

Competence Development and Assessment Using a Game-based Strategy

<http://dx.doi.org/10.3991/ijoe.v10i2.3377>

Iratxe Menchaca¹, Alex Rayón¹, Javier García-Zubía¹, Bénédicte Bardinet² and Mariluz Guenaga¹

¹ DeustoTech, University of Deusto, Bilbao, Spain

² Institut Catholique d'Arts et Métiers, Toulouse, France

Abstract—this paper presents a serious game that aims to develop and assess oral and interpersonal communication competences. Based on the University of Deusto's Learning model we implement a multiplayer adventure environment using HTML5 and Javascript technologies. It includes several activities; each of them covers usually more than one of the three levels of mastery described for each competence, and provides data that match indicators to evaluate students' performance. The main challenge, assessment, is achieved integrating automatic data collected by the system and peer and self-review using standard criteria and standards described in a rubric.

Index Terms—game-based learning, assessment, generic competence

I. INTRODUCTION

TALKY is a serious game to develop and assess oral and interpersonal communication competences. It continues SG4Edu-Comp (<http://sg4edu.deusto.es>), developed in 2012 by DeustoTech Learning research group and oriented to cover problem solving and entrepreneurship competences. Both games base on the University of Deusto's Learning Model that defines competences required by graduates: specific (the ones related with the proper area of knowledge) and generic (transversal skills not specific to a subject).

Project team is formed by computer engineers, students and pedagogues from DeustoTech Learning and the Leisure Studies Institute. This multidisciplinary approach is essential for the success of the project, as it merges technical, pedagogical and entertainment aspects.

Serious games are more and more present in the research field of educational technology and other commercial and business areas. Despite the short history of serious games in the educational landscape, great strides are forecasted, as well as related educational achievements of students' learning processes, such as their interests, their level of concentration and creativity, with their level of involvement, etc. Besides, serious games can implement a large number of skills and cognitive processes, such as the discussion of tactics, cooperation, communication, concentration on the objective, the acquisition of roles of responsibility, the attention span to multiple stimuli, troubleshooting and frustration tolerance. All these characteristics have led us to develop TALKY, a project aimed to train oral communication and interpersonal communication competences.

Following we explain the conceptual framework underlying serious games, the design process followed in

TALKY, and its current status. Finally, we expose the conclusions reached so far by the project team.

II. THEORETICAL FRAMEWORK

A. *Serious games as a pedagogical strategy*

Games are played for fun and entertainment; however, some authors argue that they are played primarily to learn, even if it is with unconscious intent [1]. Digital serious games are videogames that have been designed with a specific purpose, in this case an educational, training or informational objective [2]. Zyda [3] defines them as «a mental competition done with a computer following specific rules, which uses entertainment to train abilities related to education, health, politics and strategic objectives of communication». The main characteristics of serious games are: 1) they are oriented to ability training, 2) simulate real life situations, and 3) their content pursues specific interests (politics, economics, marketing, etc.) [4].

Bearing in mind the definition given to the term serious game by Abt [5], we have considered the following structural components for the formal modeling of our game design: 1) objectives, clearly defined and known by the player at all times; 2) rules that define the order, rights and responsibilities of the players, as well as the objectives to be achieved by each player in order to reach the challenge they face; 3) the challenge that determines when the game is finished and provokes the interest of the player and the will to success; and, 4) Interaction, the component that arises from the mechanical and dynamic of the game [6] and it originates the experiences of the player.

Several authors have identified the benefits of serious games: the observance of other players and the replication of behaviors promote social learning [7]; they allow experimentation and the acquisition of new roles, which enables the comprehension of real situations; handling the environment students develop communication and behavior strategies to achieve a goal [7].

The relevance of educational serious games relies not only in the content acquired, but they promote the acquisition of skills and competences [9]. Gros believes they encourage self-esteem and have a motivational factor, in addition to the chance to develop cognitive skills and strategies, such a decision-making, searching and organizing information [10]. Prensky [11] maintains that it is possible to learn many skills thanks to serious games: collaboration, decision-making under pressure, calculated risk taking, lateral thinking and ethical behavior. Other authors such O'Neill, Wainess and Baker [12] identified five types of demands of cognitive nature in video games: content

understanding, problem solving, self-regulation, communication and collaboration or teamwork.

B. Competence-based learning model

The University of Deusto developed a model for the development and assessment of competences that has been used as the reference for TALKY [13][14]. Each competence includes a definition, the relation with other competences, three levels of mastery, indicators that measures the level of mastery, and for each indicator a scale of five descriptors is fixed [15]. As De Miguel [16] says, professional and personal lives are together, so it has no sense to provide students, knowledge and abilities on one hand, and values and attitudes on the other.

According to this model, oral communication is classified as an instrumental linguistic competence [17] and it is defined as “the capacity to express own ideas, knowledge and feelings using the word clearly and with opportunely, adapting to the characteristics of the situation and the audience to get understanding and adhesion”.

Interpersonal communication is classified as an interpersonal competence and thus, it is defined as “a set of individual and social abilities to relate positively with other people through emphatic listening and a clear and assertive expression about what you think or feel, using verbal and non-verbal elements”.

III. A GAME-BASED STRATEGY

Several serious games have been designed aiming to improve communication skills: «Raising the Bar» aims at teaching hospital workers communication and sales techniques they can use in practice [18]; «Gaining Leadership», has the objective of teaching managers to think and act independently and to manage teams. In this program trainees play in a virtual world using communication tools like web, video, phone and text messages, as they do in the real world [19]. Other games develop communication competences, i.e. targeted to communicate in case of train crash [20], to evaluate jurists’ communication skills [20], to teach medicine students how to react in front of a serious pandemic which divides the public opinion [22], as well as games to learn how a little producer of vegetables can communicate to be heard in the fiercely competitive foods marketplace [23].

To sum up the characteristics of serious games to develop communication skills, we can say: 1) they use a concrete scenario; 2) most of them aim at developing competences and training players, assessment becomes a secondary objective; 3) games are oriented to professionals of a specific field; and 4) they are developed to be used by a concrete company or organization.

A. Design decisions

DeustoTech Learning decided to develop a serious game about oral and interpersonal communication competences because they are relevant and valued at the UD, both are closely related, can be developed and evaluated with the same set of activities, and they are very interactive and social, two features that make a game more attractive and fun. Given their nature we decided to develop a social and multiuser game that enables to interact in a virtual world, cooperate, compete and co-evaluate each other work.

TALKY is a “casual game” played during short sessions [24]; an adventure game with several challenges, rewards and penalties. It is designed for students over 16 years with the guidance and supervision of a teacher that helps to interpret results.

We found several options to develop adventure games such as ScummVM [24] or engines developed taking e-learning in mind, as eAdventure. The challenge was to meet the constraints of mentioned technology, thus it limits us in the integration of different activities within the main game mechanics. We also analyzed the popular engine Unity3D (<http://unity3d.com/>), although it is solid and powerful, it is too complex for our requirements.

Finally we decided to develop our own engine with HTML5 and JavaScript, using the Canvas as the container. The game has the same performance in different browsers, it is compatible with mobile browsers, and can be exported to mobile native applications and uploaded to different app stores. We are aware of the limitations in terms of graphic performance but our design does not require high performance, since it is based in a point-and-click interaction. The code base is developed to be flexible and scalable, so it can be reused in future games. We have developed a JavaScript engine that handles processing a game script in JSON format, which in turn represents the different parts of the game.

A key aspect of TALKY is the assessment of competences. Immediate feedback is required for an appropriate learning process; with that purpose a quantitative and qualitative assessment is generated to inform teacher and students about their knowledge and progress. Assessment integrates automatically collected data about user interaction and results of activities with a close answer. In other cases players themselves will be asked to assess the result according to a rubric with close values provided by the game. This tool, the rubric, defines a set of indicators to be evaluated and provides descriptions of what involves each mark. Rubrics will also be used by other players to assess their partners’ activities as part of the peer-review. Finally, there will be other techniques for co-evaluation, such as voting.

B. Development process

Once studied selected competences in depth, we focused on designing activities that fit one or many of the indicators of the different levels of mastery.

The next step was to organize and describe activities in detail, taking special attention to assessment: automatic by the program, with a rubric, peer-review, etc. We assigned each activity to the indicator it covers (see Table 1), and finally we reviewed the whole to get a balance of activities in both competences and levels of mastery.

The final review of activities, indicators and levels of mastery, in addition to the script and gaming elements, are the basis for the specific content creation for each activity. This phase is a critical step for the success of the game to achieve a serious game that meets both pedagogical and fun objectives. Activities have to be properly linked in the plot of the game, they have to make sense and be amusing for players. In this case we will get good educational software, but not fun, thus not a serious game.

TABLE I.
TWO TALKY ACTIVITIES, MATCH WITH INDICATORS AND MASTERY LEVELS

Indicator	Activity	Analysis of the competence	
Communicate with the support of slides	View the video (a presentation using slides) and answer: - Does the number of slides fit the time available? - Is the amount of text in slides appropriate? - Has the presentation a logical structure?	Oral competence	
		Level	1
		Indicator	5
		"He/she uses resources to support the presentation"	
Adapt to a concrete situation	Dress a character with different dressing, appropriate according to the speech, the target audience, type of event, etc.	Interpersonal competence	
		Level	1
		Indicator	22
		"Non-verbal language is appropriate and coherent"	
		Interpersonal competence	
		Level	2
		Indicator	25
"The non-verbal language is suitable for the oral speech"			

The final review of activities, indicators and levels of mastery, in addition to the script and gaming elements, are the basis for the specific content creation for each activity. This phase is a critical step for the success of the game to achieve a serious game that meets both pedagogical and fun objectives. Activities have to be properly linked in the plot of the game, they have to make sense and be amusing for players. In this case we will get good educational software, but not fun, thus not a serious game.

IV. CONCLUSIONS AND FUTURE WORK

The design of serious games like TALKY reveals the challenge of developing and evaluating generic competences. This difficulty affects directly the number and variety of activities, as well as in the overall treatment of competences, since it is not easy to separate indicators of them among activities. We have also found we cannot focus exclusively on the treatment of two competences, since inevitably other skills are present.

The framework defined at the University of Deusto by Villa and Poblete (2011) provides a structural system of levels of mastery and indicators. However, establishing a balance between indicators and values, which denote a competence acquisition, has required a significant process of reflection for the project team.

When we design serious games for education we risk achieving goals from an educational standpoint but neglecting the playful aspect. And by contrast, another possible risk is to focus mainly on the playful side of the game and let the learning objectives aside. The challenge focuses on integrating both aspects and getting the expected result as an innovative learning strategy.

We highlight the versatility offered by the serious game when it comes to work generic competences. Particularly, in the case of oral and interpersonal communication skills,

we observed that serious games can design scenarios for cooperation, communication, peer, expression and responsibility.

The project team is working to carry out the last tasks for the development of TALKY project, test its potential and ultimately assess the level of consistency between the goals and expected results. Besides, we want to contrast the acceptance among students and teachers as a learning resource. We are interested in contributing to scientific knowledge betting on the design of serious games to develop generic competences, because of its real presence in the educational programs, and versatility and correspondence with existing technology.

REFERENCES

- [1] C. Crawford. "The art of game design". McGraw-Hill Osborne Media. 1984
- [2] D. Michael y S. Chen. "Serious Games. Games that educate, train and inform" 2006. Canadá: Thonsom.
- [3] M. Zyda, "From visual simulation to virtual reality to games," 2005. Computer, vol. 38, no. 9, pp. 25-32. <http://dx.doi.org/10.1109/MC.2005.297>
- [4] B. Marcano, "Juegos serios y entrenamiento en la sociedad digital". Revista Electrónica Teoría de la Educación: Educación y Cultura en la Sociedad de la Información. Vol. 9, no 3, 2008. Universidad de Salamanca.
- [5] C. Abt, "Serious Games", New York: Viking Press, 1970.
- [6] BunchBall "Gamification 101: An Introduction to the Use of Game Dynamics to Influence Behavior" White Paper (2010)..
- [7] T.M. Connolly, E.A. Boyle, E. MacArthur, T. Hainey, & J. M. Boyle, "A systematic literature review of empirical evidence on computer games and serious games" Comput. Educ., vol. 59, pp. 661-686, 09, 2012.
- [8] S. De Freitas. "Serious Virtual Worlds report". Prepared for the JISC e-Learning Programme. 3 November 2008.
- [9] J. P. Gee, "Deep learning properties of good digital games how far can they go?" in Serious Games: Mechanisms and Effects, U. Ritterfeld, M. J. Cody and P. Vorderer, Eds. Taylor & Francis, 2009, pp. 65-80.
- [10] B. Gros, "Videojuegos y Aprendizaje". Barcelona: Graó, 2008
- [11] M. Prensky. "Engage Me or Enrage Me. What Today's Learners Demand" 2005. Educause Review, nº 40 (5), 60-65.
- [12] O'Neil, H. F., Wainess, R., & Baker, E. L. (2005). "Classification of learning outcomes: Evidence from the computer games literature". The Curriculum Journal, 16(4), 455-474 <http://dx.doi.org/10.1080/09585170500384529>
- [13] University of Deusto (2001) "Pedagogical framework UD. General Orientations". pp 18-23. Bilbao
- [14] Bologna Declaration (1999). Bologna Declaration. Retrieved November 7, 2012, from http://www.bologna-bergen2005.no/Docs/00-Main_doc/990719BOLOGNA_DECLARATION.PDF
- [15] A. Villa & M. Poblete. "Evaluación de competencias genéricas: principios, oportunidades y limitaciones". Bordón: Revista de Pedagogía, 63(Nº 1), 2011, pp. 147-170
- [16] M. De Miguel, "Modalidades De Enseñanza Centradas En El Desarrollo De Competencias: Orientaciones Para Promover El Cambio Metodológico En El Espacio Europeo De Educación Superior" 2006. Oviedo: Universidad de Oviedo.
- [17] A. Villa Sánchez, "La evaluación de competencias: Evaluación del proceso y resultados," in V Jornadas De Innovación e Investigación Educativa De La Universidad De Zaragoza, Universidad de Zaragoza. 2011.
- [18] Raising the bar, Ranj Serious Games, available: <http://www.ranj.com/content/werk/raising-the-bar>.
- [19] Gaining Leadership developed by Ranj Serious Games and Capgemini, At: <http://www.ranj.com/content/werk/the-gaining-leadership-program>.
- [20] Healthcare Compliance Experience, Ranj Serious Games in collaboration with GTP, at: <http://www.ranj.com>

PAPER
COMPETENCE DEVELOPMENT AND ASSESSMENT USING A GAME-BASED STRATEGY

- [21] Houthoff Buruma - The Game, recruitment game by Ranj Serious Games and Houthoff Buruma, available: <http://www.ranj.com/content/werk/houthoff-buruma-the-game>
- [22] The Great Flu, serious game developed by Ranj Serious Games in cooperation with the vi-rologist A. Osterhaus, available: <http://www.ranj.com/content/werk/the-great-flu>.
- [23] Hakland, Ranj Serious Games, available: <http://www.ranj.com/content/werk/hakland>.
- [24] "Casual Games Association". At: <http://www.casualgamesassociation.org>
- [25] Scumm V.M. Available: <http://www.scummvm.org/>

AUTHORS

Iratxe Menchaca, Alex Rayón, Javier García-Zubía, and Mariluz Guenaga are with DeustoTech, Deusto Institute of Technology, University of Deusto, Bilbao, Spain

Bénédicte Bardinet is with the Institut Catholique d'Arts et Métiers, Toulouse, France.

This article is an extended and modified version of a paper presented at the International Conference exp.at'13, held 18-20 September 2013, in Coimbra, Portugal. Submitted 20 November 2013. Published as re-submitted by the authors 09 March 2014.