is one of "knowledge and power" when he stated that: "Cooperative learning is the methodology of choice for foundational knowledge (*i.e.*, traditional knowledge) while collaborative learning is connected to the social constructionist's view that knowledge is a social construct." Rockwood goes one step further by distinguishing these approaches by the instructor's role:

"In cooperative learning, the instructor is the center of authority in the class, with group tasks usually more closed-ended and often having specific answers. In contrast, with collaborative learning the instructor abdicates his or her authority and empowers the small groups who are often given more open-ended, complex tasks".

Demonstrating the relevance of careful student scrutiny, Rockwood's approach varies depending upon the educational sophistication of his students. As an example, Rockwood is biased towards the more structured cooperative learning style for foundational knowledge (found in gateway courses), and reverts to the "laissez faire" approach of collaborative learning for the higher level, less foundational knowledge content.

To shed the appropriate light on the magnitude of importance in this area, other terms that are used in conjunction with collaborative/cooperative learning include: team learning; problem-based learning including guided design, case studies, simulations; peer-assisted instruction including supplemental instruction, writing fellows, mathematics workshops; discussion groups and seminars; learning communities; and lab work.

Part II: Review of Online Games

1. Online Games

The following is a list of multiplayer online games:

• The "Monkey Wrench Conspiracy" from (http://www.games2train.com/site/html/theory.html). This game incorporates many elements mentioned in effective learning methodology. It involves multiple sense stimulation, and encourages emotional engagement. The player is situated in an environment that closely resembles the real world.

• American's Army from www.americasArmy.com. Launched in 2002, America's Army is created by the MOVES instituted at the Naval Postgraduate School. It is a basic training game for squad-based first-person shooter. A few team-based missions are also part of the game. It is estimated that there are about 4 million users.

• Anti-Terrorism Force Protection from (www.willinteractive.com). This is a game to train terrorism responder how to make decisions during a terrorist attack. It is a tactic game.

• Avant Guard from (www.gamesthatwork.com). This tactic game is written for the Air Force Research Lab, Human Effectiveness Directorate. The theme is to use autonomous aerial vehicles to protect urban convoy by detecting ambushes ahead of time. The training objectives of the game are to train the personnel how to fuse sensor data, how to filter out unneeded information, and how to make sound judgment.

• Battle Command 2010 (BC2010) from (www.mak.com/bc2010.htm). This tactic game aims at training Army battalion and brigade commands with planning and execution skills in a simulated environment.

• Civil Support Team Trainer from (www.ecsorl.com). This is a team oriented collaborative distance learning game for Army Reserves.

• Full Spectrum Command from (www.ict.usc.edu). This tactic game is aimed at training the principles of company-level firepower and maneuver and adaptive thinking in tactical decision-making. This game only allows two players.

• Full Spectrum Warrior from (www.ict.usc.edu). This game is part of the Institute for Creative Technologies' game series. It is aimed at squad training for several players at a time.

• Joint Force Employment from (www.dtic.mil/doctrine/jfe/index.html). This game is aimed at teaching the concept of "Joint Warfare is Team Warfare". It allows a trainee to create and control a mixed force and exercise his/her strategic/tactic skills in a war.

• KumaWar. This game is used in adapt soldiers to various real life mission that may occur while being a soldier. Multiplayer options contain the following player modes such as: Co-op player mode- where your team plays against real people and not computer controlled people, RedonBlue- where two or more team play against each other, and Mission based- this mode is good guys against the bad guys and requires strict cooperation. The following six features were an enhancement in the game: 1) Communicating through chats and posting messages on the message boards; 2) Game appearance that can change various aspect of the game to meet the users needs; 3) Adjusting volume to meet users needs; 4) Control of the level of difficulty; 5) Choice of weapons; 6) Point to indicate how accurate shot is when shooting (www.kumawar.com).

• Aces High II. This game is to train Army personnel how to use simulated war fighting jets, boats, and various other means of transportation used in the Army.

2. Common Features of Online Training Games

The following is a list of features that are commonly exist in online training games:

- 3D Animation with life like characters
- Multimedia Instructions
- Step-by-Step Instructions
- Virtual Lectures
- Tests and Quizzes
- Instructor's positive/negative feedback
- Cooperation in multiplayer mode
- Competition in multiplayer mode
- Spectator mode in multiplayer mode
- Text Chat
- Voice Chat

- Body Language for communication
- Record and Replay
- Realistic Simulation

Part III: Training America's Army

1. Training Trainees

The researcher's motivation or reason for selecting two students to participate in online training games was (as stated previously) to investigate the features of the games as students progressed through each training session. The features in the game were investigated by the trainee as well as by the researcher by observing those benefactors and hindrances that had an effect on the performance.

In order to be a participant in the study of online games basic requirements were put in order. These requirements were the trainee: (a) has had no previous experience with the use of the software, (b) has never been trained for such research, (c) is not disabled, (d) is young, and (e) has an interest in online games.

Based on the requirements and random selection, two undergraduate students were selected from North Carolina Agricultural State University to participate in this study. Trainee 1 was of African American descent and was an eighteen year old male majoring in computer science and had little to no experience using online games. Trainee 2 was also of African American descent and was a nineteen year old sophomore who was also pursuing computer science as a major. Trainee 2 had previous experience with online games.

2. Training Plan

The goals of the training plan were to identify the following: (a) features b) performance record that students participated in, (c) helpful features (d) impeding features, (e) find features that are implemented effectively and (f) decide on the features that are mission in cooperative and collaborative learning.

3. Stages

Students partook a week of training in various missions that were provided. The duration of the training was two to three hours per day. Based upon successful completion of the training, students progressed through one to three training missions per day.

3.1 Breakdown of Weeks 1 and 2

Day 1: Marksmanship Training Obstacle Course Training
Day 2: Obstacle Course Training
Day 3: Shoot House Training, Airborne School
Day 4: Shoot House Training, Live Jump Training
Day 5: Treating Shock Training, Basic First Aid Training
Day 1-5: Multiplayer Mode Training (Missions include: 1) Defend a Bridge
2) Defend Building

The following was observed: whether the student passed or failed in training, scores in the test, number of trials for success training, durations of training, emotions, and improvements. Refer to Tables 1-20 of Appendixes A and B for the results of Trainee 1 and Trainee 2's America's Army results of training and online multiplayer results.

3.2 Evaluation and Training

The researcher's results of the trainee in the online training game revealed that the America's Army has good features. The features that were effective in the game were: little instructor assistance provided for trainees, graphics, and realism incorporated in the game, which benefited in helping to see at various levels and better enhance each student's performance in shooting its target along with keeping the retention of the student at a very high level throughout the entire gaming experience. America's Army incorporated some of the following cooperative methods and or elements in its game: spectator mode- which enables game participants to watch others while they learn, team competition, some individual accountability, and interpersonal skills.

The overall emotions of the students observed were: focused, excited, nervous and showed a little frustration at times when the students were unable to complete the various training involved in the America's Army successfully. Having to complete training at various times made the students a little impatient; and thus, they looked enthusiastically forward to completing or improving in the mission.

3.3 Results of Missions Completed by Trainee 1 and Trainee 2

Cooperative and collaborative learning has existed for many years. Today, there are many games in existence that expresses these styles of learning. A mixture of cooperative learning (without team existence) and independent learning has been incorporated in the America's Army for training the trainees. As the trainees progressed through the missions, they were able to play a more collaborative style, which is student-centered as opposed to the cooperative style, which is teacher-centered. A minimum amount of instructor assistance was available throughout most of the training missions. The training in Mission 1 (Marksmanship Training) was completed successfully with one try. Trainee 1 expressed nervousness while completing Mission 1 but stayed focused. As Trainee 1 progressed to Mission 2 (Obstacle Course Training), the mission was more difficult, and the trainee showed excitement, and focused throughout the mission. Due to Mission 2 being more difficult, Trainee 1 had to retry the mission six times before successfully completing the mission. Trainee 1 managed to complete Mission 3 (Weapon Usage Training) in three tries before successful completion. As Trainee 1 progressed to Mission 4 (Shoot House Training), the training became a little more difficult and the number of tries before successfully completing Mission 4 increased to eight. The trainees indicated that multiple trials were caused by difficulty in making distinctions between friends and foes. The trainees were anxious and focused throughout this mission as well. The trainee's training for the Live Jump and the Airborne School were around 4-5 tries before successfully completing the mission. The traditional class based training classes for the Treating Shock and the First Aid training indicated that Trainee 1 successfully passed the test with 80 to 87% accuracy. After completing the necessary training, Trainee 1 played online using the multiplayer mode. Trainee 1 was unable to win with Mission 1 (Defend a

Bridge). Multiplayer mode was very difficult as opposed to offline training. Trainee 1 was not successful with any wins after playing five times. As Trainee 1 attempted Mission 2 (Defend Building), he won one out of seven attempts. The trainee expressed excitement with multiplayer mode and became frustrated at times when no wins occurred. Refer to Appendix A for the detailed results for Trainee 1.

Training in Mission 1 (Marksmanship training) was successful for Trainee 2 as well. Trainee 2's emotions regarding Mission 1 was the same as Trainee 1. Trainee 2 was able to complete Mission 2 (Obstacle Course) with six attempts. Trainee 2 was very focused and expressed excitement in this mission. This mission was unsuccessful on a number of tries due to software bugs. As Trainee 2 progressed to Mission 3 (Weapon Usage training) the results indicated that the trainee passed with three attempts. Trainee 2 was focused and showed enthusiasm while playing. Shoot House training was also difficult for Trainee 2. Trainee 2 attempted this mission eight times before being successful. Trainee 2 expressed the same feelings as Trainee 1 about retrying this mission a number of times before successful completion. The results of Missions 5 and 6 (Airborne School Training) and (Live Jump Training), respectively indicated that with four attempts Trainee 2 successfully completed Mission 5 with five attempts. Trainee 2 completed Mission 6 successfully. Trainee 2's scores in training school indicated a high level of competence in treating shock, and basic first aid. The trainee scored a perfect score in training for treating shock, and an 88% in basic first aid training. The results of the multiplayer mode for Trainee 2 were very similar to the results of Trainee 1 who had five losses and zero wins in Mission 1 (Defend a Bridge) and seven losses and zero wins in Mission 2 (Defend City). Refer to Appendix B for the detailed results for Trainee 2.

3.4 Discussion of Features

The America's Army has many features that assisted in the training process. The following features were found to be particular helpful in training:

- 3D Animation
- Audio Instructions
- Step-by-Step Instructions
- Tests and Quizzes
- Animated Presentation
- Instructor's positive/negative feedback
- Cooperation in multiplayer mode
- Competition
- Spectator mode
- Text Chat
- Body Language for communication
- Realistic Simulation

Step-by-step instruction is a very helpful feature that allowed beginning trainees to master basic skills. Trainees became familiar with basic moves. Tests and quizzes are given right after training to evaluate the trainees' mastery of concepts and skills. A virtual instructor provided positive or negative feedback based on the trainees performance. This

feature will immediately let trainees know what they did right or wrong. In multiplayer mode, the software has team cooperation and team competition. This feature will allow the trainees to apply their learned skills and improve upon them. One observation that was made is that the trainees seemed to be more motivated by these features. Team members communicate with text, chat, and body language to relay messages. One of the best features is the spectator mode. With this feature, the trainees can observe the actions of each player, either in their team or in the opponent's team. They learned strategies from the more advanced players. This is a very important feature for beginners.

The following features were found in the America's Army to impede the learning process:

- Repeating the whole training after the failure of tests
- Not showing correct answer after the tests
- Timed Test

In some difficult training missions, trainees have failed the test many times. The trainees have to go through the whole training process after each failure. Since the lengthy training does not selectively train the weaknesses, the trainees get frustrated. The timed test puts pressures on the trainees, which cause them to perform poorly. Some tests do not show correct answers, so the trainees can not correct them. However, after the trainees passed the test, correct answers are not given for the questions that were answered incorrectly.

Four of the mission features that were found to be important for training in the America's Army are as follows:

- No effective cooperation
- No instructor coordination
- No management of skill levels
- No Voice Chat

One of the most important elements of cooperative learning is teacher coordination. It is critical for beginners because they may not have enough skills to effectively cooperate with others. The trainees got lost as they entered multiplayer mode even if they clearly understood the mission. The cooperation among team members is ineffective and informal. They are assigned to the same mission, but roles are not assigned to the players. There is no positive interdependence among the players, which is a very important component of cooperative learning. There are big discrepancies among the team players, which makes team cooperation extremely inefficient. Although text chat is helpful, voice chat is more effective.

4. Conclusion

Based upon the researcher's observations of the trainees that participated in training and multiplayer online games, the trainees had far more difficulty with multiplayer online mode as opposed to previous offline training. However, online gaming had a positive

effect on the trainees' emotions. Also, an observation that was made is that the trainees stayed focused and showed interest in each mission. The America's Army software utilized provided training for the trainees in varying aspects of the military. It has some good features such as training, graphics, realism, little AI, and instructions in some missions to provide assistance for the trainee. Due to some critical elements of cooperation that are not incorporated in the online game, it was deemed less effective. Elements that were not included in the game are teacher coordination, large degree of level discrepancy, and no positive interdependence. This researcher has identified several suggestions for America's Army that are geared toward key findings contained here in, which are documented in Appendix A and B.

Part IV: Key Features of Online Games

1. Key Features

Based on our survey of learning systems and training of America's Army we suggest that following features are relevant to online training games. Many online training games do not fully support these important features.

- Interactive Lectures
- Performance Evaluation and After Action Review System
- Group Management
- Instructor Coordination in multiplayer mode

1.1 Interactive Lectures

Lectures as a classical learning method is a critical learning step for beginners. Many current online training games have computers perform as a virtual instructor. However, this is very different from real classroom settings where students and instructors interact. Although, full interaction with a virtual instructor is very hard, it is possible to achieve partial interaction by utilizing the technology being used in e-Learning systems where previously asked questions and answers can be queried and replayed.

1.2 Performance Evaluation and After Action Review

Many online training games gives out tests and replays the actions for evaluation and review. However, without giving further explanations trainees will likely make the same mistakes again. Within technological limit, online training games should support sharing of the recorded action among a group of trainees to learn from one another and discover mistakes. It is desirable to integrate AI that is able to identify simple mistakes.

1.3 Group Management

Even after trainees successfully finish all the required single user training, it is very hard for them to excel in multiplayer world. Much more time and effort than offline training have to be spent to become an expert in multiplayer mode. Cooperative learning theory suggests that cooperation is ineffective when levels of participants have big discrepancy. With smart group management, it can detect the level of a trainee by observing past performance and group similar leveled trainees to achieve maximum effectiveness.

1.4 Instructor Coordination in Multiplayer Mode

Cooperation is not an easy learning style. If not implemented well, it will be ineffective. Teacher coordination is important factor for typical cooperative learning settings. Battlefield 2 has virtual instructions for trainees in multiplayer mode. This is feature that does not exist in America's Army of KUMA\WAR. It is important first step in making cooperative learning more effective. Smarter virtual instructor and a feature that allows an expert to monitor the whole team actions can make training more productive.

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APPENDIX A

TRAINEE 1 RESULTS

Table 1. Trainee 1 Results of Marksmanship Training - Trainee #2

Mission Name Marksmanship training
Duration 30 minutes
Features in the mission Animation, by step instruction, and instructor's positive/negative feedback
Pass/Fail Passed
Scores in the test n/a
Number of trials 1
Emotion Focused, nervous
Helpful features 3D animation, audio instructions, step-by-step instruction, instructor
positive/negative feedback, and realistic simulation
Unhelpful features Repeating whole training after failure of tests
Missing desirable features n/a
Implementation of features AI is not good enough, it doesn't tell you exactly what you did wrong and does not selectively teach the weak performance.
Existing elements
Cooperation/Collaboration
Does it have all elements of cooperative and collaborative learning
Missing elements
Cooperation/Collaboration
n/a

Table 2. Trainee 1 Results of Obstacle Course Training - Trainee #1

Mission Name Obstacle Course
Duration 180 minutes
Features in the mission Animation, by step instruction, and instructor's positive/negative feedback
Pass/Fail Passed
Scores in the test n/a
Number of trials 6
Emotion Really focused and expressed excitement throughout training
Helpful features 3D animation, audio instructions, step-by-step instruction, instructor positive/negative feedback, and realistic simulation
Unhelpful features Repeating whole training after failure of tests
Missing desirable features n/a
Implementation of features
AI is not good enough, it doesn't tell you exactly what you did wrong and does not selectively teach the weak performance.
Existing elements
Cooperation/Collaboration

Does it have all elements of cooperative and collaborative learning
Missing elements
Cooperation/Collaboration
n/a

Table 3. Trainee 1 Results of Weapon Usage Training - Trainee #1

Mission Name Weapon Usage training
Duration 60 minutes
Features in the mission Animation, by step instruction, and instructor's positive/negative feedback
Pass/Fail Passed
Scores in the test n/a
Number of trials 3
Emotion Really focused and expressed excitement throughout training
Helpful features 3D animation, audio instructions, step-by-step instructions, instructor
positive/negative feedback, and realistic simulation
Unhelpful features Repeating whole training after failure of tests, and timed test
Missing desirable features n/a
Implementation of features n/a
Existing elements
Cooperation/Collaboration
Does it have all elements of cooperative and collaborative learning
Missing elements
Cooperation/Collaboration
n/a

Table 4. Trainee 1 Results of Shoot House Training - Trainee #1

Mission Name Shoot House training
Duration 240 minutes
Features in the mission Animation, by step instruction, and instructor's positive/negative feedback
Pass/Fail Passed
Scores in the test n/a
Number of trials 8
Emotion Excited, anxious, focused
Helpful features 3D animation, audio instructions, step-by-step instructions, instructor
positive/negative feedback, and realistic simulation
Unhelpful features Repeating whole training after failure of tests, and timed test
Missing desirable features n/a
Implementation of features AI is not good enough, it doesn't tell you exactly what you did wrong and does not selectively teach the weak performance.
existing elements
Cooperation/Collaboration
Does not have all elements of cooperative and collaborative learning

Missing elements
Cooperation/Collaboration
n/a

Table 5. Trainee 1 Results of Airborne School - Trainee #1

Mission Name Airborne School
Duration 30 minutes
Features in the mission Animation, by step instruction, and instructor's positive/negative feedback
Pass/Fail Passed
Scores in the test n/a
Number of trials 4
Emotion Really focused and expressed excitement throughout training
Helpful features 3D animation, audio instructions, step-step instructions, instructor positive/negative feedback, and realistic simulation
Unhelpful features Repeating whole training after failure of tests, and timed test
Missing desirable features n/a
Implementation of features AI is not good enough, it doesn't tell you exactly what you did wrong and does not selectively teach the weak performance.
existing elements
Cooperation/Collaboration
Does not have all elements of cooperative and collaborative learning
Missing elements
Cooperation/Collaboration
n/a

Table 6. Trainee 1 Results of Live Jump Training - Trainee #1

Mission Name Live Jump training
Duration 30 minutes
Features in the mission Animation, by step instruction, and instructor's positive/negative feedback
Pass/Fail Passed
Scores in the test n/a
Number of trials 5
Emotion Really focused and expressed excitement throughout training
Helpful features 3D animation, audio instructions, step-by-step instructions, instructor positive/negative feedback, and realistic simulation
Unhelpful features Repeating whole training after failure of tests, and timed test
Missing desirable features n/a
Implementation of features AI is not good enough, it doesn't tell you exactly what you did wrong and does not selectively teach the weak performance.
existing elements
Cooperation/Collaboration
Does not have all elements of cooperative
and collaborative learning
Missing elements

Cooperation/Collaboration
n/a

Table 7. Trainee 1 Results of Treating Shock - Trainee #1

Mission Name Treating Shock
Duration 30 minutes
Features in the mission Animation, by step instruction, and instructor's positive/negative feedback
Pass/Fail Passed
Scores in the test 80%
Number of trials 1
Emotion Really focused and expressed excitement throughout training
Helpful features 3D animation, audio instructions, step-by-step instructions, instructor positive/negative feedback, animated presentation, and realistic simulation
Unhelpful features Repeating whole training after failure of tests, and timed test
Missing desirable features n/a
Implementation of features AI is not good enough, it doesn't tell you exactly what you did wrong and does not selectively teach the weak performance.
existing elements
Cooperation/Collaboration
Does not have all elements of cooperative
and collaborative learning
Missing elements
Cooperation/Collaboration
n/a

Table 8. Trainee 1 Results Basic First Aid Training - Trainee #1

Mission Name Basic First Aid training
Duration 30 minutes
Features in the mission Animation, by step instruction, and instructor's positive/negative feedback
Pass/Fail Passed
Scores in the test 87%
Number of trials 1
Emotion Really focused and expressed excitement throughout training
Helpful features 3D animation, audio instructions, step-by-step instructions, instructor positive/negative feedback, animated presentation, and realistic simulation
Unhelpful features Repeating whole training after failure of tests, and timed test
Missing desirable features n/a
Implementation of features AI is not good enough, it doesn't tell you exactly what you did wrong and does not selectively teach the weak performance.
existing elements
Cooperation/Collaboration
Does not have all elements of cooperative and collaborative learning

Missing elements
Cooperation/Collaboration
n/a

Figure 9. Trainee 1 Results of Multiplayer Mode: Mission 1 - Trainee #1

Mission Multiplayer: Defend a Bridge
Duration 60 minutes
Features in the mission Cooperation with 4-5 team mates,
Competition against other team of 5 members, Text Chat, Spectator mode,
Body Language for communication
Win/Lose 0 win 5 loss
Scores in the test N/A
Number of trials 5
Emotion Excited about competition
Helpful features 3D animation, audio instructions, step-by-step instructions, test and quizzes
Unhelpful features n/a
Missing desirable features Effective cooperation
Formal cooperation
AI Team leader that coordinate the mission
Voice communication
Implementation of features No Cooperation
existing elements
Cooperation/Collaboration
Team Competition, Some Individual
Accountability, Interpersonal Skills
Missing elements
Cooperation/Collaboration
No Teacher Coordination, Positive
Interdependence, Similar Level Group

Table 10. Trainee 1 Results of Multiplayer Mode: Mission 2 - Trainee #2

Mission Multiplayer: Defend Building
Duration 45 minutes
Features in the mission Cooperation with 4-5 team mates,
Competition against other team of 5 members, Text Chat, Spectator mode,
Body Language for communication
Win/Lose 1 win 6 loss
Scores in the test N/A
Number of trials 7
Emotion Excited about competition, tensed, frustrated
Helpful features Spectator mode, Text chat, Competition
Unhelpful features n/a
Missing desirable features Effective cooperation
Formal cooperation
AI Team leader that coordinate the mission

Voice communication
Implementation of features No Cooperation
Existing elements
Cooperation/Collaboration
Team Competition, Some Individual Accountability, Interpersonal Skills
Missing elements
Cooperation/Collaboration
No Teacher Coordination, Positive
Interdependence, Similar Level Group

APPENDIX B

TRAINEE 2 RESULTS

Table 1. Trainee 2 Results of Marksmanship Training - Trainee #2

Mission Name Marksmanship training
Duration 30 minutes
Features in the mission Animation, by step instruction, and instructor's positive/negative feedback
Pass/Fail Passed
Scores in the test n/a
Number of trials 1
Emotion Focused, nervous
Helpful features 3D animation, audio instructions, step-by-step instruction, instructor positive/negative feedback, and realistic simulation
Unhelpful features Repeating whole training after failure of tests
Missing desirable features n/a
Implementation of features AI is not good enough, it doesn't tell you exactly what you did wrong and does not selectively teach the weak performance.
Existing elements
Cooperation/Collaboration
Does it have all elements of cooperative
and collaborative learning
Missing elements
Cooperation/Collaboration
n/a

Table 2. Trainee 2 Results of Obstacle Course Training - Trainee #2

Mission Name Obstacle Course
Duration 180 minutes
Features in the mission Animation, by step instruction, and instructor's positive/negative feedback
Pass/Fail Passed
Scores in the test n/a
Number of trials 6
Emotion Really focused and expressed excitement throughout training
Helpful features 3D animation, audio instructions, step-by-step instructions, instructor positive/negative feedback, and realistic simulation
Unhelpful features Repeating whole training after failure of tests, and timed test
Missing desirable features n/a
Implementation of features AI is not good enough, it doesn't tell you exactly what you did wrong and does not selectively teach the weak performance.
existing elements
Cooperation/Collaboration

Does it have all elements of cooperative and collaborative learning
Missing elements
Cooperation/Collaboration
n/a

Table 3. Trainee 2 Results of Weapon Usage Training - Trainee #2

Mission Name Weapon Usage training
Duration 60 minutes
Features in the mission Animation, by step instruction, and instructor's positive/negative feedback
Pass/Fail Passed
Scores in the test n/a
Number of trials 3
Emotion Excited, anxious, focused
Helpful features 3D animation, audio instructions, step-by-step instructions, instructor positive/negative feedback, and realistic simulation
Unhelpful features Repeating whole training after failure of tests, and timed test
Missing desirable features n/a
Implementation of features n/a
Existing elements
Cooperation/Collaboration
Does it have all elements of cooperative and collaborative learning
Missing elements
Cooperation/Collaboration
n/a

Table 4. Trainee 2 Results of Shoot House Training - Trainee #2

Mission Name Shoot House training
Duration 240 minutes
Features in the mission Animation, step-by step instruction, and instructor's positive/negative feedback
Pass/Fail Passed
Scores in the test n/a
Number of trials 8
Emotion Excited, anxious, focused
Helpful features 3D animation, audio instructions, step-by-step instructions, instructor positive/negative feedback, and realistic simulation
Unhelpful features Repeating whole training after failure of tests, and timed test
Missing desirable features n/a
Implementation of features AI is not good enough, it doesn't tell you exactly what you did wrong and does not selectively teach the weak performance.
existing elements
Cooperation/Collaboration
Does not have all elements of cooperative
and collaborative learning

Missing elements
Cooperation/Collaboration
n/a

Table 5. Trainee 2 Results of Airborne School Training - Trainee #2

Mission Name Airborne School
Duration 30 minutes
Features in the mission Animation, by step instruction, and instructor's positive/negative feedback
Pass/Fail Passed
Scores in the test n/a
Number of trials Really focused and expressed excitement throughout training
Emotion 4
Helpful features 3D animation, audio instructions, step-by-step instructions, instructor positive/negative feedback, and realistic simulation
Unhelpful features Repeating whole training after failure of tests, and timed test
Missing desirable features n/a
Implementation of features AI is not good enough, it doesn't tell you exactly what you did wrong and does not selectively teach the weak performance.
existing elements
Cooperation/Collaboration
Does not have all elements of cooperative and collaborative learning
Missing elements
Cooperation/Collaboration
n/a

Table 6. Trainee 2 Results of Live Jump Training - Trainee #2

Mission Name Live Jump training
Duration 30 minutes
Features in the mission Animation, by step instruction, and instructor's positive/negative feedback
Pass/Fail Passed
Scores in the test n/a
Number of trials 5
Emotion Really focused and expressed excitement throughout training
Helpful features 3D animation, audio instructions, step-by-step instructions, instructor positive/negative feedback, and realistic simulation
Unhelpful features Repeating whole training after failure of tests, and timed test
Missing desirable features n/a
Implementation of features AI is not good enough, it doesn't tell you exactly what you did wrong and does not selectively teach the weak performance.
existing elements
Cooperation/Collaboration
Does not have all elements of cooperative and collaborative learning

Missing elements
Cooperation/Collaboration
n/a

Table 7. Trainee 2 Results of Treating Shock - Trainee #2

Mission Name Treating Shock
Duration 30 minutes
Features in the mission Animation, by step instruction, and instructor's positive/negative feedback
Pass/Fail Passed
Scores in the test 100%
Number of trials 1
Emotion Really focused and interested in subject
Helpful features 3D animation, audio instructions, step-by-step instructions, instructor positive/negative feedback, animated presentation, and realistic simulation
Unhelpful features Repeating whole training after failure of tests, and timed test
Missing desirable features n/a
Implementation of features AI is not good enough, it doesn't tell you exactly what you did wrong and does not selectively teach the weak performance.
existing elements
Cooperation/Collaboration
Does not have all elements of cooperative and collaborative learning
Missing elements
Cooperation/Collaboration
n/a

Table 8. Trainee 2 Results of Basic First Aid Training - Trainee #2

Mission Name Basic First Aid training
Duration 30 minutes
Features in the mission Animation, by step instruction, and instructor's positive/negative feedback
Pass/Fail Passed
Scores in the test 88%
Number of trials n/a
Emotion Really focused, interested in subject
Helpful features 3D animation, audio instructions, step-by-step instructions, instructor positive/negative feedback, animated presentation, and realistic simulation
Unhelpful features Repeating whole training after failure of tests, and timed test
Missing desirable features n/a
Implementation of features AI is not good enough, it doesn't tell you exactly what you did wrong and does not selectively teach the weak performance.
existing elements
Cooperation/Collaboration
Does not have all elements of cooperative and collaborative learning

Missing elements
Cooperation/Collaboration
n/a

Figure 9. Trainee 2 Results of Multiplayer Mode: Mission 1 - Trainee #2

Mission Multiplayer: Defend a Bridge
Duration 60 minutes
Features in the mission Cooperation with 4-5 team mates,
Competition against other team of 5
members, Text Chat, Spectator mode,
Body Language for communication
Win/Lose 0 win 5 loss
Scores in the test N/A
Number of trials 5
Emotion Excited about competition
Helpful features Spectator mode, Text chat, Competition
Unhelpful features Cooperation (Never cooperated)
Missing desirable features Effective cooperation
Formal cooperation
AI Team leader that coordinate the mission
Voice communication
Implementation of features No Cooperation
existing elements
Cooperation/Collaboration
Team Competition, Some Individual Accountability, Interpersonal Skills
Missing elements
Cooperation/Collaboration
No Teacher Coordination, Positive
Interdependence, Similar Level Group

Table 10. Trainee 2 Results of Multiplayer Mode: Mission 2 - Trainee #2

Mission Multiplayer: Defend City
Duration 45 minutes
Features in the mission Cooperation with 4-5 teammates,
Competition against other team of 5 members,
Text Chat, Spectator mode, Body Language for communication
Win/Lose 0 win 7 loss
Scores in the test N/A
Number of trials 7
Emotion Excited about competition, tensed, frustrated
Helpful features Spectator mode, Text chat, Competition
Unhelpful features Cooperation (Never cooperated)
Missing desirable features Effective cooperation
Formal cooperation
AI Team leader that coordinate the mission
Voice communication

Implementation of features No Cooperation
existing elements
Cooperation/Collaboration
Team Competition, Some Individual Accountability, Interpersonal Skills
Missing elements
Cooperation/Collaboration
No Teacher Coordination, Positive
Interdependence, Similar Level Group