

A New Definition of Competence Developing Games

- and a framework to assess them -

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Abstract—There are different types of games that try to make use of the motivation of a gaming situation in learning contexts. This paper introduces the new terminology ‘Competence Developing Game’ (CDG) as an umbrella term for all games with this intention. Based on this new terminology, an assessment framework has been developed and validated in scope of an empirical study. Now, all different types of CDGs can be evaluated according to a defined and uniform set of assessment criteria and, thus, are comparable according to their characteristics and effectiveness.

Keywords-*Serious Games; Gamification; Business Simulations; Assessment.*

I. INTRODUCTION

Using gaming concepts for teaching approaches provides the advantage of transferring the motivation of a gaming situation into a learning situation [1]. In addition, games provide a safe room which gives players the possibility to explore new behaviors or strategies without taking any risks on their health or their (business) environment [2]. There are three major kinds of games which are used in teaching context: Serious Games, Business Simulations/Games and the approach of Gamification. According to current research, there is no framework or tool that stipulates the capability to assess Serious Games, Business Simulation/Games and gamified applications in a structured and comparable way. One reason for this is the lack of an aligned terminology for such games. In Section II and Section III, a terminology suggestion will be further motivated and defined. Section IV describes a framework needed to handle the new terminology. Section V offers an overview about future work and further use.

II. MOTIVATING COMPETENCE DEVELOPING GAMES

A variety of publications defines the terms Serious Games, Business Simulations/Games or Gamification, e.g., [3][4][5]. Furthermore, there is a number of definitions for game concepts that are close to Serious Games (e.g., Game-based Learning). By now, some authors argue that these kind of game concepts are more or less equal to Serious Games [6]. Other authors try to elaborate differences between these concepts [7]. However, there is the conviction that characteristics, pedagogies and the way of game design are too different and that it is impossible to handle all three concepts within one approach.

In order to develop an umbrella term that combines the three concepts mentioned within one approach, similarities and differences had to be identified: All different kinds of game concepts try to teach someone something, by using different teaching approaches. There are very simple designed games that teach only pure information without any pedagogical concept or significant Game Design, Game Mechanics, e. g., a vocabulary trainer. Such applications are not inside the scope of the umbrella term because they are not real games. If you extend the vocabulary trainer with ranking systems or with a dynamic vocabulary in simulated conversations, you get a gamified application that starts touching the target field of the assessment framework. A vocabulary trainer teaching the vocabulary inside a 3D-world while telling a discoverable story (independent of the pedagogical nature of such a game) is – by definition – a Serious Game and, thus, inside the target field. Games in scope of the umbrella term CDG have one characteristic in common: They do not transfer information only, they also teach how to use them.

III. DEFINE COMPETENCE DEVELOPING GAMES

The European Parliament published a recommendation for the definition of the term ‘competence’ based on the work of the European Universities Continuing Education Network (EUCEN). They are defining ‘competence’ as follows: “‘competence’ means the proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations and in professional and personal development...” [8]. This definition of competence describes the idea behind transporting knowledge -and how to use it- in a sophisticated way. Games have the ability to teach knowledge, skills, methodological abilities and how to use them. If needed, they can even teach attitudes (Examples: [3]). So CDG seems to be a suitable umbrella term. The following definition of CDG is based on the above-mentioned definition of ‘Competence’:

A Competence Developing Game (CDG), is a game that has the primary purpose to teach knowledge, skills and personal, social and/or methodological abilities, in work or study situations and in professional and personal development of the game player, by retaining the motivation of a gaming situation.

IV. PYRAMID ASSESSMENT FRAMEWORK FOR ‘COMPETENCE DEVELOPING GAMES’

The ‘Pyramid Assessment Framework for ‘Competence Developing Games’ (short PACDG-Framework) provides the possibility to assess any CDG in a systematic way. Assessment results are comparable even if CDG are different in their nature.

A. Framework layers and steps

With the PACDG-Framework CDGs are evaluated from a ‘Designer’ and a ‘Player’ perspective in seven separated steps that build up on each other (hierarchical structure).

The basic idea of having a designated ‘Designer’-Layer is to evaluate the game’s potential by investigating the integral game components and the game’s goals. To support this, the Designer-Layer includes the Pyramid-steps ‘Problem’, ‘Learning Goal’, ‘Story & Pedagogy’ and ‘Game Design & Aesthetics’.

The main goal of the ‘Player’-Layer is to investigate the effect on the players during and after playing the game. In scope of that, the game experience and the desired learning effect on the player are investigated. The basis for that are the Design-Layer results. However, the PACDG-Framework provides three pyramid-steps inside the Player-Layer: ‘Experience’, ‘Aftereffect’ and ‘Impact’. Figure 1 illustrates the framework and described the framework steps.

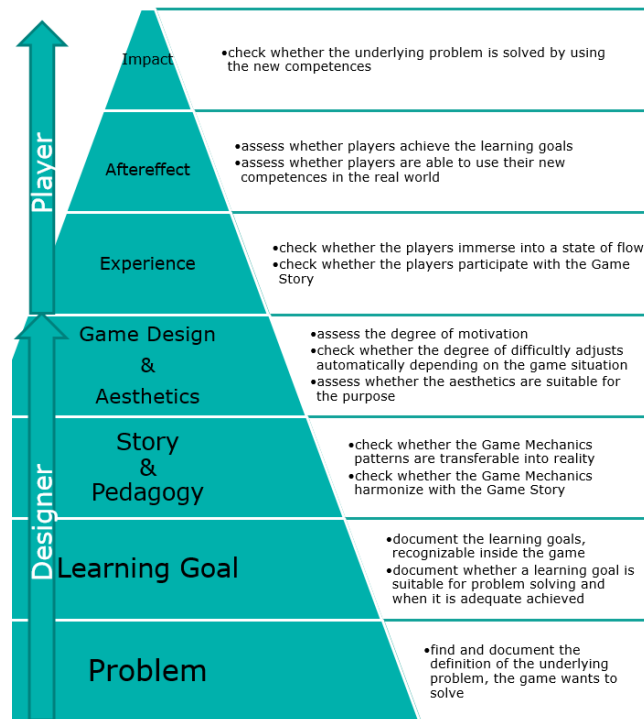


Figure 1. The PACDG-Framework

Using the framework means to execute the illustrated steps from bottom to top. Each layer focuses on another game part. Because of the hierarchical structure causes for failures or unwanted effects can be found in each underlying step. Every step requires different assessment operations. These operations are described on the right hand site of every step.

B. Framework derivation and evaluation

Game types summarized under the CDG umbrella entail a variety of frameworks, assessment tools, etc. The PACDG-Framework combines these established approaches that can be found e.g., in [9]. It represents a universal solution for all game types summarized under the CDG umbrella. Thus, in scope of its development, the most relevant and acknowledged game focusing concepts as well as their underlying measurement tools have been considered. Furthermore ‘Bloom’s taxonomy of the Cognitive Domain’ was taken into account as a common measurement tool for learning outcomes [10]. Table 1 shows which PACDG-Framework element has been mainly extracted from or is inspired by which approach. In order to establish an integrating concept by utilizing these different approaches the major work had to be done by adjusting the concepts among each other. That means, the PACDG-Framework combines these concepts avoiding the identified weaknesses. By this, it expanded the framework range. The original approaches presented in Table 1 support either Serious Games or Business Simulations. The PACG-Framework supports both and Gamification-Application beyond.

TABLE I. DERIVATION OF THE PACDG-FRAMEWORK

Base Approach	PACDG-Framework Step
Bloom’s Taxonomy [11][12]	Impact
Annetta’s Framework [13]	Experience Game Design
DPE Framework [14]	Game Design & Aesthetics Story & Pedagogy
SDGA Framework [15]	Learning goals
Eight fields instrument [2]	Aftereffect Problem

An empirical study with 39 education experts was conducted to validate the hierarchical PACDG-Framework structure. The results show that the framework structure is valid. First practical experiences using the framework show a very suitable way to assess all kinds of CDGs. In addition, the assessment results facilitate the description of game problems and the identification of the associated causes in a systematic way. The theoretical assumptions (game design & learning) on which the framework is constructed are based on many established and used approaches. That ensures a sophisticated level of validity for the theoretical aspects, too. By this, in short, the PACDG-framework validity is shown.

V. CONCLUSION AND FUTURE WORK

Further explanation about the empirical study and practical tests will follow in a longer version of this paper. In addition, more detailed assessment criteria underlying the assessment operations of each step are being worked on. They will contribute a better level of comparability between assessments. Next, the framework will be used to assess games developed for Cyber-Security trainings. By this, critical success criteria for this kind of games should be defined and used for developing an exemplary serious game within this scope.

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