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Analyzing the relevance of serious game elements for effectively teach innovation process

Introduction

The term **serious games** typically refers to any games that do not have entertainment, enjoyment, or fun as their primary purpose [1]. Our research focuses on some of serious games that are used in the context of design education, more specifically, those for teaching **innovation process (IP)**. One of the most important criteria for measuring the quality of serious game is whether it can achieve the **designer's intentions**, but we still lack the corresponding assessment methods. Based on the framework put forward by Mitgutsch and Alvarado [2], this paper proposes an **upgraded assessment method** for serious games. This method has been applied to analyze an open innovation serious game "Consortio". The results of the analysis show that other five game elements (Figure 1) of Consortio are closely related to the design purpose of the game.

Upgraded assessment method

Our method aims to assess the quality of design in serious games through analyzing the relevance between design purpose and other game elements. The first step is to identify design purpose of the selected serious game, then determine whether mechanic, content, fiction, graphics and framing can serve the design purpose well. The analysis for these game elements should cover the following aspects [2].

Game elements	Explanation
Mechanic	The game mechanics that are used in the serious game and their corresponding learning mechanics. For each game mechanics, its usage and implementation should be analyzed [3].
Content	The information or data offered and used in the game. All of the given information should be valid, easily approachable and fact-based. Especially for the innovation serious game, we should also focus on models extracted from real business environment.
Fiction	The created fictional space and how it relates to the game purpose.
Aesthetics	The audiovisual language used in the game and how does it attract players.
Framing	The framing of other elements in terms of the target group, their play literacy and the broader topic of the game.

Figure 1: Serious Game Design Assessment (SGDA) Framework [2].
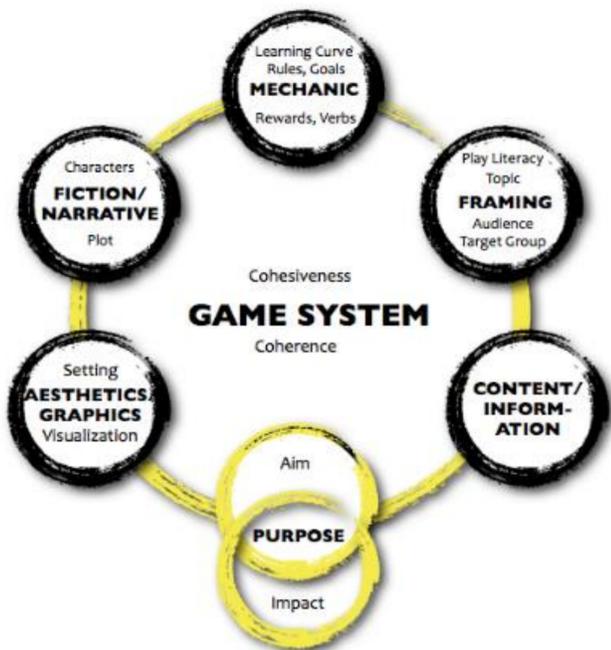
Our method has made two improvements based on SGDA framework:

- For the **mechanic,** we not only simply analyze the relationship between the overall game rules and purpose, but also discuss about the usage and implementation of each game mechanic used in the game.
- For the **content**, we further divide it into basic information and key information. The key information refers to models extracted from actual business environment.

Key references

- [1] Michael, D. R., & Chen, S. L. (2005). Serious games: Games that educate, train, and inform. Muska & Lipman/Premier-Trade.
- [2] Mitgutsch, K., & Alvarado, N. (2012, May). Purposeful by design?: a serious game design assessment framework. In Proceedings of the International Conference on the foundations of digital games (pp. 121-128). ACM.
- [3] Arnab, S., Lim, T., Carvalho, M. B., Bellotti, F., De Freitas, S., Louchart, S., ... & De Gloria, A. (2015). Mapping learning and game mechanics for serious games analysis. British Journal of Educational Technology, 46(2), 391-411.
- [4] Le jeu IØ. Un projet de Rhizome avec le soutien du Ministère de l'Économie, de la Science et de l'Innovation. Available from: http://jeuio.rhizome.group/about. [Accessed on 30th Apr, 2018]

Case Description

The upgraded assessment method served to analyze the relevance of game elements of a serious game for teaching IP, named Consortio, in the particular context of illustrating open-innovation strategies. The game was used to teach third-year master students open innovation. The session lasted 8 hours, 22 players and one trainer participated.

Figure 2: The entire game process is consists of four phases: research, design, prototyping and deployment [4].
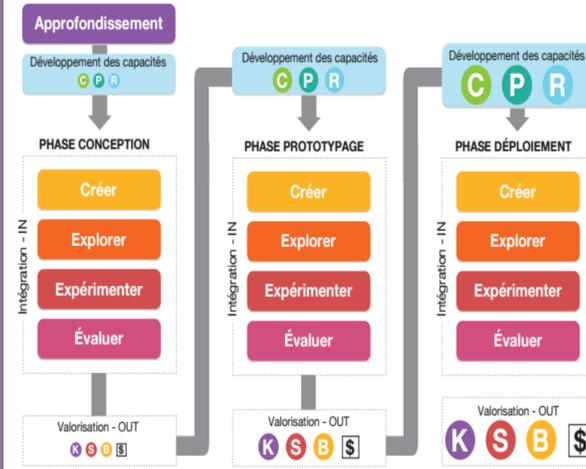
Consortio is a collaborative board game. The players are gathered in a consortium, and represent each one of the actors of the consortium (company, research laboratory, etc.). The goal for the consortium is to develop new products by generating maximum value. But each player also has personal goals, which he must reach. At each turn (Figure 2), the consortium must make a decision on the program (s) to be put in place (playing cards) according to the phase in which it is, its maturity, the amount left to spend, not to mention the individual goals of each. Each ACTION card (Figure 3) costs a certain price IØ and some require a minimum level of CPR points.

Results

Here we only show some of the analysis results related to the mechanics. Consortio uses learning mechanics to ensure that knowledge around open innovation can be imparted. At the same time, it also uses a variety of game mechanics to enable players to enjoy fun and maintain sufficient motivation during the learning process. The following table describes all the game mechanics and learning mechanics used in the "research phase".

Train Period	Game mechanic	Learning mechanic	Implementation	Usage
At the beginning of research phase 15min	Tutorial	Instructional Guidance	PPT presentation	Guide the game process
During the research sub-phase 20min	Signposting	Participation Action/Task Plan Tutorial Feedback Reflect/Discuss	PPT presentation	
	Collaboration		Negotiation between players	Immersion
	Selecting/Collecting		Cards selection	Highlight urgency and accelerate the game process
	Tutorial		PPT presentation	Immersion and emphasize that communication vital for team success
	Time pressure		Time controlled by trainer	Accelerate the game process
	Feedback		Counters of CPR Trainer Phase switch	Motivation and message reinforcement
	Resource management		Budgets	Enhance the realism of the virtual world
	Branching choices		Choose cards	Freedom and immersion

FOCUS GROUP
- Créer -
Générez rapidement des idées sommaires sur le plan créatif

15000 IØ

Vous recueillez les commentaires et réactions des usagers et de certaines parties prenantes au cours de cet atelier de discussion de 2 à 3h.

10 20 15

Figure 3: "Focus group" is one of the action cards. By reading the information on the card, players can understand the meaning and benefits of focus group. In order to buy this card, consortium need to pay 15000 IØ and its points of "culture", "process" and "resources" should be no less than 10, 20 and 15. These three indicators are used to evaluate the innovation capacity of each organization as well as the entire consortium in the Consortio.

Discussion

Our upgraded assessment amethod served to analyze the relevance of game elements of Consortio. The results of the analysis show that other five game elements of Consortio are closely related to the design purpose of the game. Here are two limitations of this study::

- The upgraded assessment method is proposed base on the Consortio, whether the method can be applied for analyzing other serious games of the same type still needs research.
- This method can be used to predict whether a game can achieve the design purpose by evaluating the formal conceptual design of it. However, it can not be used directly to assess the effectiveness of a serious game.

Two major directions for future research are determined:

- Improve the upgraded assessment method based on practical experience.
- Generate a conceptual framework for the design of serious game for teaching IP.

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