# The Serious Games Showcase & Challenge Distilled

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## ABSTRACT

Since 2006, the Serious Games Showcase & Challenge (SGS&C) has encouraged student, government and commercial game developers to submit their serious games for review by a panel of military, academia and industry gaming experts. For the SGS&C, an entry is considered a serious game if it incorporates game play dynamics in a product to educate or train a learner at any stage of the learning continuum from K-20 through adult. Finalists are showcased, and winners announced annually in the I/ITSEC exhibit hall. A wide range of information is collected when a product is submitted to the SGS&C and as each entry navigates through the evaluation process. Previously, the rich data collected each year has only been shared with individual entrants to help them learn from the process and possibly improve their games. The aggregate data that has been collected has historically only been reviewed internally by the SGS&C Planning Committee. The available data not only provide insight into what it takes to design a best-in-class serious game but by analyzing data from games submitted across a series of dimensions we've identified industry trends relevant to anyone interested in the application or development of serious learning games. This paper provides context to the aggregated data that spans the serious games and maps finalist scoring to instructional interventions, design principles and technologies being used.

## ABOUT THE AUTHORS

**Jennifer McNamara** is Vice President of Serious Games at BreakAway, Ltd. currently researching the use of games for the Telemedicine Advanced Technology Research Center (TATRC) and Intelligence Advanced Research Projects Agency (IARPA) and providing serious games serving the defense, homeland security, corporate and medical communities. Jenn holds a B.S. in Cognitive Psychology from Drexel University and a M.Ed. in Instructional Systems from The Pennsylvania State University. Jenn serves as Chair I/ITSEC Education Subcommittee, Member Technology and Standards Subcommittee for the Society for Simulation in Healthcare and member of the Serious Games Showcase and Challenge Committee.

**Peter Smith** is lead for emerging technologies at OSD's ADL Co-Lab, responsible for heading up efforts in games, virtual worlds, and social media. His rich background in games covers research and development efforts ranging from massively multiplayer online games to small scale web games and everything in between. Peter is currently pursuing his Modeling and Simulation PhD at the University of Central Florida. He is a founder and current Committee lead of the Serious Games Showcase & Challenge, and active in serious games and games for health.

**Brent Smith** performs extensive research in the areas of collaborative distributed learning architectures, distributed simulations and the use of commercial gaming technologies as educational tools for the US Military. His professional focus is on the development of technologies to enable new learning methods and tools to improve training effectiveness. As the CTO of ECS, Brent is responsible for the design of the company's next generation enterprise-wide learning technologies. He is a founder of the Serious Games Showcase & Challenge, served as the 2012 Defense GameTech Users' Conference Chair and is current Deputy Program Chair for I/ITSEC.

**Kent Gritton** As the Director, Joint Training Integration and Evaluation Center (JTIEC), Kent Gritton actively supports Team Orlando by coordinating Service training capabilities to the benefit of the Joint Warfighter, managing cross-cutting Inter-Service, Joint or Other Government Agency projects, and coordinating Team Orlando human performance and training solutions for Joint and Other Government Agencies. Kent is an active Serious Games advocate. He is the architect of the Serious Games Showcase & Challenge, and continues to remain active in its production. Kent has also been a three-time Conference Chair for the Defense GameTech Users' Conference.

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## BACKGROUND

In 2005, the use of PC-based games for training and education was still relatively nascent. While there was ample anecdotal evidence that serious games were effective, the scant empirical evidence was inconclusive. Given this backdrop, it should be no wonder that developers were approaching this disruptive technology with caution; that training institutions (especially within the military) were equally wary of the cost-benefit analysis of serious games; and that digital arts and game design students were not aware that serious games were a potential market for their talents. It was within this environment, and with the intent to help bridge these gaps, that the Interservice/Industry Training, Simulation and Education Conference (I/ITSEC) Serious Games Showcase & Challenge (SGS&C) was born.

With a belief in serious learning games as an effective training medium and an interest in inspiring growth of their use, the SGS&C needed to: create a working definition of a serious learning game, chose a venue to showcase and judge serious game finalists, craft a well-designed evaluation rubric, solicit expert committee members, evaluators and volunteers, determine worthy incentives and institute strong processes.

While the list has changed slightly over the years, currently to qualify for the SGS&C, serious game entries should:
- have clearly defined, measurable learning objectives;
- provide players with a clearly identified challenge/problem;
- make use of game play dynamics and/or gaming technology;
- provide players with positive/negative feedback with respect to progress toward the game's challenge and achievement of learning objectives;
- be original games (as opposed to novel uses of existing games); and
- NOT be modifications to existing games.

With the focus of the SGS&C defined, a well-designed evaluation rubric was crucial to attract expert evaluators. Expert evaluators and worthy incentives were necessary to generate the marketing/awareness campaign in order to attract competitive entries. Strong processes were developed and continuously refined to ensure the SGS&C not only reflected positively on the hosts, sponsors, and entrants, but also on all the volunteers and evaluators.

The motivations of potential entrants and therefore the incentives necessary to drive developers to enter their serious games into the SGS&C were initially misunderstood. During the SGS&C planning phase, incentives from other "contests" (like the Independent Games Festival (IGF, 2012) held during the annual Game Developers' Conference) were studied. The most common incentive was cash rewards. Accordingly, cash prizes were offered in the first year of the SGS&C. Discussions with both the winners and the finalists that year revealed that the potential of a cash prize was not the reason they submitted to the SGS&C; the primary incentive was the visibility being a finalist provided. As a result, cash prizes were eliminated beginning in the second year. As seen in Figure 1 submissions have increase every year, without any cash incentives provided.
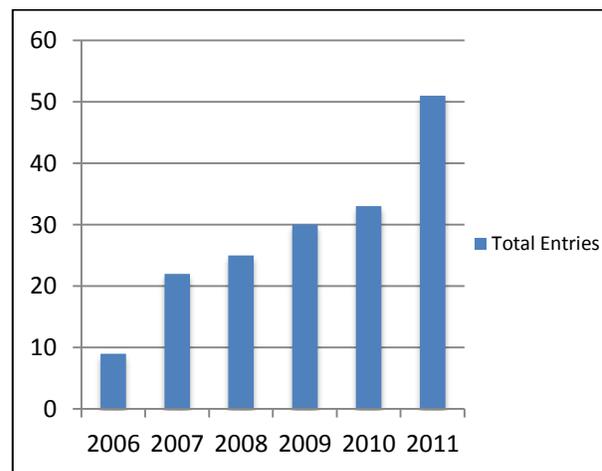


**Figure 1. Total Submissions Per Year**

Besides generally making people aware of the SGS&C, our marketing efforts have concentrated on students within game and instructional development curricula and finding ways of providing maximum return on SGS&C sponsorship investment.

## SGS&C STRUCTURE

The SGS&C is a year-round venture: marketing never stops; recruitment of evaluators and SGS&C team members is ongoing; processes are constantly being evaluated for improvement (e.g., inclusion of and methodology for accepting mobile games); and the SGS&C itself. The main stages of the SGS&C are: pre-planning, submission entry, finalist selection, evaluation, the showcase and awards.

All entered games undergo a rigorous vetting (called the "down select") by the approximately 25 SGS&C team members to select the finalists. Finalist games and the evaluation rubric are forwarded to the worldwide corps of evaluators. Each evaluator is assigned three to four games to evaluate, but given access to all finalist games, and asked to evaluate as many as possible. At the conclusion of the six week evaluation cycle, all evaluations are independently tabulated by three people. The winners of the various serious games categories are announced at the SGS&C awards ceremony.

The Showcase portion of the SGS&C occurs on the I/ITSEC show floor during the course of the conference. All finalists are provided a kiosk with computer and monitor for the purpose of demonstrating their games and discussing aspects of their games with conference attendees. During this timeframe, not only are they and their games receiving excellent exposure, they are also vying for the People's Choice Award. This award is based on voting by the conference attendees. The winner is announced at the SGS&C awards ceremony.

## SGS&C EVALUATION PROCESS

The SGS&C evaluation process collects both qualitative and quantitative data about each entry. As each entry is submitted, information is collected about the instructional goals and objectives of the application. This information is collected via free-form responses on the entry form and provides insight into the target audience for the application, the technologies used to develop the application, the various instructional feedback/remediation strategies used within the application, and how the game is designed to meet the stated instructional objectives. As entries are received, this information is used to populate the first

of two rubrics used within the evaluation process.

### Evaluation Rubrics

Since serious games run the gamut of training objectives and game methodologies, designing a single evaluation rubric capable of assessing all entrants equitably was crucial. The essence of a well-designed evaluation rubric is simplicity. At its' core, a serious learning game is a game merged with instructional elements. Accordingly, the rubric concentrated on three main areas: the physical operation of the game; the enjoyment of the game; and its ability to impart the desired training. The simplicity in assessing the pedagogy of training objectives as diverse as culture and language, aircraft maintenance, and animal husbandry comes from requiring the entrant to clearly articulate the training objective. Armed with the goals for the serious game, the rubric assesses how well it achieves the entrant's stated training objective while employing key education and training principles (i.e., after action review, real-time tutoring, remedial training, etc). A final aspect of the rubric covers the unexpected – extra bonus points for innovative aspects of the game within any of the aforementioned criteria.

Measures were put in place to further ensure equitable assessments. First, to preclude over-weighting any one assessment area based on community biases, evaluators were recruited from industry, government, and academia, with an eye towards balancing between the developer, user, and research communities. This balanced approach to evaluation has strengthened the credibility of the SGS&C. To guard against individual evaluator biases, all assessment areas were refined with anchor statements so evaluator deviations would be minimized. Thus, the mixture of objective criteria and anchored subjective measures provided a rubric able to competitively select clear winners without controversy.

A final aspect of the rubric which has afforded great insight into the evaluator's likes/dislikes of a serious game is the free-form comments section. These objective comments have become an excellent source of constructive criticism for the game developers. All comments are collected and collated at the conclusion of the SGS&C, and forwarded to the entrants (less evaluator's name) as feedback for review. Many of the serious games developers reported that this feedback is incentive enough for becoming a finalist.

### The Down Select

The down select rubric is used by the SGS&C Committee to systematically and consistently evaluate all entries submitted to the challenge. This rubric provides a standard mechanism to measure the production quality, playability and instructional

effectiveness of each entry while also identifying the innovative qualities a particular entry incorporates into its design. The down select rubric is populated during a two to three day meeting where all submitted entries are reviewed. During the down select, each game is evaluated by the committee based on a set of key attributes: operation, enjoyment, and training. As the committee plays and evaluates each entry, scores are entered into an electronic spreadsheet and comments are collected. These scores are used to determine the finalists for each SGS&C category.

**The Formal Evaluation**

After finalists have been identified, they are assigned to the SGS&C evaluators for the formal evaluation. The evaluation rubric used during this stage of the evaluation establishes a clear and concise score based on how well the entry meets the established criteria that comprise the overall categories of instructional quality, technical quality, and usability/playability. The formal SGS&C evaluation team is comprised of a multi-disciplinary team of individuals from government, academia and industry. The evaluation team includes educators, developers (artists, engineers, and designers), program managers, business developers, and senior leaders with a wide range of perspectives for how these technologies are used around the world. To provide an example of the evaluators' backgrounds, the 2011 pool of evaluators will be discussed. It included 19 people from academia, 21 people from government, and 33 people from industry. Twenty-five percent of the evaluators were women and seven percent were from outside the United States. No specific data was collected on the age of the evaluators, but ages spanned from early twenties through early sixties.

## DATA AND TRENDS

The SGS&C is in its seventh season and while there have been some changes the core of the SGS&C has withstood the test of time. Throughout its course many trends have emerged among the entered serious games that can be used to show a snapshot of where the serious games have been and where they are headed within the greater simulation community.

Meaningful discussion of trends based on serious game submissions requires an understanding of the nature of the overall pool of submissions. From 2006 – 2010, the SGS&C only accepted games that could be run on a Personal Computer (PC) regardless if versions that ran on other platforms existed. Beginning in 2011, two new theme based submission categories were added: a mobile games category and a category for topics of special emphasis relevant to I/ITSEC's end-user warfighter community. For 2011 and 2012, the special

emphasis category has been Adaptive Force Training. Theme categories can and will change and evolve as the military community's training needs and serious game trends change.

**Data Collection and Analysis**

To categorically classify the serious learning games entered to the SGS&C we recorded data based upon the submission forms populated by the entrants that accompanied the game uploads, reviewed pictures and videos from submissions and replayed all of the games we could still access (approximately 80%), reviewed the evaluators' scores and comments and relied on memory from having participated in the annual down selects and showcases for all of the games reviewed. Data from 2006 and 2007 was excluded from the analysis because it was unfortunately not stored sufficiently for reference. Thus, unless otherwise noted the trends in this paper cover the 139 serious learning games submitted to the SGS&C between 2008 and 2011. Games were classified across the following dimensions: the subject matter addressed by the learning game, game genre, game development and rendering engines, interface technologies, instructional interventions, and evaluative feedback.

Trends spanning the previous 4 years of serious games within the SGS&C are presented in the succeeding paragraphs. Please note that as this is a convenience sample based on voluntary submissions and includes 139 games total, no classical statistical analyses of the data will be presented, rather we report observed trends in the data and discuss possible interpretations and implications for the serious games community.

**Trends in Submissions**

The number of submissions to the SGS&C has been increasing each year. As discussed previously, the SGS&C Committee evaluates all submissions and selects the finalists. The target number of finalists had been held constant around 12 – 13 until 2011 where the introduction of the theme based categories increased the number of total finalists to 21. The Committee strives for a balance of approximately 6 business finalists, 3 government finalists, 3 student finalists and 4 mobile finalists. The remaining slots are typically allotted based on the current themes or additional similarly-scored competitors. All finalists selected are invited to showcase at I/ITSEC and are evaluated by the evaluation team. Non finalists are only evaluated by the members of the committee. See Figure 2 depicting the numbers of finalists vs. non finalists for each year. Table 1 contains more information regarding the total number of submissions broken out by non-finalists and

finalists annually.
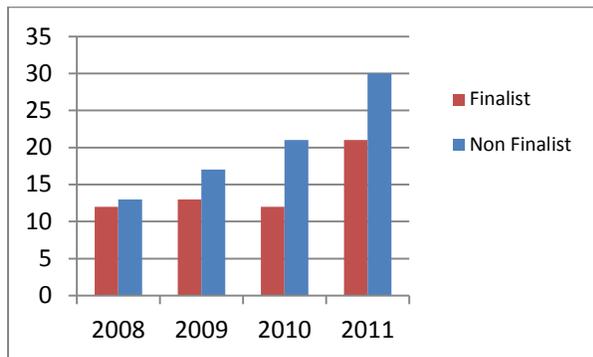


**Figure 2. Finalists vs. Non Finalists**

**Table 1. Submissions, Finalists and Non Finalists**

| Year | Non Finalists | Finalists | Total Submissions |
|------|------|------|------|
| 2008 | 13 | 12 | 25 |
| 2009 | 17 | 13 | 30 |
| 2010 | 21 | 12 | 33 |
| 2011 | 30 | 21 | 51 |
| Totals | 81 | 58 | 139 |

The SGS&C has three principle categories: student, government and business. These categories relate to the origins of the game developer. Anyone may enter in the business category; entry in the government category requires validation from a government (.mil or .gov) sponsor, and entry in the student category requires both validation of school affiliation and affirmation that a preponderance of game development was done by students.

As illustrated in Figure 3, the majority of all submissions are in the business category every year and while business submissions are growing annually, the other categories have remained relatively flat over the last few years. If these trends continue we anticipate increases in business entries each year. But the historical data illuminates great opportunities for new entrants in the student and government categories.

Student created games have added a unique element to the SGS&C, finalists report satisfying experiences, receive valuable game development software packages, and many are offered future jobs as a result of their participation. However, difficulties remain in drawing their participation. We believe this is largely due to academic and SGS&C calendar alignment issues. The SGS&C is anchored to the I/ITSEC conference schedule; entries therefore are due in September, at the beginning of a typical academic year. Efforts are

underway to mitigate this issue through establishing regional academic serious game challenges, which would be held in the late Spring. Students whose serious games win one of these regional events would be guaranteed entry as a finalist in the SGS&C.
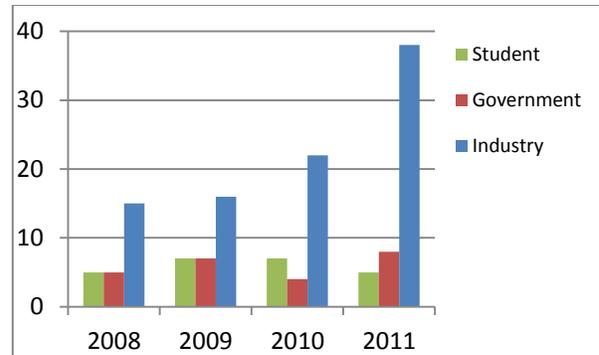


**Figure 3. Submissions by Category Annually**

The lack of government entries may reflect a trend that most serious game development is being performed by contractors for the government agencies who choose to submit their own games. While we don't receive as many government as business entries, many of the business entered games have been funded by and developed for government organizations.

**Trends in Content**

While the SGS&C affiliation with I/ITSEC clearly demonstrates a connection with offering unique training experiences to our warfighters, we welcome submissions that contribute broadly to this mission including games that contribute to the success of the large civilian research and contractor workforce, secondary educational games helping to better prepare future warfighters and provide the next generation of research and contract professionals and even games that improve the health, safety and well being of the general population. With this broad reach, over the years we've seen serious games covering an incredibly wide array of training needs.

While an exhaustive account of the training content addressed by prior entrants is beyond the scope of this paper, below we share notable trends in the subject matter addressed. While not included in the formal data analysis, 2006 entries were almost all military constructive simulations and we've seen that category almost completely disappear. In general, few serious learning games have a singular training focus, most address complex, interrelated needs. Thus, the trends reported are not necessarily mutually exclusive, for example over the four years problem solving skills were a focus of 50% of the submissions, but they were

most often trained within a particular context which could also fall into one of the other trend areas i.e. business skills or medical professional training allowing a game to be counted in multiple categories.

Figure 4 illustrates the subject matter categories which have consistently received learning game submissions across the four years. It is notable that problem solving
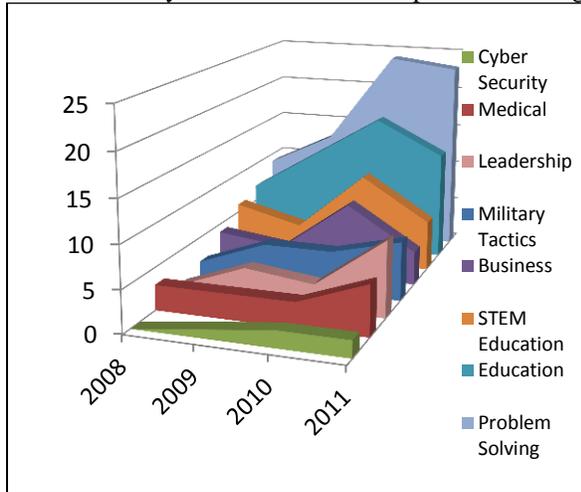


**Figure 4.  Consistent Submitted Subject Matter**

skills are addressed by entrants in the greatest frequency, this is consistent with claims that serious learning games are ideal for training complex, higher-order skills (Vogel et al., 2006; Greitzer, Kuchar, & Huston, 2007). For an event associated with a conference serving the warfighter, military tactics training games never account for more that 17% of the submissions in a given year, illustrating the breadth of skills organizations are utilizing serious games to address including leadership skills, business skills, teamwork, communication and social skills, cyber security awareness and even medical professional skills. It is also worth noting that the education category includes all general education subjects including science, technology, engineering and mathematics (STEM) but those are also illustrated separately to indicate the number of entrants using serious games to address these critical educational gaps also note that educational games often address adult learning needs and not just secondary students.

While it is true that the number of submissions in these categories is increasing annually, in some cases dramatically, remember that the total number of submissions is also increasing. Figure 5 shows game submissions addressing these same content areas as a percentage of annual submissions illustrating a relatively constant ratio with regard to total submissions for these content areas.
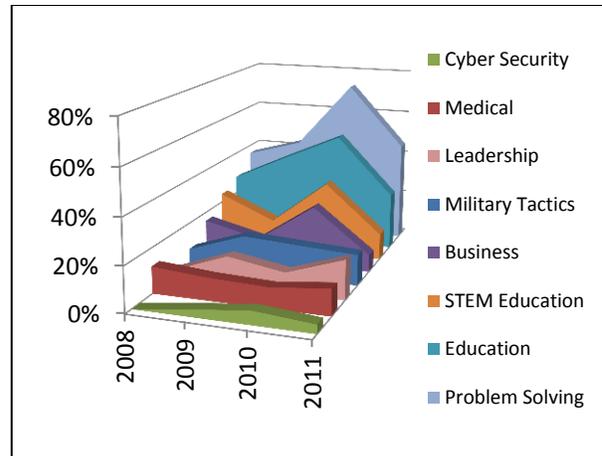


**Figure 5.  Consistent Submitted Subject Matter as a Percentage of Annual Submissions**

A few content areas, psychological health, personal health and safety have experienced an increase in entries over the years in overall number as shown in Figure 6.
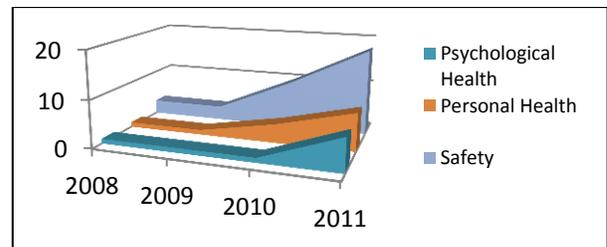


**Figure 6.  Submission Growth by Subject Matter**

Figure 7 shows subject matter growth as a percentage of overall entries. This illustrated that safety in particular as a topic is growing rapidly in our field.

As investments grow in subject areas in the industry more entries are submitted in that area for the next few years. Presumably as more data is gained to track these trends it will be easier to identify core investment areas in the industry. For other accounts of content areas covered by serious games, see Hussain & Feurzeig (2008) and Chandler et. al (2009).
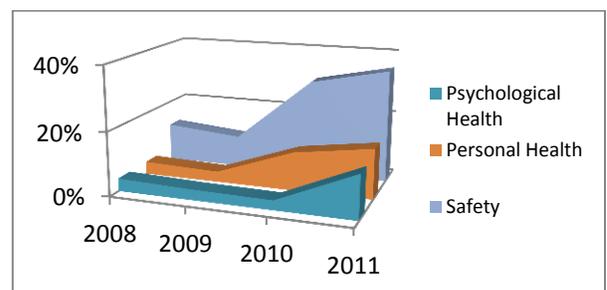


**Figure 7.  Percent Growth by Subject Matter**

## Trends in Target Audiences

As previously mentioned, the SGS&C attracts serious games that address learning needs beginning with secondary education. While many of the games target educational content, a relatively small proportion, around 24%, of the total games submitted address secondary education or under 18 year old children's learning. Some of the secondary education games are also used by adults, for example basic language and cultural training games. While about half of the submissions are used in formal education and training programs, 68% of the serious games target professionals in the workplace, note some of these were also used by students in formal training programs. Figure 8 illustrates the number of games submitted annually that target child vs. adult learners and their use as part of formal education and training programs versus by working professionals.
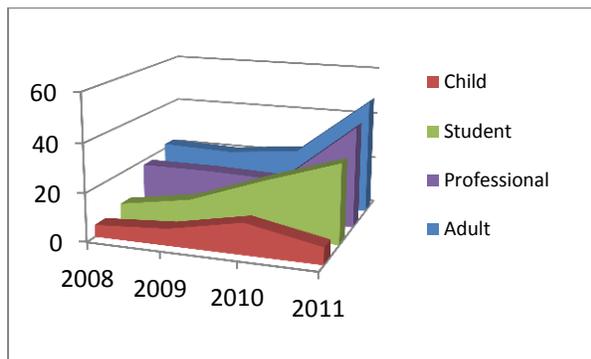


**Figure 8. Audience of Games Submitted**

## Trends in Game Genres and Styles

While first person shooter games like VBS2™ are often the first types of games people picture when serious games for the warfighter are mentioned, submissions of first person shooters has dropped to nothing over the past two years while other genres including casual games, real time strategy (RTS), mini-games and simulations remain strong, see Figure 9. First person shooters are played in the first person view where the player views the game world from the perspective of the character and sees a gun or hand floating in front of them to represent their view (Adams, 2006). The characters typically have human actions and movement and FPSs are commonly associated with training military in particular in battlefield tactics but serious games often apply this perspective to other types of interactions. Casual games and mini-games are more friendly games that use simple game play i.e. puzzles, can often be played using a one button mouse or cell phone key pad/touchscreen and allow short bursts of game play.

Casual and mini-games are often 2D and abstract and can contain cartoony graphics where the player is not necessarily embodied in the games. They are used primarily for drill and practice of non-kinetic learning objectives like the acquisition process, or coping strategies for post traumatic stress disorder (PTSD). RTS games emphasize high level strategy requiring real-time high level decision making, they are typically associated with action, use abstract control – clicking, dragging, tasking and the player has a top-down perspective of the gamespace note that some 3D RTS allow free camera movement. RTS are strong for multiplayer gaming – each player can interact with the game independently Simulations rely upon game rendering and programming technology but not extensive game design or play elements, they merely simulate as accurately as possible a task and environment.
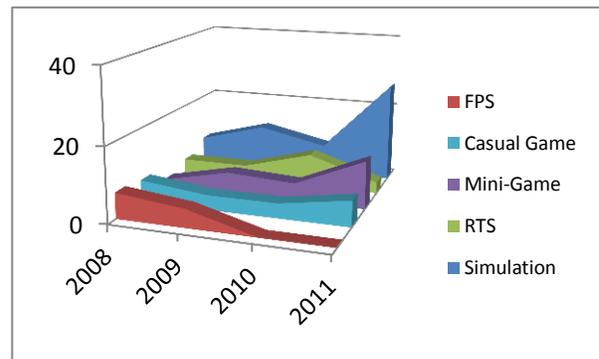


**Figure 9. Top Game Genres Submitted**

It seems any discussion of the use of serious games in adult education and training includes a discussion of what it is about serious games that draws organizations to use them. Often people argue that merely using game technologies to create simulations that can be easily accessed and deployed without incorporating any elements of game design or mechanics is a strong contribution of serious games (Hunicke et al., 2005). The counterpoint is that the underlying game design and strategies for creating immersion, engagement and flow (Csikszentmihalyi, 1991) are critical elements to truly enjoy the benefits of serious learning games.

While our submission numbers indicate a reasonable number of simulation games submitted, 39% total across the four years, when we look at the number of simulation games accepted as finalists versus non finalists we see that on average very few of the simulation games have been advanced as finalists, see Figure 10. This appears to indicate that while the SGS&C receives many simulation games, very few are evaluated well for meeting the SGS&C criteria.
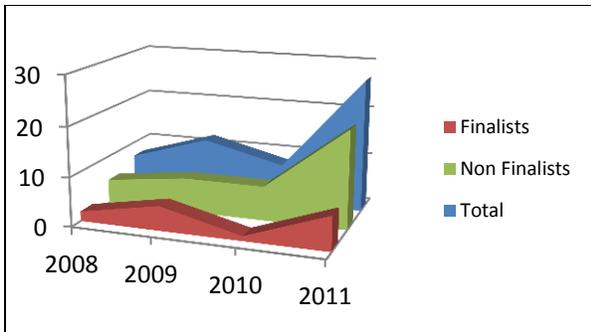
**Figure 10. Simulation Finalists vs. Non Finalists**

Often there is an assumed emphasis on 3D games versus 2D games or a mistaken belief that 3D games are always necessary or superior to their 2D counterparts. Interestingly, the SGS&C has received 23% 2D and 48% 3D games over the years see Figure 11. More 2D games have been submitted in recent years than earlier years.
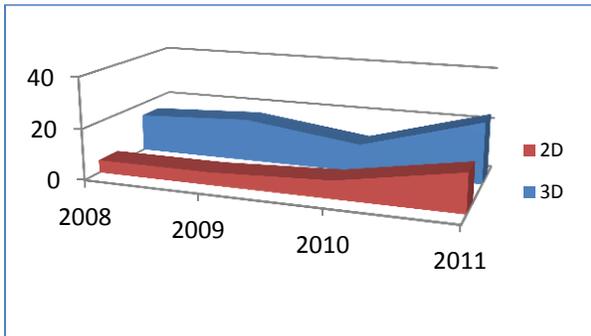


**Figure 11. 2D vs. 3D Submissions**

Figure 12 illustrates that in 2011 there were more 2D finalists than 3D finalists for the first time. This is most likely due to overcoming the stereotype that games in the military need to be 3D simulation based games. It is encouraging to see that 2D games can be taken seriously by the community and do not need to be high fidelity simulations or first person shooters to be recognized as worthwhile learning interventions. Supporting a move away from emphasis on high physical fidelity environments Chandler et.el, (2009) point to the higher importance of cognitive vs. physical fidelity suggesting that game design abstraction of physical aspects is acceptable as long as the necessary cognitive fidelity is maintained and share Clark's, 2008 report that "people are comfortable with the use of iconic representations, and in fact, when first being introduced to domain concepts, the iconic representation is less distracting than a full blown simulation of a realistic setting. High end graphics and ambient sound can diminish learning outcomes, especially for novice learners" or it may … "obscure the true learning requirements".
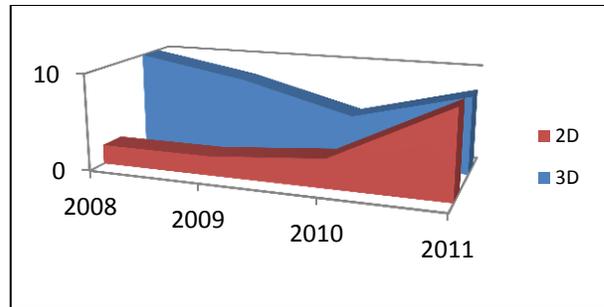


**Figure 12. 2D vs. 3D Finalists**

While 2D has grown each year the spike between 2010 and 2011 is most likely due to the increased number of finalists in the mobile category. This category is new, and many of the games submitted for it were 2D first efforts by the submitters.

**Trends in Technology Platforms**

While 2011 was the first year that the SGS&C officially accepted mobile entries, we had received several in prior years. In 2011 we received 9 mobile applicants. It will be interesting to watch this theme category grow and see if it can match or outpace PC serious games and no longer require its own category.
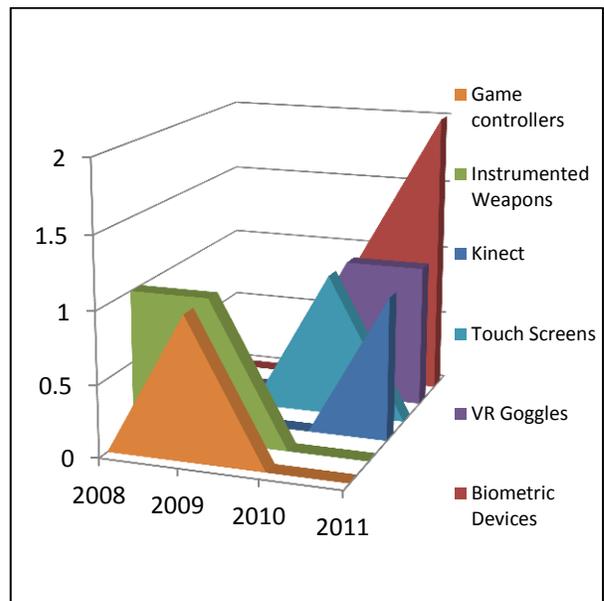


**Figure 13. Interface Peripherals**

Over the years several serious games have been submitted that incorporated some form of unique user interface to the game including xbox™ game controllers, instrumented weapons, Kinect™, touch screens, VR goggles and biometric devices. While we don't receive many of these, it is interesting to see what

peripherals are popular and when they start to lose popularity.

Note than none of these peripherals or interface mechanisms receive more than a few entries a year, we expect to see greater use of touch screens, accelerometers and GPS capabilities with increases in mobile submissions, Figure 13 illustrates that biometric devices for measuring physiological response during play, Kinect to use physical body movement to drive actions in game and the use of VR goggles integrated into serious game entrants have been emerging while use of game controllers and external simulated weapons is waning.

**Trends in Instructional Elements**

As the focus of the SGS&C is serious learning games, emphasis is placed on evaluating the elements embedded within the serious game to achieve educational and instructional objectives; Figures 14 and 15 illustrate the percentage of entries and finalists that employ each of the most commonly used in-game instructional strategies.
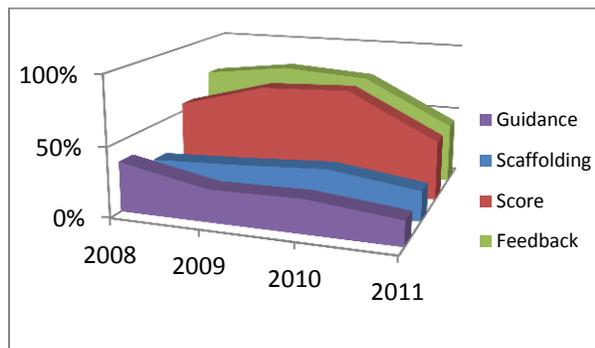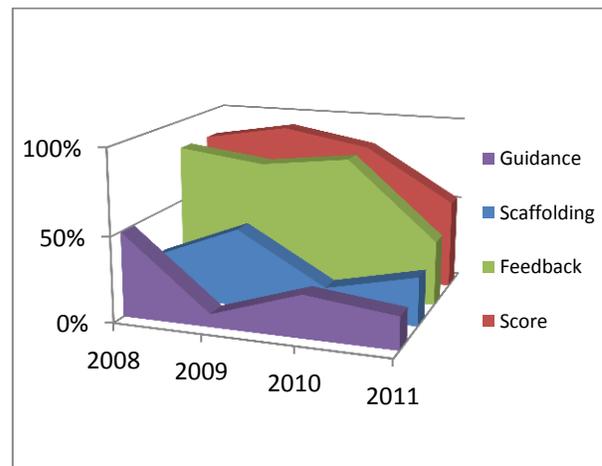


**Figure 14. Instructional Trends Across All Submissions**

Consistently, entrants have heavily relied upon an explicit score provided to the learner as feedback on performance 60% of all submissions included an explicit scoring system and 74% of all finalists rely upon scoring. While a score is a nice game element to keep a learner engaged and constantly driving toward a goal, more specific instructional elements are often utilized in learning games.

Our submissions include use of explicit in-game guidance by 24% of submissions and finalists, where a non-player character mentor, teammate, and/or challenge and progressive elements of the game itself are used to guide the learner through game play to explicitly address content learning, remediation or course correction embedded within the game. Scaffolding employed by 25% of entrants and 29% of

finalists uses game levels to incrementally and instructionally appropriately challenge the learner as new information and skills are gained in a series of progressively difficult levels. For example, scaffolding in a basic nursing training game could have the learner learn and demonstrate mastery of basic vital sign collection before unlocking and proceeding to working with more advanced diagnostic tests.

The final instructional strategy employed in a number of submissions is feedback to the learner regarding demonstrated learning and performance. Feedback can be embedded into the environment and provided during game play i.e., a character thanks you, you save someone, you successfully advance past a challenge or receive an explicit notice of an accomplishment or are awarded a badge or achievement or it can be saved for an after action report on performance. A serious game was considered to include feedback if it used implicit or explicit mechanisms or even a combination of the two. Feedback was utilized in 64% of submitted games and 66% of finalists. For more discussion on instructional elements in games, see Gunter, Kenny, & Vick (2007).



**Figure 15. Instructional Trends Across Finalists**

**Trends in Engines**

Creating a game requires use of a game engine and associated development software. Over the years, we've received entries created using over 32 different commercial game engines and 15 games built using the developers' own proprietary technologies. As Figure 16 illustrates, in earlier years the Gamebryo™ engine was common and the Unreal™ engine has been used by a small number of games consistently, but in recent years specifically 2010 – 2011 XNA™, Unity3D™ and Flash™ have emerged as engines of choice for serious game developers. We believe these trends in commercial engine selection reflect attractive business

models offered by the vendors of these products, an interest in web-delivered content (Flash and Unity3D, a low barrier to entry for developers using Flash, and the ability to create mobile games using Unity3D. Note there are many other commercial tools being employed by one or two submissions captured in the "other engine" category including: Ogre™, Trinigy™, Real World™, Delta3D™, Jupiter™, VBS2, Second Life™ and Thinking Worlds™.

With the recent surge in use of Flash and Unity3D, it makes sense to explore the patterns more closely. Flash games have been submitted since 2008 and Unity 3D emerged as a tool in 2010. However, when we look at recent finalists, Figure 17, using these engines we see that Unity3D finalists are approaching Flash.
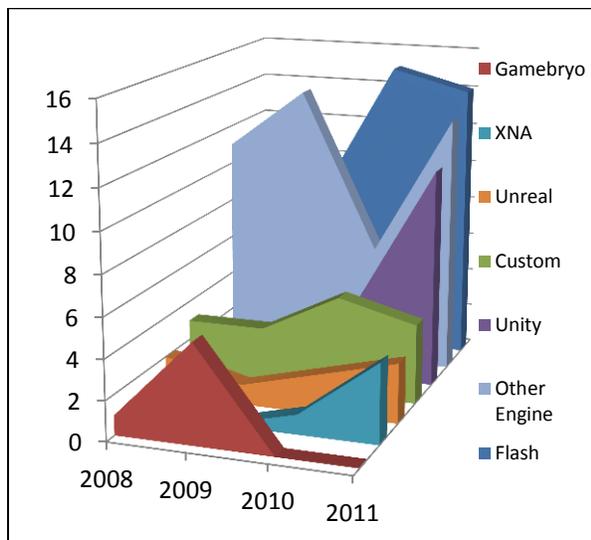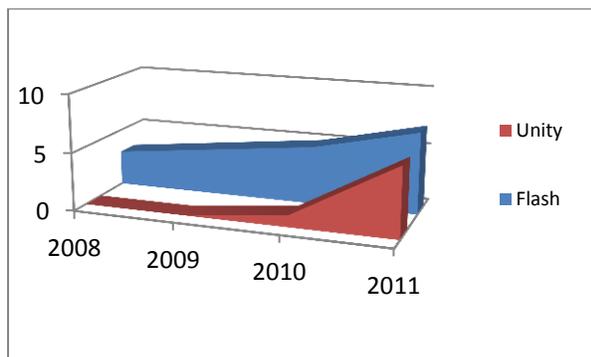


**Figure 16. Popular engine use over time**



**Figure 17. Finalists Using Flash vs. Unity3D**

**CONCLUSIONS**

Through both a growth in quantity and quality of games entered, the SGS&C has proven that serious games is a training medium that has considerable and

continued interest. While we can't claim statistically significant representation of the entire serious learning games space based on the SGS&C submissions and finalists, many of the trends discussed in this paper do mirror general trends being discussed in the industry as a whole (Ritterfield et al., 2009).

The broad representation of the application of serious games to many different learning topics, using unique genres and styles of game play, moving to web-delivery and mobile platforms, and leveraging commercial off the shelf game engines are clearly representative of trends seen industry wide. In addition, the incorporation of explicitly designed learning elements into serious games is a key feature successfully illustrated by the SGS&C entrants and finalists. These trends are encouraging for the continued and expanded application of serious games within the I/ITSEC community. The increased awareness of serious learning games and their potential applications created by the SGS&C coupled with more and more research being conducted to demonstrate games' effectiveness as learning tools and to understand the game mechanisms and their instructional counterparts that provide successful learning outcomes (Hays, 2005; Blunt, 2009; Hussain, & Feurzeig, 2008; Smith, 2007; Zyda, 2006) we forecast a strong future for serious learning games.

**Future Challenge Plans**

The SGS&C has plans to expand to provide an even broader representation of serious learning games to our community and recognize developers in other markets. As mentioned previously we are exploring establishing regional student challenges to be held in the Spring to feed student finalists to the following year's SGS&C and increase student representation. While we've achieved a small level of international game representation at the SGS&C, we are moving to expand that presence, and highlight and broaden the exposure of serious games by exporting the SGS&C to international markets currently devoid of mechanisms to recognize the efforts of serious games developers.

Four macro regions were selected for this effort: Australia/New Zealand, Asia, Europe and SouthAmerica. Conferences that have a focus on serious games were researched and selected for consideration. With the intent that they establish their own SGS&C, all intellectual property (rubric, rules, processes, etc.) and lessons learned from the SGS&C have been provided as a means to jump start the process. The exact format and categories have been left up to the conference organizers in order to properly align their event to the conference's structure and objectives. The only quid pro quo requested is that the

winners of their business category and student category (if so established) be sent to the United States as guaranteed finalists in the SGS&C at I/ITSEC. The first region to enact this concept was the Australia/New Zealand market via SimTecT for the 2012 calendar year. By linking SGS&Cs, serious games as a training medium gains greater regional awareness, all regions gain greater awareness of neighboring capabilities, and the ultimate goal of expanding worldwide visibility of great serious gaming is realized.

**Future Data Analysis Plans**

It was originally our intention to analyze the data collected from the evaluators and examine trends across the actual category winners (Business, Government, Student, Mobile, Adaptive Force, Audience Choice) of the challenge. While that analysis proved beyond the possible scope of this paper. We look forward to conducting the analysis from the raw comments and data in the coming year to return to I/ITSEC 2013 with an update on trends and a focus on the lessons learned from the evaluations of the serious learning games. Now that we have begun tracking the games across the dimensions shared in this paper, we plan to incorporate this into the annual SGS&C process to be able to routinely provide updates to trends.

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