Knowledge Management Approach to Support a Serious Game Development

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Abstract

This paper details the development of a “Business Game” created for a large financial institution. The objective of the game is to present the company to new employees. As the project unfolded, integrating the different kinds of knowledge into the game became the critical issue. The game has gone through 3 successive versions. A vast range of knowledge can be transmitted in a serious game; consequently, knowledge is integrated into the game in a number of different ways, either directly integrated into the game play (game mechanics) as scenarized knowledge, or made available as an external resource. A Knowledge Management Approach has been used and refined during the development of the game. This methodology wants to complement Prensky and Chong’s arguments about learning techniques and learning styles.

Keywords

Serious Game (SG), Business Game, Scenario, Game Play, Knowledge Base (KB), Cognitive Model.

1. Introduction

The appetite for videogames among adolescents and young adults is a universal social phenomenon, and the number of large companies wishing to train their employees using videogames is growing daily. This growing demand for SG has created a need in companies specialized in creating didactic software to acquire experience and a methodology in developing serious games. This work has received funding from the Region IDF by the ERDF (European Regional Development Fund).

2. Towards a Knowledge Centered Approach

The intention of the client company was to create software that teaches new employees about the organization and structure of the group, its functions, and its corporate values. Our product has evolved during its development process.

The first mock-up, V0, was initially conceived as a classic scenarized learning software. Consequently V0 contained a pedagogical scenario [1], but also certain elements of videogames: scoring, character selection, etc. However, V0 falls under the category of “learning software in a videogame envelop”. Evaluation tests showed up that it was necessary to fully implement game-related aspects to really motivate and engage users, as a real SG should do.

Second version, V1, was conceived as a game accompanied by a knowledge base. From this point, our game became a SimCity-style building game, where a mascot sends training modules to the learners as they advance in the game. Questions relating to the content motivate the learners, as each correct answer allows them to gather additional points and advance through the game. This fact should have encouraged learners to consult the knowledge base. V1’s approach was an “extrinsic metaphor” type: “The game is nothing but an amusing wrapper for didactic content completely unrelated to the game” [2].

2.1. Why a Knowledge Centered Approach?

The evaluation of the prototype revealed an unsatisfactory learning experience. The rupture caused by leaving the game to engage the training modules, provoked a rupture in the engagement and immersion. This dichotomy between pedagogical and game scenario proves that a stronger link between the two scenarios is required in a SG. Consequently, a different
approach was needed: an “intrinsic metaphor” [2]. This approach calls for creating “a virtual environment and a gaming experience in which the content that we want to teach can be naturally embedded with some contextual relevance in terms of the game-playing” [2]. Likewise, placing knowledge in the center of the conception process seems the best way to bring pedagogical scenario and game scenario closer and put in context in order to benefit of SG benefits.

3. Constituent Components of a Knowledge Centered Intrinsic Approach

The goal is to integrate knowledge in such a way that the player perceives the learning tasks as a typical game-play element [2]. This new approach entails classifying knowledge according to a typology, creating a cognitive model and ensuring the connection between our pedagogical model and the videogame.

3.1. Knowledge Characterization

The first stage of our methodology is a detailed analysis according to three criteria.

3.1.1 Nature of the Knowledge: The nature of the knowledge deals with its proper characteristics according to objective criteria: durability, volatility, confidentiality, degree of relevance, veracity, accessibility, legibility, interpretability (or misinterpretability), accessibility, etc. As long as we want to create a durable project, this criterion is useful when validating and prioritizing knowledge with the clients. Consequently, characteristics of knowledge such as whether or not the concept is perennial, volatile or uncertain became highly important when deciding what our SG would teach the player/learner, particularly in the framework of a real project with tight delivery deadlines. For instance, a number of employees can be a very volatile fact.

3.1.2 Type of Knowledge: According to Chi’s approach [3], we have decided to classify knowledge in factual, declaratory and procedural knowledge.

3.1.3 Pedagogical Objectives Specification: Once all knowledge has been characterized, we can detail the pedagogical objectives of knowledge. At earlier stages of the development, the game pedagogical objectives have been defined. In this stage of specification, we assign these pedagogical objectives to our typified knowledge. As a result we obtain a hierarchical view of our knowledge.

3.2. Linking the pedagogical scenario and the game/utilization scenario

This step is a pre-process allowing us to connect the pedagogical model and the videogame. According to the knowledge characterization, pedagogical objectives will be described in terms of game-design. This correspondence determines whether a pedagogical objective has to be integrated into the story of the game or rather integrated as a playable element, i.e., integrated in the game-play. In our case, the standard heuristic was to integrate factual knowledge into the story and procedural knowledge into the game-play, as procedural knowledge is obviously easier to integrate into a game as a process or a mechanic.

This correspondence aims to guide game-designers when defining game rules. Further research could refine this process, as it is the first step to link pedagogical scenario and game scenario.

3.3 Creation of a cognitive model

Within this framework, it is essential to construct a cognitive model. This is an iterative analysis based on the identification of the objects and actions of the domain, their properties and the rules and conditions which make them interacting within each other. In order to do this, we can use classic modelling techniques, for example “object-oriented modelling” [4]. The development of our cognitive model should also result from a meta-knowledge model. Likewise, from this model, we can deduce the learning activities [5] and mental processes that learners/players will use in order to make the knowledge transfer and learning. So, according to Rapeepisarn et al. study [6], based on Prensky [5] and Chong [7] et al. theories, we can define the suitable game genre for our serious game.

The concept of a meta-cognitive experience perfectly matches our pedagogical approach by means of a SimCity-style videogame. The learner learns about his own learning experience as long as he sees his actions in the game as well as their consequences.

As we said, we defined our game-play as an economic construction simulator. The cognitive model has revealed itself useful in order to develop, with the help of a financial expert, an Expert System that simulates an economic bank environment.

4. Integrating the knowledge into the game

At this stage, game-design tasks become crucial. Pedagogical aspects will have to be considered by
game designers. Here, we will decide how to use our expert system or data model, which variables the player is going to control, the consequences of good or bad actions, rewards, conditions of failure or victory or frequency of messages or cut-scenes, etc. As we can see, these are decisions that directly affect motivation, commitment, thus also the pedagogical efficiency of the game. Game design is primarily an artistic process, but also a technical process [8]. The tuning and adjustment of game-design decisions is an iterative conception/testing process. By the way, we can follow some principles as Prensky says: find the right metaphors, the right pedagogical elements [5]. This last step of design finally determined the efficiency [1] of the pedagogical scenario and the effectiveness of the game experience (or pedagogic experience).

5. Conclusion

The experience gathered over the course of the project presented in this paper was gained pragmatically as we lived through the transition from scenarioized learning-ware to a SG. Our methodology was eventually defined on the basis of the “intrinsic metaphor”. Even though the methodology is not exhaustive, it can reduce risks in the development of a SG. On the other hand, it does not guarantee the success of the game design: a SG can be a failure if it does not maintain a balance between story and gameplay, or when the game-flow is not stimulating [9].

This methodology contains the following stages:

1. Creation of a KB
2. Knowledge Characterization
3. Linkage of Pedagogical and Game Scenario
4. Creation of a cognitive model
5. Learning Activities Deduction
6. Game Genre Definition
7. Integration of knowledge into the game: taking into account the learning techniques

It is essential to choose the right game style [10]. Points 5 and 6 are based on Rapeepisarn et al. study [1]. Learning styles and cultural background of players can constrain the game genre and the game conception [6]. The type of knowledge can also constrain the conception and effectiveness of a SG, but it can lead us to integrate knowledge into the video game too.

With this knowledge management approach we try to generalize first stages of conception and development of a SG. This approach can make easier the validation processes with the client, the extraction of cognitive processes involved in learning the content and the knowledge integration into the videogame.

We found the Rapeepisarn et al. study [6] compatible with our approach, which tends to reinforce our ideas. Furthermore, we wanted to give a different approach centered on knowledge management. Additional research may give our approach greater cohesiveness with learning techniques and learning styles theories.

6. Evaluation and Perspectives

Early evaluations have showed up a positive predisposition from the players in using a SG as a support for learning. The players’ opinion about pedagogical effectiveness of the game has revealed some gaps in our approach. Learners often feel lost and not knowing what to do. Further research will investigate how to adapt this guidance to different learning styles and to different kind of players.

The actual methodology could be refined in order to allow a fine tuning link between pedagogical and game scenario.

6. Bibliographical References