Relation Between Game Genres and Competences for In-Game Certification

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Abstract. Digital Games can be effective as learning tools, in applications that can be designated as Serious Games (SG), Games for Learning (GL) or Games-based learning (GBL). SG provide challenges in accordance with the intended learning objectives and can adapt and/or repeat (by allowing error recovering) them according to the learner's level. In training, this aspect is decisive in the acquisition of knowledge, experience and professional skills. The effectiveness of games-based training is directly related to the success on how the challenges promote the acquisition of skills, for which there is no optimal design methodology. This paper presents how a study that identifies the most appropriate game genres to develop specific skills and competences can be used to provide initial solutions to serious games design methodologies. The Triadic Certification model combines the competences defined for each training plan with the challenges designed for the serious games on a matrix that matches the needs and levels.

Keywords: Serious games · Skills · Competences · Assessment · Game genre · Game-based learning · Training certification

1 Introduction

The growing reputation of SG confirms its high value in education as well as the potential benefits of using video games to engage learners and to improve the learning effectiveness. Our aim in this paper is precisely to give a contribution to create initial solutions that identify with the most appropriate serious game genres and the game design guidelines to promote the successful training and certification of specific skills. With the In-Game Certification methodology approach we intend to define, verify and validate the game design contributions and how systems are capable to provide real learning experiences. The success of this proof of concept is defined by the player performance results into different training plans.

The methodology of this study includes three main references: a taxonomy of game genres (Action, Strategy, Role-Playing, Sports, Management Simulation, Adventure, Puzzle and Quiz) and its relation with standard competences and skills; the referential

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competence model as "a collection of competencies associated with the necessary attributes, behaviour, areas of knowledge, skills and abilities for a successful job performance" [1], called Educational Competency Wheel; and a certification model with the following axes: the identified skills (competences), mechanics based in game genres and training levels [20].

This paper is structured as follows: After this brief introduction, a section on the use of serious games for training and certification and game genres is presented. Section 3 describes the study on the relation between game genres and competences and Sect. 4 presents the integration of the results of this study with the in-game certification methodology. Finally, Sect. 5 presents conclusions and future work.

2 Serious Games for Training

Serious Games are becoming increasingly more popular in the corporate level as well as in research communities. SG are defined as games that aim to take advantage of all the features that make them fun and engaging [10], promoting the interest of trainees by making the educational subject and learning process exciting [2].

The research of Freitas and Jarvis [3] about Game-based Learning "shows some initial evidence of accelerating learning, increasing motivation and supporting the development of higher order cognitive thinking skills". The association of that with digital games, digital games–based learning, supports a new approach to learning because the player, which in the educational context is a learner, uses games to explore, discover, question and ultimately construct concepts and relationships in authentic contexts [4]. This study also concluded that games helped learners to understand very complex concepts more easily and also increased their motivation through a positive association between the learner and his learning. In this work it was also concluded that "the advantage of serious games approaches lies in their ability to create dedicated content for learning purposes, rather than to adapt existing leisure games to educational practices". These games are intentionally designed to help in learning, skills acquisition and behaviour change [5, 6]. The game design process becomes the key to achieve the learning outcomes through the game play.

A new contribution to skill training certification can be done by the Methodology for In-Game Certification [7] where several game design guidelines will be incorporated into a serious game to measure the training performance. This approach is composed by four steps which will be explain in Sect. 4 of this paper, and works as a communication support in favour of the dialectic between the trainer(s) and the game designer(s).

2.1 Training and Educational Competencies Standard

A competency is the capacity to apply or use a set of related knowledge, skills and abilities required to successfully perform a desired task. Lominger's set of sixty-seven competencies [8] became a universal common denominator as most of these competencies lead to task success.

This assessment tool is called Leadership Architect Competences and allows composing a list, using one or combining a few of the existing competency models, which encapsulates the competencies needed to succeed [1]. This competency model represents "a collection of competencies associated with a successful performance" [9]. In order to apply to education or training the same authors created together with Microsoft a similar approach called Education Competencies or Educational Competency Wheel [10]. This tool represents many of the necessary attributes, behaviour, areas of knowledge, skills and abilities for a successful job performance.

The table of competences, as seen in Table 1 consists of six core skill-sets and personality characteristics such as Individual Excellence, Organizational Skills, Courage, Results, Strategic Skills, and Operating Skills. These categories contain 44 competencies of Lominger's standard, but can be extended to other areas outside of education or training. The competency wheel provides other resources to help identify the core competencies, which are the ones associated with the success of an organization [9]. These resources include a definition, four levels of proficiency, sample interview questions, activities and resources for developing skills in order to help an organization achieve success.

Table 1. Educational Competency Wheel

Education Success Factors					
Individual excellence	**Organizational skills**	**Courage**	**Results**	**Strategic skills**	**Operating skills**
- Building effective teams (IE1) - Compassion (IE2) - Customer focus (IE3) - Humor (IE4) - Integrity and trust (IE5) - Interpersonal skills (IE6) - Listening (IE7) - Managing relationships (IE8) - Managing vision and purpose (IE9) - Motivating others (IE10) - Negotiating (IE11) - Personal learning and development (IE12) - Valuing diversity (IE13)	- Comfort around authority (OrS1) - Organizational agility (OrS2) - Presentation skills (OrS3) - Written communications (OrS4)	- Assessing talent (C1) - Conflict management (C2) - Managerial courage (C3)	- Action oriented (R1) - Drive for results (R2)	- Creativity (SS1) - Dealing with ambiguity (SS2) - Decision quality and problem solving (SS3) - Functional/technical skills (SS4) - Intellectual acumen (SS5) - Learning on the fly (SS6) - Strategic agility and innovation management (SS7) - Technical learning (SS8)	- Developing others (OpS1) - Directing others (OpS2) - Managing and measuring work (OpS3) - Managing through processes and systems (OpS4) - Organizing (OpS5) - Planning (OpS6) - Priority setting (OpS7) - Time management (OpS8) - Timely decision making (OpS9)

Table 1 presents the six qualities, or success factors, and its competencies. The factors can be divided into two categories: hard and soft skills. This categorization became usual as the hard skills are teachable abilities or skill sets that are easier to quantify, and the soft skills are subjective skills that are much harder to quantify.

For this categorization, we can consider as soft skills the core skill-sets: Individual Excellency, Courage, Results, Strategic Skills, and as hard skills the others: Operating Skills and Organizational Skills. This group of soft skills provides the ability to achieve results by working effectively with others in various circumstances; the ability to speak directly, honestly, and with respect in difficult situations; an emphasis on goal-oriented action; and an array of skills used to accomplish focused, long-term goals. As for the hard skills group, this provides an array of skills used for daily management of tasks and relationships; and the ability to communicate by various means within different organizational settings.

2.2 Game Genres

Games can be organized into categories (game genres) defined by the type of game play challenges (mechanics). Understanding games genres allows game designers to appropriately match new problems with a standard solution and to expand already established game mechanics [11]. The main factor that unifies a game genre is a similarity in the type of interaction that is supported between the player and the game [12]. So this interaction corresponds, to the game mechanics, as actions of game objects and players during the game play. These repeated actions or challenges are what defines the genre of a game.

Overall, this type of classification can be seen as a subjective practice, and the number of accepted game genres has evolved in recent years as games mechanics become more sophisticated and diverse [13]. Based on several available taxonomies of game genres [11, 14, 15], there isn't a standard, but rather a list which varies between 5 and 9 categories, which includes several sub-genres.

3 Relation Between Game Genres and Competences

In order to help the game designer to adapt the mechanics for a more effective training and certification through SG, the definition of game genre is one of the key points. For this reason, a study was developed to analyse the most common choices on the specific challenges used according to the competency sets [19]. For that an extended game genre taxonomy was used. This taxonomy is composed of eight sets: Action, Strategy, Playing, Sports, Management Simulation, Adventure, Puzzle and Quiz [16–18].

This game survey of 116 SG crossed the game genre categories with the previous sets of competences and as the results of this sampling we can identify some areas with significant identified intersections [19] in order to achieve the learning outcomes. This analysis is intended to identify the set of genres, from which the mechanics and challenges are more appropriate according to the core skills-set. The quantitative results obtained were based on a two-step approach. Firstly, we choosed the most relevant subgenre of each game genre and compared them with each other, producing the results that allow the understanding on the distance between them. Secondly, the analysis falls on each chosen genre in comparison with all skills of Educational Competency Wheel. The results show how distinct impacts each game genre has in each skills training and can be used as knowledge to improve serious games design.

The potential of several game genres to support skill learning is extremely important and contributes to the development of a wide variety of strategies to the game design. This contribution can result in a mix of game genres or reinforcement of challenges to achieve skills such as: Decision Quality and Problem Solving and Technical Learning (SS); Organizing and Timely Decision Making (OpS); as well both skills results (Action Oriented and Drive for Results) can be synchronized with different strategies to get better learner performances.

Unfortunately, others skill sets haven't shown to be relevant, such as Individual Excellency, which shoes that the soft skills or personal development issues are more difficult either to train or to measure, in order to improve new skills. Exceptionally, the

Role. Playing Game genre presents several contributions in cooperative work (Building Effective Teams (IE), Motivating Others (IE) or Conflict Management (C)).

Table 2 presents which skill sets (hard and soft) are more appropriate for each game genre. Each column of skill type presents the most relevant skills-sets identified, and in some cases, one or more specific skills that distinguishes themselves.

Table 2. Summary of Games genre and Skills by genre and sub-genre

Genres	Sub-Genre	Hard skills	Soft skills
Action	Platform games		(R1) (SS3; SS7)
Strategy	Turn – based strategy	(OrS2) (OpS)	(SS) (R)
Role Playing	MMORPGs		(R) (C) (IE10; E11) (SS2; SS3; SS4)
Sports	Sport/Management games	(OpS5; OpS6; OpS3) (Or2)	(C3) (SS3) (R)
Management Simulation	Virtual worlds/Pets	(OrS2) (OpS)	(SS) (R)
Adventure	Graphics adventure	(OpS5)	(SS3; SS5; SS9) (R)
Puzzle	Action/Arcade puzzle (timed)	(OpS9)	(SS3; SS5; SS9)
Quizzes			(SS9)

The set of graphical analysis presented in [19] demonstrate the stronger correlation and impact between some game genres, such as adventure, sport, strategy and management simulation, and some of the hard skills (organizational and operating) and soft skills (strategic and results). An expected result is the low impact of most game genres with the core skills-set of Intellectual Excellency, with the exception of RPG.

4 Methodology for In-Game Certification

Rather than evaluating the players' performance at the end of the game using traditional questionnaire forms, we propose a four steps design methodology for in-game certification [20]. We provide a set of guidelines for game designers to build games for the competence certification, and an in-game assessment framework. This is needed to balance the relationship between the game mechanics for serious game genres, the array of competences to certify, and the game elements.

Following this methodology, we'll first get the diagnosis of training context through to identify the situations, applied scenarios as well as its objectives. Secondly, the competency profiles of the training target groups must be defined. In this step, the Education Competences, as seen in Table 1, serves as a reference to identify which (or the combination of) competencies should be used to obtain the correct outcomes for each scenario. This tool helps building the mapping of a restricted and adequate number of competencies (core competencies), based on expected results.

Thirdly, the game designer selects the basic mechanics by matching the list of competencies identified on the previous step to the correlation matrix (available at

https://db.tt/Sl9JBACM) and summarized in Table 2 [19]. Lastly, the forth step is to obtain the triadic certification model (Fig. 1) with the following axes: the identified skills (competences), mechanics based on game genres (mechanics) and training levels (play). Similarly with the Triadic Game Design [21], the balancing between the three components is the success of the certification process, which is supported through the Analytics.

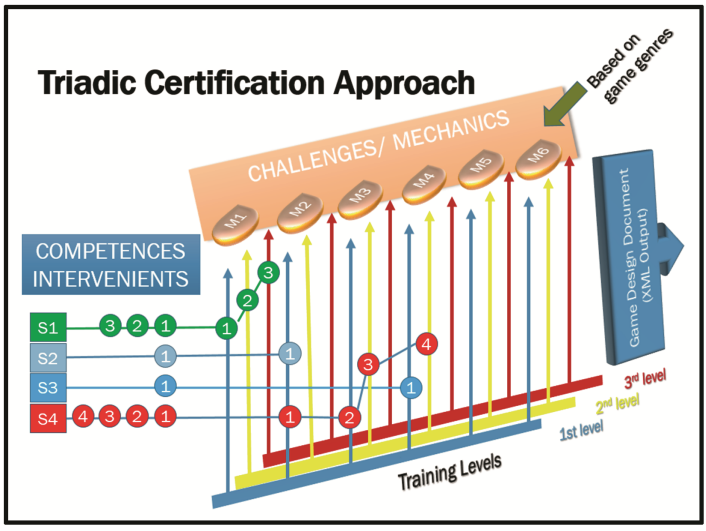

Fig. 1. The triadic certification model

This approach keeps each process independent to each intervenient: trainer(s) (who define the training competences), game designer(s) (who define game elements of serious game) and certification (how to analyse the training data). This is a starting point and the suggested mechanics are the directions and procedures that professionals will further develop to enliven the user experience.

5 Conclusions and Future Work

In the future, the game genres survey will be continuously updated with the analysis of new releases of SG, in order to improve the best game genre identification to achieve the desired learning outcomes. This contribution may eventually be developed as game genres vs competence and skill matrix.

The Serious Games emerge as an interesting alternative for training and certification of competences because they can offer a more meaningful and engaging learning experience. While desirable to measure the performance as a whole and through the game, by applying the in-game certification methodology, the results allow, both individually and combined, the quantification of player performance based on the competence matrix.

With this methodology approach in generic game we intend to define, verify and validate the game design contributions and how systems are capable to provide effective

learning experiences. The success of this proof of concept is defined by the player performance results into different training itineraries.

The results of the analysis of the relation between game genres and competences show that can be applied as reference to different training contexts or domain areas, as well as how it can be useful to understand previous experiences and can provide hints for the game designers to develop new SG. Future work will also focus on integrating this methodology in several areas. An example of the application of this methodology to the tourism can be seen in [20].

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