The Innovative Implementation of Evaluation Mechanisms on the P4G Business Game

Zacharoula Smyrnaiou, Evangelia Petropoulou, Stefano Menon, Vincenzo Zini

***Abstract*—** The P4G Business Game is a simulation game that has been developed in the context of the European project PLAY4GUIDANCE. In alignment with the project objectives, the P4G online interactive space in the form of a business game is addressing both theory development issues and learning purposes and meets the conditions and specifications that attain to bring the world of education and training in close contact with the job market and match school and university curricula to the market's real needs. In this context the business game provides a basic supplement and interactive educational approach to the core curriculum of business and economic classes. In this highly engaging and motivating environment, users are trained and guided in the use of entrepreneurial, transversal and mathematical skills. What differentiates the P4G Business Game from other relevant simulation games is its innovative implementation of a set of evaluation mechanisms that are embedded in the game aiming both to assess the users' performance and to scaffold and guide them. The evaluation tool provides users with individual tracking of their performance on every aspect of management of a company and supports them to reflect on previous decisions, review their effect, and apply critical thinking and problem-solving skills in order to improve the problematic areas. The design and development of the P4G self-evaluation tool was realized based on a set of pilot tests and research action plans on the basis of assessing (1) players' level of the key skills and competences highlighted in the P4G matrix and (2) players' performance in alignment with the learning objectives highlighted by the P4G Pedagogical Framework and involved all project member countries as well as target groups: unemployed, students, teachers. The findings from the testing phase have shown a positive level of reliability of the P4G Evaluation tool regarding the assessed competences and its scaffolding nature as an entrepreneurial training tool.

***Keywords*—** business game; evaluation tool; multiplayer simulation

I. Introduction

Business Games are an innovative learning method that aims at reinforcing managerial, entrepreneurial, digital and collaborative competences and promote critical thinking, problem solving and leadership [1]. The Play4Guidance (P4G) project, which is funded within the framework of the European Union Erasmus+ programme, introduces an innovative Business Game with the aim to train and guide students and young unemployed on entrepreneurial, transversal and mathematical skills. The players assume the role of decision makers by operating within a model that simulates an economic reality, micro-economic (enterprise) or macro-economic (market). The P4G Business Game (BG) is a browser-based single-player simulation in which players manage from a strategic point of view their own business in alignment with the market needs. It simulates a market of manufacturing companies, which operate by transforming raw materials into finished products and try to sell the finished products to customers.

The aim of the game is to maximize the value of the company, assessed in terms of operating margin, recruitment policies, the growth rate of investment and the financial results of the company itself. The game is divided into rounds; each round simulating a month of the company's activities and the market. Players make decisions during each round/month and analyze results/effects in the next one. The competitive feature of this kind of simulation boosts students' engagement and motivation and therefore enhances the learning outcome.

The innovative aspect that distinguishes the P4G BG among other serious games is its evaluation and scaffolding mechanism that provide significant guidance for the trainees. It focuses on both qualitative and quantitative data analysis providing users with immediate feedback and constant tracking of their performance. The sophisticated interactive technology underpinning the game accommodates social and technical dimensions -player exposure to varying levels of social interaction and cognition, removal of time and space constraints - not always available in the physical world. It allows for user intervention and decision taking processes while it offers a specific and structured space where critical analysis of intertwined and complex information is necessary. The evaluation tool was validated through pilots and national conferences conducted in all participating member countries of the project; enabling this way the collection of valuable information from all the countries involved in the project and different target groups. Now the BG is available in single player version on the P4G platform (http://play4guidance.eu/p4g-business-game/). The findings

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from the testing phase have shown a positive level of reliability of the P4G Evaluation tool.

Traditional Serious games are often based on qualitative analysis of scenarios in order for the player to make some decisions. The P4G BG also focuses on quantitative analysis of data providing both trainers and trainees with a source of valuable information that can be exploited to focus on specific areas that need improvement or further practice. The evaluation tool embedded in the P4G BG provides immediate feedback and facilitates the constant tracking of the trainee's performance. This individual tracking of performance on every aspect of management of a company (management of supply, production management, management of marketing and sales) scaffolds and guides users to reflect on previous decisions, review their effect, apply critical thinking and problem-solving skills in order to improve the problematic areas. In addition, the aim of the P4G Evaluation tool is to provide participants and users of the P4G Business game with simple and clear feedback so that they can use it to self-evaluate their skills and competences.

II. THE P4G BUSINESS GAME AND UNDERPINNING PEDAGOGICAL APPROACHES

The pedagogical approach of the P4G project is achieved by taking a multi-disciplinary approach to examine a set of principles which are considered from social-cultural approaches, psychological principles, gaming experiences and the technological point of view. The P4G online interactive space in the form of a business game is addressing both theory development issues and learning purposes.

Following socio-cultural approaches, online interactive environments do not exist in isolation to the real-world but rather belong within a context where actors use common-sense practices to produce, analyze and make sense of one another's actions. "Situated actions" are unrolled in doing in situ where participants act and interact within an environment [2]. In this context attention is drawn to the character of instant interaction of people with technology rather than focusing only on the cognitive processes whereas at the same time players are exposed to varying levels of social interaction [3], [4]. Understanding the social and cultural influences requires getting to know the customers and think about the products or services from their points of view. The culture, attitudes, values and beliefs of consumers are the social factors that affect marketing. The usefulness of national culture as an analytical basis in international marketing research is discussed and the construct of national culture is placed in the context of layers of culture, ranging from global cultures to micro cultures [5]. Ethnicity is another socio-cultural variable that affects the marketing decisions [6]. For example, in some cultures the wife still does all the cooking and cleaning, whereas in mainstream American culture, such an assumption is seen as offensive. Thus, sociocultural factors/variables (such as culture/ethnic identity, attitudes, cross culture difference, etc.) are the larger scale forces within cultures and societies that affect the thoughts, feelings and behaviors.

In the context of micro social approaches variables such as organizational structure and group structure are also examined. In terms of organizational structure, there is an effort to identify and elaborate on the mechanisms that facilitate or hinder the knowledge possessed by each group member to equal the knowledge possessed by the organization. Therefore, the variable of organizational structure addresses the issue of organizationally shared knowledge as directly dependent on the 'amount and nature of interaction' (such as willingness to share information and expertise, etc.), 'the organizational culture' (equality among group members, etc.), and 'the technology available to support group sharing' [3]. The second micro social variable examines issues of group structure that influence and define the quality of collaboration and information/knowledge exchange among the group members. The issues examined in this variable are: (1) subjectivity in processing information, (2) trading behaviour, (3) intimacy-immediacy in mediated communication [7], (4) professional context and individual competences and (5) normative (in enhancing one's position in the group and/or one's self-image) and informational influence (as a task-centered issue) [3], [8], [9].

Following a psychological perspective, activity is a cycle that begins from the brain and, through the body and the world (such as business world), returns back constituting knowledge. The power of cultural structure can lead to the transformation of the problem solving activity [10]. The way that a learner or group of learners interacts/interact with each other and with the technology / business game -in a real word- could lead to new forms of gaming and learning activities and experiences which the designers have not anticipated. Psychological researches have studied self-perception, entrepreneurial self-image and/or entrepreneurial typology. A research found that experience as a small business person most clearly predicts entrepreneurial self-image and supported predictions of both direct and indirect effects of gender as well as direct effects of education and business degree [11]. In the P4G context, the psychological processes that are responsible for initiating and continuing goal directed behaviours [12] are identified and analyzed through six principle perspectives [13]: (1) the trait perspective (in terms of achievement motive, power motive and affiliation motive) [14], (2) the behaviourist learning perspective (in terms of positive and negative reinforcement), (3) the cognitive perspective (in terms of performance orientation and mastery orientation-goals, expectancies, values of consequences) [15], [12], (4) the perspective of self-determination (in terms of competence, autonomy, and social relatedness) [16], (5) the perspective of interest (with interest perceived both as an affective and cognitive variable) [17] and (6) the perspective of emotion (in cognitive and motivational processes) [18]. These perspectives are not contradicting but dependent on the focus of perspective and are used to inquire the underpinning psychological mechanisms of an online game and group interaction and engagement. A gaming experience is

a playful experience that can be described through the relationships between the players' actions and the systems' reactions. Players' actions are expressed by cognitive psychological, physical and emotional dimensions. Systems reactions are specified through the rules of the games. The relationships between players' actions and the system reactions are within a cultural framework and/or business context which specify the players' attitudes and prepositions to the playful experience. According to Brandenburger and Nalebuff [19] 'Successful business strategy is about actively shaping the game you play, not just playing the game you find' which denotes the potential offered by an interactive learning environment for subjective experiences and objective outcomes to become intertwined. Culture includes the larger contexts engaged with and inhabited by the system [20].

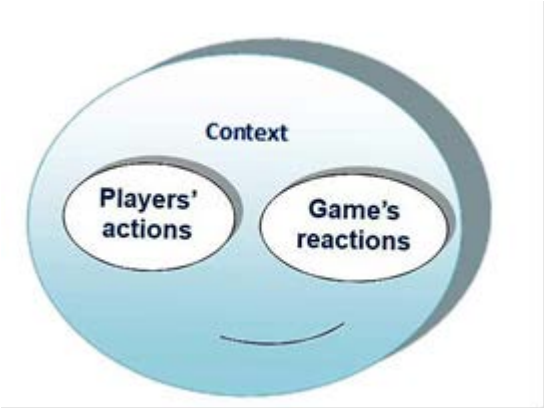

Fig. 1 Representation of the 'gaming experience' context

Following a game design perspective, rules of a game are categorized as operational, constitutive and implicit [20]. The operational rules are the guidelines players require in order to play. These become known to players through their own play or through the intervention of animators/mentors that introduce the game. The constitutive rules of a game are the underlying formal structures that exist "below the surface". These are not presented to players but advanced users may realize some of them, especially when they refer to unexpected system behavior. These formal structures are logical and mathematical. Implicit rules are the "unwritten rules" of a game and refer to the game etiquette. These rules refer for example to how players will behave, etc.

Regarding the player's actions, a player's strategy will determine the action the player will take at any stage of the game. In game theory, the player's strategy is the key-element and involves any option he or she can choose in a setting where the outcome depends not only on his own actions but on the action of others. Analyzing the players' interactions as they play a game, entails focusing on their strategies, both technically executed and verbally expressed, in order to make sense of the scientific concepts embedded in the game [21], [22]. The verbally expressed strategies are revisited again and again during the play and for some of the players the rationale seems to change from action-centered to concept-centered, the longer they are engaged in the play. However, there are many implicit strategies that enhance meaning generation processes, based on different semiotic systems related to embodied or collaborative experience. These strategies seem to feed the players' meaning processes, as they interact with the environment and observe the outcome of their strategies and reshape their understandings accordingly.

Following a technological point of view, the P4G Business Game "Manage your own company" is a simulation game between teams, where each team has the task of managing from a strategic point of view their own business competing with the other in a market. The business game simulates a market of manufacturing companies, which operate by transforming raw materials into finished products, and are in indirect competition for acquisition of scarce resources upstream, in the process of acquisition of raw materials from suppliers, and downstream, trying to sell finished products to customers. The rationale of the game lies on the users' training and guidance in the use of skills both quantitative and qualitative. The P4G business game is an online learning environment which acts as a replication and extension of the physical market world. However, the sophisticated interactive technology underpinning the game accommodates social and technical dimensions (player exposure to varying levels of social interaction and cognition, removal of time and space constraints, etc.) not always available in the physical world. It allows for user intervention and decision taking processes while it offers a specific and structured space where critical analysis of intertwined and complex information is necessary. Following the business game objectives for entrepreneurial training, skill relevant acquisition and efficient communication and collaboration among the participant members, the following five variables are examined: (1) computer mediated communication (CMC), (2) feedback, (3) decision support, (4) collaboration and (5) debriefing. Computer-mediated communication has been proven to generate more alternatives with more equal participation among group members and the greater the interaction and exchange of information and ideas among team members, the greater the learning from the simulated environment [23]. In addition, feedback is a very important element in a technological environment designed for learning purposes and in the business game context is perceived both as a decision support and motivational contributor. The decision support variable addresses both the embedded script that aims to guide the users and the mechanisms and tool functions that facilitate the interconnection among the provided or registered information and data. Collaboration addresses the group work facilities provided by the technological environment and their efficacy in enhancing interaction among the group members perceived either as competitors or team members [24]. Finally, following a meta-cognitive approach it is essential for tools to provide users with debriefing techniques and comparative (in terms of group performance) outcomes in order for users to develop self-improvement skills [25].

Gaming experiences in virtual multi-user gaming environments as well as online mass games provide opportunities to study users "experience with technologies from innovative points of view" [21]. Providing close links between the game-play and the learning objectives and outcomes is a key challenge for using games effectively [26], [27]. It is important to avoid the "chocolate-covered broccoli" design approach [28] where the game is used as a reward, separate to the learning task since it separates joy from learning. Recent research on intrinsic integration between the game and its learning content [29], [30] proposes ways to motivate learners to understand the learning task through play. Additionally, other games allow learners to apply knowledge in "hypothetical worlds that are increasingly a part of how we work and play" [31]. Survey studies also suggest that game experiences are changing a generation's attitudes toward work and learning, even though they are largely overlooked by educators [31], [32]. Therefore this business game will exploit game-based learning as means to engage young people with learning about business, maths, science, etc. – in a learning environment where each team has the task of managing, from a strategic point of view, their own business, competing with the others in a market.

III. METHODOLOGY - THE DESIGN OF THE P4G SELF-EVALUATION TOOL

The P4G Self-evaluation tool supports the design and development of a serious business game morpheme that is based on the simulation-based assessment structure. The distinction between designing simulations for learning and designing simulations for assessment is that the former requires focusing on the features of situations that provoke the targeted knowledge and skills while the latter requires focusing on the knowledge and skills provoked by a specific situation and evaluate how they were provoked, what the response was, and what the results were [33]. This distinction necessitates the identification of principles and development of tools that differ from those required to merely build simulations [34] although the rationale in designing both simulation approaches in certain design aspects seems to overlap [33]. Assessment-based simulations have additional processes integrated that provide feedback about performance by evaluating examinees' capabilities, either in terms of overall proficiency or focusing on more specific aspects of knowledge and skill [33].

In addition, the creation of valid assessment in simulation environments requires expertise from disparate domains and exploitation of different approaches and strategies that would enable the acquisition and development of skills and competences considering the users' individual needs, expertise and cognitive background. The P4G Consortium differentiated expertise is applied in the design of a shared framework that additionally considers the different cultural contexts that each country member brings. This way an-all inclusive and shared framework is adopted and we are enabled to track and examine the way different expertise fits in with others, further develop the P4G skills matrix (a state-of-the-art compilation of skills standards among target groups and Countries) the different aspects addressed in the project and result in valuable and measurable data on the effectiveness of co-existence and interaction among different methodologies in terms of cognitive and skill development. The P4G Matrix informs the evaluation tool and defines the competences to be embedded in the P4G BG. Having thoroughly analyzed the competences definition in relationship with the Business Game and especially with the different actions needed to play the game in a successful way, a strong interrelationship among certain competences was found; in the sense of a sort of dependence of one competence with another.

Table I. Interrelationship among competences in the context of the P4G BG

Category of competences and their relationship	
Competence	***Related competences***
Analytical Thinking	Information seeking
	Order and Quality
Expertise	Order and Quality
	Result Orientation
Flexibility	Innovation
Decision Making	Result Orientation
	Analytical Thinking
	Flexibility

The P4G self-evaluation tool was designed and implemented on the basis of (1) assessing (1) players' level of the key skills and competences highlighted in the matrix and (2) players' performance in alignment with the learning objectives highlighted by the P4G Pedagogical Framework. In addition, it was designed and informed regarding both literature review on competence classifications and specifications and empirical research data occurring from surveys conducted in all project member countries (Bulgaria, Greece, Ireland, Italy, Turkey) addressing three targeted groups: unemployed, students, teachers. As a result a) the inclusion of learning goals supported by the literature was validated, b) the adoption of a generic competence scheme was enhanced to include differences between countries and target groups and c) dimensions such as affective skills that had been neglected in previous research on entrepreneurial skills and corresponding training concepts have sprung up.

IV. DESIGN AND STRUCTURE OF THE TOOL OF SELF-EVALUATION AND EVALUATION FOR GUIDANCE

A. Identification of the P4G BG learning objectives

Having identified the set of principles that inform and support the structure of the P4G Business Game it is important to consider and clarify the specific learning objectives that the business game addresses and elaborate on their assessment

process in order to provide a route map for designers to develop the game model. This attempt addresses both theoretical and practical issues that need to be considered in order to accomplish a complete and efficient guideline template with specific learning objectives and assessment points for the P4G Business game users.

The learning objectives are the result of different data entries and research examinations. Specifically, they have been formed based on the results of the Assessment Output (Skill Matrix), the P4G business game characteristics as well as the pedagogical theory related to online gaming which was mentioned in the first section. The identified learning objectives address two fundamental aspects of game engagement: (1) users' skill development which concerns the behaviour/development of the players as problem solvers and (2) users' cognitive development which is about the knowledge/learning about business and management sciences.

The first aspect of game engagement occurs as a natural element based on the expectations set and the 'modus operandi' of the game and therefore it is embedded in the pedagogical structure of the game. Throughout the game players are prompted and challenged to use available information and data in order to meet the game's expectations. By doing so they are engaged in cognitive processes that necessitate development and application of various and multifaceted skills. Players are instructed and guided to fulfill a set of tasks that consist of strategies that need to be designed and developed: a) make decisions on the evidence available to them, b) seek out further evidence, c) organize and examine evidence, d) conduct safe-to-fail tests (where they have insufficient evidence available to them) and e) decide and follow a strategy. Users by being engaged in such tasks have to practice and apply a set of skills in order to take informed and data based decisions. For example, users while examining evidence they need to sort out relevant and irrelevant factors, issues and facts; prioritize evidence for their given goal and develop a strategy for monitoring evidence in the light of dynamic changes in the game environment. In addition, in group situations they should discuss all the evidence and factors, listen to each other, and develop a clear strategy that they all agree to follow. This way the P4G business game users are engaged in hands-on activities provided in a realistic setting simulating real business conditions and market needs that challenge a set of essential entrepreneurship skills such as problem solving Skills (Defining the problem. Generating alternatives. Evaluating and selecting alternatives. Implementing solutions), Analytical Thinking (The abstract separation of a whole into its constituent parts in order to study the parts and their relations), Creative Thinking, etc.

The second aspect of game engagement addresses the users' cognitive development and concerns their comprehension of the business practices of the game environment. This involves as set of learning objectives that specifically focuses on the users practice and acquisition of essential knowledge in terms of business terminology as well as business practices and sustainability issues. Addressing the users' cognitive development the following learning objectives have been identified:

- **Essential Business Understanding**: players should have a clear understanding of what their game/business goals are.
- **Supply Management, Production, Marketing Basic Skills**: players should understand the areas where resources need to be devoted (R&D, marketing, human resource, capital equipment, raw materials, logistics etc.)
- **Critical Thinking**: players should understand what areas need to be prioritized at different stages in a business cycle.
- **Organization and Planning**: players should act with full knowledge of financial constraint and probity: i.e. understand cash flow, P & L, trading while insolvent, debt finance etc.
- **Communication and Cooperation, Leadership, Managerial Skills, Teamwork skills** (in case of 'team' player scenario): players should take turns, listen to each other, and record decisions.

B. Identification and Development of the P4G BG assessment system

In our effort to design and implement an educational assessment approach that would be based on evidentiary arguments we adopted the Evidence-centered assessment design (ECD) [35] as the most relevant and targeted approach to the P4G Business game learning objectives. Evidentiary reasoning [36] and statistical modeling allow us to identify and specify the kinds of observations that are required in order to assess specific knowledge and skills we aim to develop in students [35] and are mostly efficient in cases of complex performances or when complex data processing is involved. Efficient assessment models should be tightly linked and informed by a set of interconnected factors such as the set inferences, the relevant observations that would ground them and the context for them to evoke.

The ECD provides a conceptual design framework based on the principles of evidentiary reasoning and is conceived as a most suitable assessment model for the P4G Business game not only due to its coherence among the reasonably interconnected factors but also for its support of the P4G simulation based assessment nature as well.

The ECD evolves on two basic models: a) **the Conceptual Assessment Framework (CAF)**, acting as the blueprint for assessment and addressing the operational elements of an assessment by providing the required technical details for implementation such as specifications, operational requirements, statistical models, details of rubrics, etc. and b) **the Four-process Delivery Architecture**, addressing the assessment delivery which involves the functions of selecting and administering tasks, the presentation of materials and capturing work products, the evaluation of responses and updating of the scoring record and accumulating evidence across them.

The **CAF** is divided into three models that address specific aspects of the assessment system and thus data processing is facilitated: a) the **Student model**, b) the **Evidence models** and

c) the **Task models**.

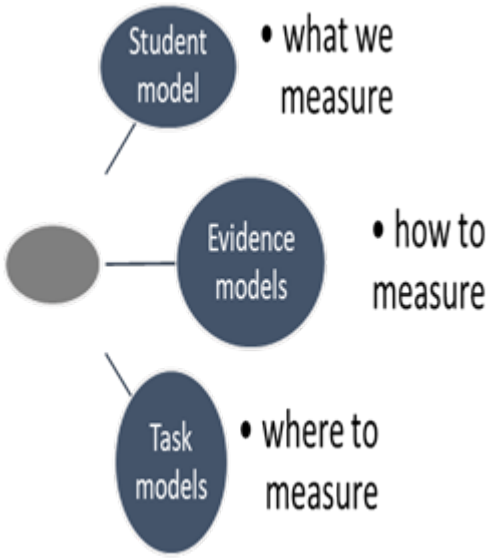

Fig. 2. Representation of the CAF and its principal design models

The **Student model** addresses the measuring objectives. In other words, it defines the variables related to the knowledge, skills, and abilities we wish to measure. In the P4G business game the Student model characterizes the user in terms of degree and nature of knowledge, required in different combinations in different tasks (e.g. Problem solving skills). Of course, at the beginning of the task-assessment process the probability distribution representing the user's status will be uninformative but it will be updated according to his/her performance at the simulated tasks of the P4G Business game and finally evaluated in alignment to certain variables addressing some aspects of knowledge, skill, or ability. Figure 3 shows a student model for the P4G Business game simulation-based assessment that has variables for six areas of knowledge in the domain of entrepreneurship. The variables are defined with associations among aspects of knowledge and skill and they are used to synthesize evidence from task performance, in terms of a probability distribution over them.

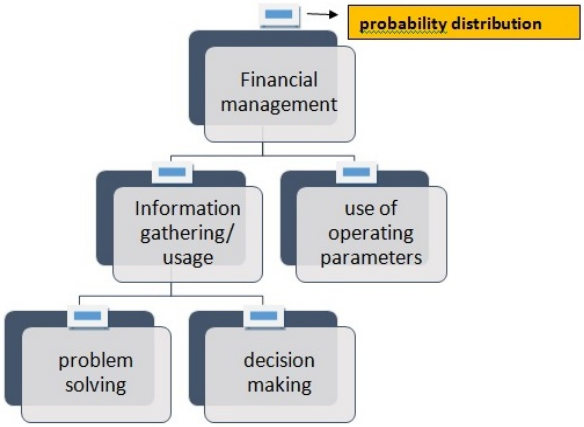

Fig. 3. Generic Model of the P4G simulation-based assessment

The **Evidence Models** are informative in providing detailed instructions on how we should update our information about the student model variables by considering the users' work products from tasks. The evidence model contains two parts: a) the evidence rules which characterize the user's performance in terms of observable variables and concern the identification and summary of evidence within tasks and b) the Measurement Model which provides information about the connection between student model variables and observable variables and concerns the accumulation and synthesis of evidence across tasks, in terms of student model variables. In the P4G Business game several observable variables are evaluated from each task performance. In figure 4 there is the measurement model for the scenario of addressing the company's supply needs. The five variables on the right represent observable variables; the two toward the upper left are two of the variables from the student model and the variable at the bottom center accounts for the dependencies among the observables that arise from evaluating multiple aspects of the same complex performance.

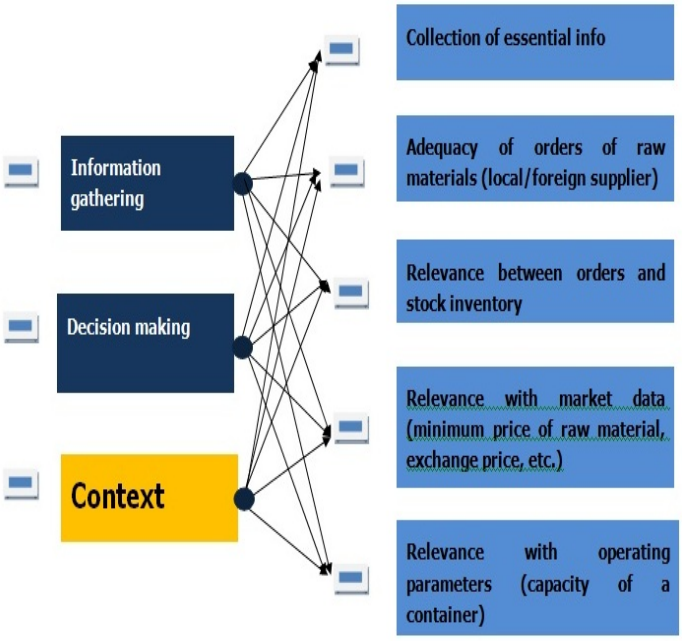

Fig. 4. Example of the Measurement model of the P4G Business game

The **Task Models** guide us in the structuring of situations that are necessary in order to obtain evidence needed for the evidence models. They represent a family of potential tasks as structures for understanding and controlling evidential variation and contain task model variables that inform the presentation material and work products. A task model for the P4G Business game would evolve around the scenario of business operation and it would necessitate determining the values of variables that characterize key aspects of basic operational business processes, providing responses that seem to take into consideration and are relevant to certain data and operating parameters.

The **Four-process Delivery Architecture** is a generic delivery framework of the Evidence Centered Design and contains four essential processes that inform the assessment

delivery whether it is carried out by humans, computers or human-computer interactions: a) the Presentation Process, b) the Response Process, c) the Scoring Process and d) the Activity Selection Process.

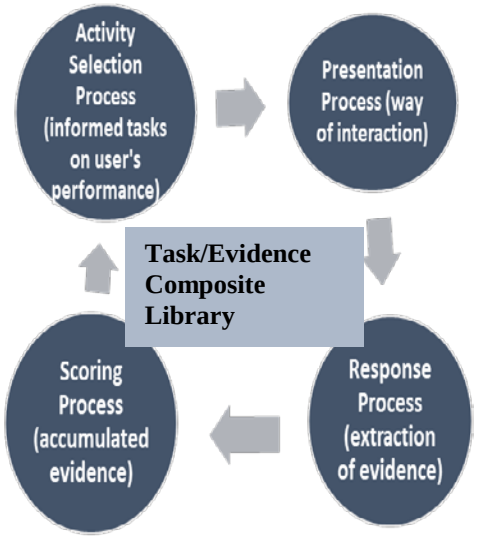

Fig. 5. The Four-process Delivery Architecture (Mislevy, et al., 2003)

The **Presentation Process** is responsible for presenting the task to the users and all supporting presentation material as well as gathering up the work products. In the P4G Business game the presentation process concerns administering simulation tasks to users. These tasks involve presenting a customized sequence of items to users and after each item capturing the response so it can be evaluated on the spot to direct the selection of the next item.

The **Response Process** is responsible for identifying the key features of the work product or the observable outcomes for one particular task which revert back to the user for task-level feedback and/or on to the summary scoring process. In the P4G Business game assessment system the response process is guided by sophisticated algorithms and consists of running automated rules on the sequence of actions carried out by their users in their effort to identify salient features and their resulting interconnection when the variable values change.

The **Scoring Process** is responsible for accumulating the observable outcomes across multiple tasks to produce section- and assessment-level scores. The P4G Business game "Manage your own company" is a simulation game between individual users or teams, where each one has the task of managing a strategic point of view their own business competing with the other in a market. The aim of the game is to maximize the value of the company, assessed in terms of operating margin, recruitment policies, and the growth rate of investment and the financial results of the company itself. It is divided into rounds, each round simulating a month of activities of the company and the market. During each round, each team or user analyzes the current situation of the company and the market, quantitatively specified by a set of "status" variables that describe precisely the situation of the company and makes decisions on the operational and strategic management of the company, assigning quantitative values to a set of "input" variables; These decisions, along with those taken by other teams and a set of control parameters assigned by the manager of the game, determine the new situation of the company and of the market. The users are assessed in their performance during their engagement in the companies' activities which are organized in three general areas: the management of supply, the production management and the management of marketing and sales which are based on the rationale of decision-result data.

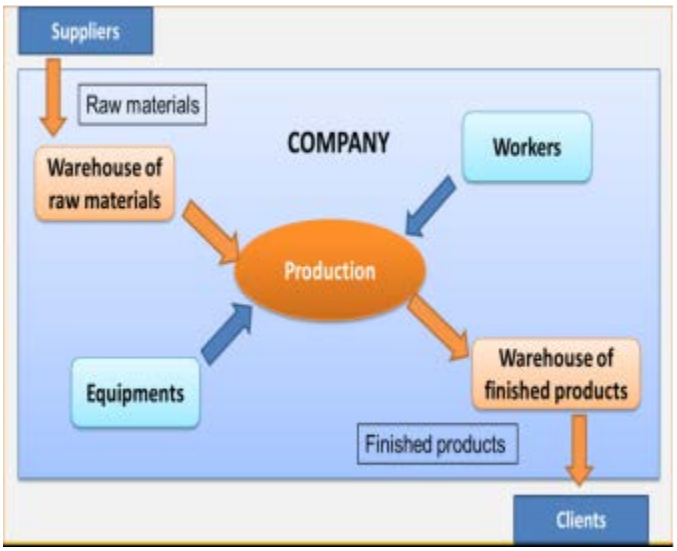

Fig. 6. The Company's activities

In the P4G Business game the different companies/teams have tools to interact directly with one / against the other since the scenario guiding the game involves business competition. Therefore, the summary scoring process involves not only the company's performance in its operating areas but also a comparative configuration against the other companies' performance.

The **Activity Selection Process** basically determines the next task or level that the user should undertake. This is accomplished with the use of data concerning the current state of the user's performance occurring by the Summary Scoring process. In the P4G Business game together with the scoring data there are also provided instruction modes and information data the user can consult but this depends on his decision. Moreover, in the game the activity selection process include both linear sequencing addressing a specific area (although the user may choose the order in which to answer items within each section as it is administered), and user choice as to which area or set of items to deal with first.

However, the operation of the Four-process Delivery Architecture could not be possible without a repository bank

that would provide all four processes with relevant data. To this aim the Task/Evidence Composite Library (shown in fig. 5) is a central element of the Delivery Architecture and consists a unified database storing essential information for all four processes.

C. *Structure of the self-evaluation tool*

The tool of self-evaluation and evaluation for guidance is designed and structured on two levels: (1) the evaluation tool operating internally and automatically as an implemented function of the P4G Business Game (internal evaluation tool) and (2) the evaluation tool operating externally in the form of worksheets (external evaluation tool). The former is implemented into the business game and automatically informs the P4G Business game players on their performance. The internal evaluation tool appears in the form of feedback provided to participants directly on the game site at the end of the game session. In addition, users' decisions and intervention on the values of the parameters implemented in the game are registered and constantly tracked to inform them on their pace of progress and enable them to make a comparative analysis. The external evaluation tool is designed in the form of worksheets that could be used as flexible supporting material by both trainees and trainers in order to enable them to evaluate more subtle competences and engage them in a more challenging tracking of their strategic decisions and their self-evaluation process.

A key element of the P4G internal evaluation tool is its structure in accommodating several functionalities-tools that enable players' self-evaluation both regarding formative and summative assessment. The former type of assessment is facilitated by the game's function to register users' decisions and intervention on the values of the parameters implemented in the game; enabling players to make a comparative analysis regarding their decisions and results and keep a track on their pace of progress. Summative assessment is implemented in the game in the form of an assessment report that appears at the end of the game sessions. This assessment report identifies and informs players on their performance on all key business competences, providing them with explicit feedback on their strengths and areas that need improvement. At the end of each match, the P4G Business game provides players with feedback on the ten selected competences (see table 2) that are addressed in the game. The evaluation system is based on 3 levels: "low", "medium" and "high", with a dedicated description for each of them. It is important to remark that the system provides a feedback on the performance of the competences during each match and not on the level of the competence of the person that is playing.

Table II. Competences automatically evaluated in the P4G BG

P4G Competences
Analytical thinking
Business acumen
Commitment to learning
Order and quality
Expertise
Flexibility
Information seeking
Innovation
Results orientation
Decision Making

In addition, the P4G Business Game functionalities-tools facilitate players' support and feedback on the development of their entrepreneurial skills and competences throughout their engagement with the game, at all stages of the game. By stages of the game, we refer to (1) the initial stage (1st round) of the game in which players are presented with the initial value of their company and a set of "input" variables and control parameters, addressing the operational and strategic management of the company; players engaged in this market simulation game are encouraged through the support of data and visual graphs to consider and reflect upon them in order to make informed decisions, (2) the intermediary stages (2nd-12th rounds) in which players are guided through the "General view" and 'Decision History' tools (fig. 3) to make informed decisions on control parameters by displaying data from all the rounds already played in the current session and (3) the last stage (12th round) in which players are provided with a holistic and analytical assessment report on the level of their competences development.

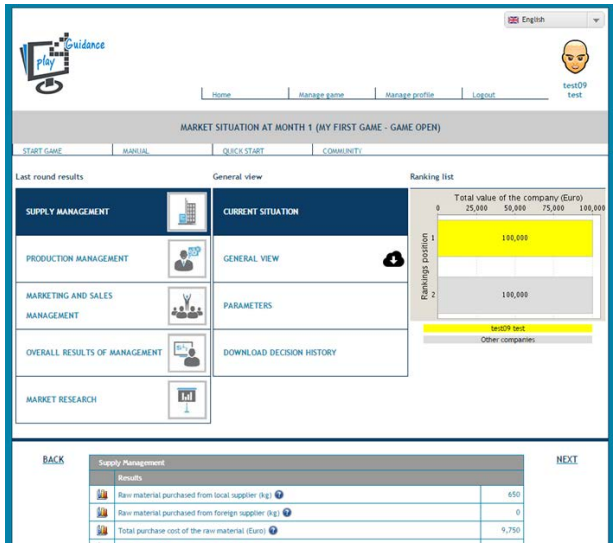

Fig. 7. Display of the General view and 'Decision History' tools

The P4G External Self-evaluation tool appears in the form of worksheets and/or scenarios and it guides the self-evaluation process around 3 thematic areas: (1) the Pedagogical approach of strategic planning, (2) the Self-evaluation of learning goals and skills, (3) Summative assessment and (4) the Course Evaluation Questionnaire. The thematic areas and items of the self-evaluation tool are designed in a flexible way to facilitate their use in different contexts and by addressing all target groups. The External

Self-evaluation tool is uploaded in the P4G platform (http://play4guidance.eu/) in a printable version to enable its accessibility and practical use by both trainers and learners.

V. Discussion- Validation of the Evaluation Tool

The self-evaluation tool is one of the core elements of PLAY4GUIDANCE Business Game and it aims to provide users with simple and clear feedback they can use to self-evaluate their skills and competences by being engaged in the game. The self-evaluation tool may be also used as a tool for evaluation and guidance by P4G indirect target groups and stakeholders (centres for guidance, employment centres, SMEs and personnel of companies, etc.). The self-evaluation tool provides feedback on: (1) how the users (teams and/or single players) have managed their company, (2) several types of managing such as managing investments, managing workers and training, managing production, managing sales, managing supplies, etc. and (3) skills and/or competences that users should strengthen.

A core element in the validation of the evaluation tool was its examination and testing through pilots and national conferences conducted in all participating member countries of the project and addressing all target groups: students, unemployed, stakeholders. The findings from the testing phase have shown a positive level of reliability of the P4G Evaluation tool in assessing the ten competences selected. Participants of all target groups validated the tool's main objectives in assessing and guiding players on the basis of the ten embedded competences in the P4G BG. In order to be the winner in the game, players must apply all relative competences and skills. It is also highlighted the positive aspect of the evaluation tool for enhancing self-reflection. Players are guided in the identification of the various interconnected variables and the impact their decisions have on the different aspects of management. The evaluation tool identifies their strengths and weaknesses and supports them in planning improvement strategies in the next rounds of the game. This way they become more focused on putting more effort in areas where they identify their weaknesses.

The evaluation process of the assessment tool had been designed together with the pilot. The reporting tools that partners had to use to record data, in synthesis are: a) the Direct observation table, b) the Focus group, c) the Ex-ante survey and d) the Final survey. They are fully integrated in the whole evaluation process, considering the assessment tool as part of a training and guidance system.

The first pilot with stakeholders as test users has been a fundamental step to verify the choices taken by the partnership. We presented to teachers, educators, HR and recruitment managers the whole list of the competences and we asked them which had been addressed by the P4G Business Game. They could vote with a range from "1 – completely disagree" to "5 – fully agree". The result had been encouraging because the competences selected by the partnership had obtained very good scores.

During the pilots some differences appeared when comparing the different target groups involved. As shown in the table below, the evaluations to the question "Are these competences addressed by the P4G business game?" have positive and similar ratings, but the pick decreases with the level of instruction/experience.

Table III. Results of the question "Are these competences addressed by the P4G business game?" for each target group.

Target groups	Analytical Thinking	Business Acumen	Commitment to learning	Order and Quality	Expertise	Flexibility	Information Seeking	Innovation	Results Orientation	Decision Making	**Average**
Stakeholder	3,52	3,29	3,31	3,05	3,22	3,33	3,60	3,29	3,63	4,00	**3,42**
High School	3,58	3,59	3,49	3,41	3,38	3,32	3,52	3,60	3,53	3,98	**3,54**
Unemployed	3,45	3,47	3,60	3,39	3,35	3,49	3,46	3,46	3,61	3,77	**3,50**
University	3,42	3,47	3,39	3,45	3,16	3,31	3,56	3,47	3,53	3,82	**3,46**
Average	**3,49**	**3,46**	**3,45**	**3,33**	**3,28**	**3,36**	**3,54**	**3,45**	**3,57**	**3,89**	**3,48**

In addition, sensitive differences can be found in the evaluation from one country to another. This comes partially from the cultural differences, but most from the different settings and scenarios that have been selected by each partner involved. This situation has allowed our research to cover a wider spectrum of situations.

In any case, according to the project's objectives, the findings from the pilots and the national conferences have been totally considered towards the improvement of the system and the further development of the P4G BG. Therefore, the innovative evaluation mechanism that is embedded in the business game enhances the learning process by providing trainees with direct feedback and enabling them to proceed in the next rounds with a clear view on the managerial areas and relevant competences that he should improve. In addition, the evaluation tool consists a valuable teaching exploitation source for trainers who can use the deriving information to highlight the interconnected business areas and parameters and the effect that players decisions have on them. The qualitative and quantitative data provided by the tool become a powerful teaching and learning source and informed report of the players' performance.

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