Serious Games, Gamification and Game Engines to Support Framework Activities in Engineering: Case Studies, Analysis, Classifications and Outcomes

Dr. Alexander Uskov, Bhuvana Sekar
Department of Computer Science and Information Systems
Bradley University, Peoria, Illinois, U.S.A.

Abstract—Recently many global well-known companies such as Microsoft, IBM, Oracle, Adobe, Cisco, Siemens, SAP, Google, Accenture, American Express, Caterpillar, PWC started an implementation of full-scale games and/or gamified applications to support their main business activities, processes and functions in "serious" areas such as management, simulations of complex physical objects and phenomena, engineering, project management, quality management, HR management, corporate training, marketing, and other areas. The particular objectives of performed multi-aspect research project on serious games and serious gamified applications in industry were to 1) identify and analyze best cases of use of serious games and gamification of main business processes in industry, 2) identify possible classifications of main types and attributes of serious games and serious gamified applications used in industry, and 3) identify serious game engines and platforms and classify their main features. This paper presents the research findings and outcomes relevant to specified project objectives.

Keywords— serious games; gamification; serious game engines; engineering.

I. INTRODUCTION

Recently many global well-known companies such as Microsoft, IBM, Oracle, Adobe, Cisco, Siemens, SAP, Google, Accenture, American Express, Caterpillar started an implementation of full-scale serious games and/or serious gamified applications to support their main business functions, processes, and framework activities in "serious" areas such as management, administration, marketing, simulations of complex physical objects and phenomena, engineering, project management, marketing, quality management, HR management, and other areas.

In accordance with Gartner market research company [1], "…many small businesses, as well as 70% of the top 2,000 global organizations, will use "gamified" applications for marketing, employee performance and training, and health care by 2014". In accordance with the Pew Research Center report [2], 53% of surveyed 1,021 technology stakeholders and critics agreed that "… by 2020, there will be significant advances in the adoption and use of gamification".

These and multiple additional relevant reports by industrial organizations motivated authors to perform a multi-aspect project on research, analysis, design, development and active use of serious games (SG), serious game engines (SGE), and serious gamified applications (SGA) in industry and businesses to support their framework and umbrella activities, main business functions and processes.

The core framework activities in software engineering [3] include 1) communication/initiation, 2) planning, 3) analysis/design/modeling/prototyping, 4) development/coding and testing, and 5) deployment/implementation. The software engineering umbrella (or, support) activities include but are not limited to 1) software development project management, 2) testing and/or formal technical reviews, 3) risk management, 4) software quality assurance (software quality management), 5) software configuration management, 6) reusability management, 8) work product preparation, etc.

The main goal of this multi-aspect research project is to understand how SG, SGA, SGE, game components, techniques, mechanics and analytics can benefit engineering in general, and, software engineering in particular. The specific objectives for this part of the project were to 1) identify and analyze current best cases of innovative use of SG and SGA in industry, 2) identify possible classifications of main types and attributes of SG and SGA used in industry, 3) identify and classify main features of SGE that are actively used by businesses.

Up-to-date research project findings and outcomes are presented below.

II. SERIOUS GAMES AND SERIOUS GAMIFIED APPLICATIONS IN INDUSTRY: BEST CASES

A. Serious Games and Gamification: Terminology

"*Gamification* is the use of game design elements in non-game contexts. … Whereas *serious games* describes the use of complete games for non-entertainment purposes, *gamified applications* use elements of games that do not give rise to entire games. … Together with *serious games*, *gamification* uses games for other purposes than their normal expected use for entertainment (asserting that entertainment constitutes the prevalent expected use of games)" [4].

As a result, below we assume that *gamification* means an implementation and use of game design elements and techniques, game thinking, game mechanics and analytics,

computer game technology in business models, framework activities, processes, procedures, services, etc. to improve employee and/or customer/user skills, experience, engagement, effectiveness, and productivity outside pure entertainment area.

B. Serious Games and Serious Gamified Applications in Industry: Best Cases Analyzed

More than 60 cases of successful use of SG and SGA by well-known companies in industry have been reviewed and analyzed by authors; a summary of 30 relevant best cases is presented in Table I.

TABLE I. SERIOUS GAMES AND SERIOUS GAMIFIED APPLICATIONS IN INDUSTRY: BEST CASES ANALYZED

Company	Focus on framework activity (details)	SGA or serious game used	Ref.
IBM	Communication (corporate social communication and collaboration)	*IBM Connections*	[5]
Oracle	Communication (support of communication to about new software features)	*Prune The Product Tree*	[6]
SAP	Communication (corporate social networking)	*Two-Go*	[7]
Scrum Alliance	Communication and collaboration (support of software development teams' communication/collaboration)	*Knowsy*	[8]
Qualcomm	Planning (1. better understand how customers use its products, 2. identify key marketing messages for the launch of its asset-tracking product line, 3. discover new product opportunities)	*ProductBox*	[9]
VersionOne	Planning, communication and collaboration (support of agile software development teams)	*Speedboat, Buy a Feature*	[10]
Computer Sciences Corporation	Planning (accelerate time to market)	Development/ Test-as-a-service	[11]
HP	Planning and management (increase of sales)	*Project Everest*	[12]
IBM	Planning and management (reduction of cost of internal business)	Document translation	[13]
HP	Planning and management (user engagement)	HP Operations Manager	[14]
PWC	HR management (employee recruitment)	*Multipoly*	[15]
Google	HR management (employee recruitment)	Google code jam	[16]
Accenture	HR management (employee flexibility)	*Liquid Workforce*	[17]
American Express	HR management (business travel support)	Global Business Travel	[18]
IBM	Management (business process management to drive innovation)	*IBM Innov8*	[19]

Company	Focus on framework activity (details)	SGA or serious game used	Ref.
Microsoft	Quality management (improvement of productivity and software quality assurance)	*Language Quality Game, Ribbon Hero*	[20]
Cisco	Quality management (improvement of global sales experience)	*The Hunt*	[21]
Microsoft	Quality management (gamification of threat assessment process)	*Elevation of Privilege*	[22]
Microsoft	Software development (software development/ coding skills improvement)	*Pex4Fun*	[23, 24]
	Software development (software development/ coding skills improvement)		[25]
Cisco	Testing (testing of network planning skills)	*myPlanNet*	[26]
Cisco	Training and team working (building a team and teamworking)	*The Threshold*	[27]
Oracle	Training (employee on-boarding)	New Hire	[28]
Siemens	Training and development	*Plantville*	[29]
NTTData	Training (leadership training)	*Ignite Samurai Leadership*	[30]
SAP	Training (sales training)	SAP Road Warrior	[31]
SAP	Marketing and branding	*Paul the Octopus*	[32]
HP	Improvement of conference papers' selection	HP global technical conference	[33]

The outcomes of performed analysis show that companies and businesses just started to use SG and SGA not solely in employee on-boarding, training, user engagement, etc. but also in framework activities that are relevant to engineering such as a) communication (between team members, between customer and company, etc.), b) planning, 3) management (quality management, HR management, etc.), 4) testing, etc.

III. RESEARCH PROJECT OUTCOMES

A. Serious Games: Classifications

The outcomes of performed research show that a well-though classification of SG is needed for deep understanding of SG purpose, scope, domain, type, gameplay, audience, etc., and, as a result, better use of game mechanics, techniques, GUI, computer game technologies in the final product – effective SG or SGA. Several possible SG classifications are available, for example, in [34-39].

B. SG Classification Based on G/P/S/ Model

In accordance with the G/P/S model [36],

- the SG purpose may be of various types, such as a) message broadcasting: educative - edugames, informative - newsgames, persuasive – advergames, political games, and subjective – military games and arts games), b) training: mental or physical, and c) data exchange;

- the SG scope may consist of SG's a) market/domain (such as state & government, military & defense, healthcare, education, corporate, religious, culture & art, ecology, politics, humanitarian, advertising, scientific research, and entertainment), and b) public/audience (i.e. general public, professionals, and students);
- the SG gameplay may be of the following types: a) game-based (with a clear game goal), and b) play-based (without clear game goal).

The proposed modified G/P/S model-based classification of SG is presented in Table II. It takes the ideas of the G/P/S/ classification [36]; however, it significantly extends it in terms of purpose-oriented characteristics of SG and SGA.

TABLE II.   PROPOSED EXTENDED G/P/S/ MODEL-BASED CLASSIFICATION OF SERIOUS GAMES (WITH EXAMPLES)

Characte-ristic	Details	Examples of SG
1. Purpose –oriented characteristics of SG and SGA		
Decision-making	Mechanisms for making better decisions faster	*ProductBox*
Simulation	Face-to-face or electronic simulations of situations that might play out in reality	*Packet Tracer, Millennium Challenge 2002*
	Subjective (military games, art games)	*America's Army*
Sharing of knowledge	Educative (edugames)	*The Beer Game*
	Informative games (newsgames)	*September 12th*
Persuasion	Persuasive games	*Dying in Darfur*
Data collection/ exchange/ exploration	Games based on data collection and data exchange	
	Focus on research, discovery, innovation	*Foldit, Buy a Feature*
	Adventure games	*The Silent Spy*
Motivation	Badges, scores & rewards, incorporated into work	*Ribbon Hero*
Training	Focus on analytical skills (problem solving)	*Lure of the Labyrinth*
	Focus on technical skills (hands-on skills)	*Prog&Play*
	Focus on management skills	*Innov8, Multipoly*
	Focus on communication skills	*Prune The Product Tree*
	Focus on team working skills and collaboration	*Novicraft, PowerUP, The Threshold*
2. Scope-oriented characteristics of SG and SGA		
Domain/ Market	Corporate	*Electro City*
	Education	*Enterprise Battle*
	State and government	*Cyber Budget*
	Healthcare	*Fatworld*
	Marketing	*Flip Mobile*
	Military	*America's Army*
	Culture and arts	*Grotte de Gargas*
	Ecology and environment	*Climate Change*
	Politics	*Debate Night*
	Humanitarian	*Deliver the Net*
	Advertising	*Blam Blam Fever*
	Scientific research	*Foldit*
Public/ Audience	General public	*Creepy Crossword*
	Professionals	*Maritime Warfare*

	Students (elementary/middle school)	*GeoDefi*
	Students (high school/college)	*Virtual U*
3. Gameplay-oriented characteristics of SG and SGA		
Type	Game-based (with clear game goal)	
	Play-based (without clear game goal)	
Goal	Choices: 1) Avoid, 2) Match, 3) Destroy	
Means	Choices: 1) Create, 2) Manage, 3) Analyze, 4) Solve, 5) Move, 6) Select, 7) Shoot, 8) Write, 9) Random	

C. Gamification Mechanics and Techniques Used in SG and SGA

The outcomes of performed research show that modern SG and SGA actively use various game elements and components, game mechanics and techniques [40], gaming analytics, game-like graphic user interfaces, game engines, and various computer game technologies to provide high quality outcomes (Table III).

TABLE III.   GAME ELEMENTS AND MECHANICS [40] USED IN SERIOUS GAMES AND SERIOUS GAMIFIED APPLICATIONS

Game element or technique	Details
1. Progression gamification mechanics	
Goal setting	A sense of progress towards a goal in meaningful work
Leadership boards	Tools to monitor and display desired actions
Badges, trophies	Symbols to indicate mastery of skills and required accomplishments
Levels	A system to reward for accumulation of points
Points	Numerical values given for a single action or combination of actions
2. Feedback gamification mechanics	
Quests/ challenges	"Challenges" usually implies a time limit or competition whereas "quests" are meant to be a journey of obstacles the user must overcome
Cascading information theory	Information should be released in the minimum possible snippets to gain the appropriate level of understanding
Transparency	Ability to capture performance data and make it available to employees
Appointment dynamics	At a predetermined times a user must return for a positive effect
Bonuses	A reward after having completed a series of challenges or a specific task
Countdown	Users are only given a certain amount of time to do or to complete something
Real-time feedback	Anytime you take an action, you receive instant feedback
Combos	Reward skill through doing a combination of things
3. Behavioral gamification mechanics	
Discovery/ exploration	Users love to discover and to be surprised
Free lunch	Getting something for free due to someone else having done work
Epic meaning	Users will be highly motivated if they believe they are working to achieve something great, something awe-inspiring, something bigger than themselves

Loss aversion	Influences user behavior not by reward, but by not instituting punishment; the user having to perform an action to avoid losing something they currently have
Ownership	Creates loyalty by owning things
Community collaboration	An entire community is rallied to work together to solve a riddle, a problem or a challenge
Competition	Users are competing for promotions and raises
Behavioral momentum	Users try to keep doing what they have been doing
Virality	Users are more successful in the game if they invite colleagues
Status	The rank or level of the user

D. SG and SGA in Industry: Reported Benefits

Based on analyzed business reports, active use of SG and SGA for improvement of business processes amplify worker's positive psychology and strengthen and extend the PERMA concepts [41], including:

- positive emotions (experiencing joy, pleasure, fun, safety, etc.),
- engagement (being constantly involved in activities),
- relationships (enjoyable/supportive interactions),
- meaning (creating a purposeful narrative),
- accomplishment (achieving goals, following core values, etc.).

Additionally, SG and SGA on corporate web site promote [42]:

- better retention and efficient memorization factors;
- high customization of information;
- better interactivity and maximum implication;
- attractive and non-intrusive advertising;
- better "word of mouth" virality;
- better dissemination and promotion of web-published information (due to attractive challenges of online SG).

E. Serious Game Engines' Classification

Significant collaborative efforts of various specialists in computer science – software engineers, advanced programmers, graphic user interface designers, human-computer interaction experts, specialists in computer graphics, databases, artificial intelligence, intelligent systems, networking and security – are necessary to engineer, design and develop quality SG or SGA for real-world complex tasks and simulations [43]. "A modern, high-end computer game today costs on the order of $ 50 million dollars" [44]. Its success and quality of outcomes significantly depend on selected integrated development environment (IDE) – SG engine. Several specialized SGE were carefully reviewed and classified in terms of main features and functionality.

Based on performed research and comparative analysis, the following engines for SG development have been selected for detailed analysis: 1) Unity Pro Modeling Simulation Bundle [45], 2) Game Salad Creator [46], 3) DX Studio [47], and 4) V-Play [48]. The outcomes of performed comparative analysis of those SGE is available in Table IV; the identified and summarized technical specs significantly help SG developers to select the optimal SGE for SG or SGA design and development projects.

TABLE IV. COMPARATIVE ANALYSIS OF SERIOUS GAMES ENGINES: A SUMMARY

Feature	Sub-feature	Metrics	Unity Pro [45]	Game Salad Creator [46]	DX Studio [47]	V-Play [47]
Audio-visual fidelity	Rendering	Special effects	PS, EM, BB, LF	PS, LF	PS, EM, LF, SE, AS, VM, PE	PS, LF
		Shadows	RT, PR	BA	RT, PR	BA
		Lighting	ILM, GI	BA	DL, LM	BA
		Texturing	RE	BA	BA, MT	BA
	Animation		FK, KA, SA, MO, AB	BA	FK, KA, SA, MO	BA
	Sound		2D, 3D	2D	2D, 3D	2D
Functional Fidelity	Scripting	Script	Y	N	Y	Y
		Object model	Y	Y	Y	Y
	Supported AI techniques	Collision detection	Y	Y	Y	Y
		Path finding	Y	N	Y	N
		Decision making	Y	N	Y	N
	Physics	Basic physics	Y	Y	Y	Y
		Vehicle dynamics	Y	N	Y	N
		Rigid body	Y	Y	Y	Y
Composability	Import/export content	CAD platforms supported	3ds max, maya	N/A	3ds max, maya	N/A
		Import-Export limitations	N	N	N	N
		Content availability	M	M	M	M
	Developer toolkit		N	N	Y	N
Accessibility	Learning curve		M	Easy	M	M
	Docs and support	Docs quality	OW	OW	OW	OW

		Technical support	Y	Y	Y	Y
		Community support	Y	Y	Y	Y
		Licensing	IN, PRO	BA, PRO	PRO	IN, ST, SD, EN
Networking and heterogeneity	Networking	Client-server	Y	Y	Y	Y
		Peer-to-peer	N	N	Y	N
	Heterogeneity	Multiplatform	Y	Y	Y	Y

Table IV uses the following legend in the "Metrics" section:

1) Special effects: PS - Particle System; EM - Environmental Mapping; BB - Bill Boarding; LF - Lens Flares; SE - Sequencer; AS - Animated Sprites; VM - Vertex Morphing; PE- Post Processing Effects;
2) Shadows: RT - Real-time; PR – Projected; BA – Basic;
3) Lightning: ILM - Iterative Light Mapping; GI - Global Illumination; DL - Dynamic Lighting; LM - Light Mapping; BA – Basic;
4) Texture: BA - Basic; MT - Multi Texturing; RE - Render to Texture Effects;
5) Animation: BA - Basic ; FK - Forward Kinematics; KA - Key-frame Animation; SA - Skeletal Animation; MO – Morphing; AB - Animation Blending;
6) Docs quality: OW - documents and tutorials are available from Official Website;
7) Licensing: IN - Indie; PRO – Pro; BA – Basic; ST – Starter; SD – Studio; EN – Enterprise;
8) Others: Y – Yes; N – No; M – Medium; N/A – Not Applicable.

IV. CONCLUSIONS

The research, design, development and acceptance of SG and SGA in industry and businesses will, in general, lead to a fusion of physical and virtual worlds.

Applications of SG and SGA in most of engineering areas are still in embryonic phase; as a result, massive research, analysis, design, development and testing efforts are required to make those applications beneficial for companies and corporations in engineering.

Based on the findings and outcomes of this pilot research project, we believe that the main tendencies in SG and SGA applications in industry are:

- **The use of SG, SGA and gamification of main business processes in businesses, companies and industry (Table I) is a nascent but fast growing tendency.** "By 2020, there will be significant advances in the adoption and use of gamification" [2].

- **SG and SGA will help organizations to solve complex engineering and business problems.** They will help to

1) interpret and process massive data produced by complex corporate computer information, manufacturing, security/safety monitoring, and other systems, 2) apply these data to make information-based decisions that minimize possible risks, 3) present essential findings and outcomes in such a simplified way that even non-expert can understand it, 4) optimize SG techniques in order to influence user behavior, effectiveness, invention abilities, etc.

- **Active implementation and use of SG and SGA will provide businesses and companies with significant benefits.** They may include 1) improving performance and effectiveness of entire team and individual team members, 2) enjoyable quality training and the acquisition of new knowledge and skills, 3) energizing employees through smarter wellness and health initiatives and activities, 4) harnessing and leveraging the insight of customers, business partners, 5) engaging customers as part of a long term relationship development strategy, 6) innovating through the crowd sourcing and the Internet of Things (IoT).

- **Advanced IDE - serious game engines - should be used for a design and development of prototypes as well as final versions of sophisticated SG and SGA (Table IV).** Design and development of SG or SGA is still a complex development task for software engineers and programmers; as a result, well-tested SG engines should be actively used by experienced software designers and programmers in SG/SGA design and development teams.

V. NEXT STEPS

The next steps in above described research project is a thorough research on a fusion of SG and SGA with smart systems, smart software agents and smart technology to achieve the new level of quality serious games and serious gamified applications for businesses and industry – smart serious games and smart gamification.

REFERENCES

[1] Gartner Predicts Over 70 Percent of Global 2000 Organizations Will Have at Least One Gamified Application by 2014, Gartner, Inc., available at http://www.gartner.com/newsroom/id/1844115

[2] Gamification: Experts Expect "Game Layers" to Expand in the Future, With Positive and Negative Results, *Pew Research Center*, available at http://pewinternet.org

[3] R. Pressman, B. Maxim (2014). Software Engineering: A Practitioner's Approach, 8th Edition, McGraw Hill, ISBN 978-0078022128.

[4] S. Deterding, R. Khaled, L. Nacke, D. Dixon (2011). Gamification: Toward a Definition. Proceedings of the CHI '11 Gamification Workshop. ACM, May 7-12, 2011, Vancouver, BC, Canada.

[5] Nitro for IBM Connection Gamification, available at http://www.bunchball. com/products/nitro-ibm-connections

[6] Pruning the Product Tree at Oracle, available at http://archive. constantcontact.com/fs007/1103829989576/archive/1104945352292. html

[7] OINK OINK! Welcome to the SAP Gamification Cup!, available at http://scn.sap.com/people/mario.herger/blog/2011/06/27/oink-oink-welcome-to-the-sap-gamification-cup

[8] ScrumKnowsy - a Service by the Innovation Games and the Scrum Alliance, available at http://www.scrumknowsy.com/

[9] Qualcomm Uses Serious Games to Keep Pace with the Demands of a Rapidly Changing Technology Market, available at http://www.serious gamesatwork.org/2012/ 10/30/qualcomm-success-story/

[10] Buy a Feature Online Integration With VersionOne, available at http://www.innovationgames.com/innovation-games-online/buy-a-feature-online-integration-with-versionone/

[11] How CSC Delivered Dev/Test-as-a-service 20 months ahead of schedule, available at http://globalsystemscircle.wordpress.com/2013/06/21/how-csc-delivered-devtest-as-a-service-20-months-ahead-of-schedule/

[12] How HP/Intel made $1 Billion Through Gamification, available at http://www.callcentre.co.uk/how-hpintel-made-1-billion-through-gamification/

[13] Why IBM Represents The Future Of Social Business, available at http://www.bunchball.com/blog/post/7903026979/the-ibm-social-laboratory-is-also-using

[14] Gamification, The Way Forward to Engage Your IT staff, available at http://h30499.www3.hp.com/t5/Business-Service-Management-BAC/Gamification-the-way-forward-to-engage-your-IT-staff/ba-p/6226233#.Up0wSMTrzqQ

[15] The Gamification of Recruitment, available at http://www.webrecruitusa.com/blog/bid/320212/the-gamification-of-recruitment

[16] Why Top Companies Are Using Gamification for IT Recruiting, available at http://info.recruitingdivision.com/blog/bid/341595/Why-Top-Companies-are-using-Gamification-for-IT-Recruiting

[17] Building More Dynamic Teams With Gamification, available at http://go.bunchball.com/rs/bunchball/images/Building%20More%20Dynamic%20Teams%20with%20Gamification%20WP%20FINAL%20March%202013.pdf

[18] Modern Loyalty and Gamification: Making Smart Travel Choices Fun, available at https://businesstravel.americanexpress.com/modern-loyalty-gamification-making-smart-travel-choices-fun/

[19] Innov8: The Business/IT Alignment Game, available at http://www.datamation.com/netsys/article.php/3729046/Innov8-The-BusinessIT-Alignment-Game.htm

[20] On the Integration of Human Computation into Traditional Business Processes Productivity Games in Microsoft Windows Development, available at http://www.42projects.org/docs/LQG.pdf

[21] Cisco's Transmedia Adventure Breaks New Ground in Collaboration, available at http://the-hunt.juxtinteractive.com/

[22] Serious Play Conference 2011: Microsoft's "productivity Games", available at http://www.gamasutra.com/view/news/36824/Serious_Play_ Conference_2011_Microsofts_Productivity_Games.php

[23] T. Xie, N. Tillman, J. de Halleux, Educational Software Engineering: Where Software Engineering, Education, and Gaming Meet, available at http://research.microsoft.com/pubs/189241/gas13-educationalse.pdf

[24] Pex4Fun Serious Game for Software Development Skills, available at http://www.pexforfun.com/

[25] D. Dubois, G. Tamburrelli, Understanding Gamification Mechanisms for Software Development, Proceedings of the ESEC/FSE '13, August 18-26, 2013, Saint Petersburg, Russia.

[26] Cisco *myPlanNet*, available at http://www.slideshare.net/petra1400/case-study-the-power-of-social-media-and-cisco-myplannet

[27] Cisco Gets Real with Alternate Reality Games, available at http://blogs.cisco. com/news/cisco_gets_real_with_alternate_reality_games/

[28] Adding Gamification into the Oracle User Experience, available at http://www.oracle.com/webfolder/ux/applications/customerInput/130102_gamification.html

[29] Siemens' Plantville Celebrates One Year, Announces New Site Features, available at http://www.industry.usa.siemens.com/topics/us/en/pressarchive/2012/pressreleases/pages/siemensplantvillecelebratesoneyearannouncesnewsitefeatures.aspx

[30] Gamification, available at http://americas.nttdata.com/Services/Services/Application-Development-Management/Application-Development-Management-Offerings/Offerings/Gamification.aspx and http://www.businesswire.com/news/home/20120912006151/en/NTT-DATA-Earns-Prominent-Spot-2012-InformationWeek

[31] SAP Makes the Case: Examples of a Gamified Enterprise, available at http://enterprise-gamification.com/index.php/en/education-a-training/71-roadwarrior-how-sap-trains-its-sales-people-on-mobility

[32] SAP & Gamification in the Enterprise, available at http://enterprise-gamification. com/index.php/en/marketing-a-branding/81-paul-the-octopus

[33] Improving the Selection of Conference Paper Submissions Through Gamification, available at http://enterprise-gamification.com/index.php?option=com_content&view=article&id =168:improving-the-selection-of-conference-paper-submissions-through-gamification&catid=28& Itemid=41&lang=de

[34] Serious Games Classification, available at http://serious.gameclassification.com/

[35] Bergeron, B. (2006). Developing Serious Games. Charles River Media, NJ.

[36] D. Djaouti, J. Alvarez, J.-P. Jessel (2011). Classifying Serious Games: The G/P/S Model, in Handbook of Research on Improving Learning and Motivation through Educational Games: Multidisciplinary Approaches", P. Felicia (Ed.), IGI Global.

[37] B. Sawyer, P. Smith (2008). Serious Games Taxonomy, available at http://www. dmill.com/presentations/serious-games-taxonomy-2008.pdf

[38] Serious Games at Work, available at http://www.serious gamesatwork.org/different-types-of-serious-games/

[39] Chen, S., & Michael, D. (2005). Serious Games: Games that Educate, Train and Inform. USA, Thomson Course Technology.

[40] Game Mechanics, available at http://badgeville.com/wiki/Game_Mechanics

[41] A. Kim (2011). Smart Gamification: Social Game Design for a Connected World, available at http://www.slideshare.net/amyjokim/smart-gamification-social-game-design-for-a-connected-world

[42] Seven Serious Games Benefits, available at http://www.soyculto.com/en/serious-games/7-serious-game-benefits/

[43] A. Uskov (2013). Gamification in Computer Science. Proc. of the 6th international conference on Intelligent Interactive Multimedia Systems and Services (IIMSS-2013), June 26-28, 2013, Sesimbra, Portugal. IOS Press, ISBN 978-1-61499-261-5, pp. 41-50. DOI: 10.3233/978-1-61499-262-2-41.

[44] H. Kelly (2010). How Games and Simulations Can help Meet America's Challenges in Science Mathematics and Technology Education, 117-133, in Serious Game Design and Development: Technologies for Training and Learning, Cannon-Bowers, Bowers, C. (Eds)., Information Science Reference.

[45] Unity Pro Modeling Simulation Bundle, available at http://unity3d.com/ company/sim

[46] Game Salad Creator, available at http://gamesalad.com/creator

[47] DX Studio, available at http://www.dxstudio.com/index.aspx

[48] V-Play, available at http://v-play.net/