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RESEARCH ARTICLE OPEN ACCESS

PROPOSAL FOR AN INTEGRATED EVALUATION MODEL FOR EDUCATIONAL GAMES BASED ON MEEGA+ AND ITS IMPLEMENTATION IN A THREE-YEAR ACADEMIC PROGRAM FOR ENVIRONMENTAL EDUCATION FOR SUSTAINABLE DEVELOPMENT

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ABSTRACT

Game-based or play-based learning offers particularly positive results, combining learning and entertainment. Educational play in any form effortlessly introduces the participants to the learning processes, while maintaining high levels of interest and satisfaction. The value of the modern game lies in its great attractiveness. In contrast to traditional learning processes, which are compulsory and rarely fun, children and adults, without having to, spend many hours in these modern forms of entertainment, which are fascinating and seductive. Especially in the programs of Environmental Education and Education for Sustainable Development, the use of games is an excellent choice, which contributes to the achievement of the set goals. In this context, a six-month course was designed in the Postgraduate Program "Environmental Education" of the University of the Aegean, which taught the design and evaluation of educational board games. This course was repeated for three years, resulting in the creation of about sixty original board games, focused on teaching how to balance economics and ecology. At the same time, a complete evaluation model of board games was designed, based on the MEEGA+ model, which was successfully applied in the evaluation of specific games. From the analysis of the research data, the beneficial contribution that educational board games have in achieving the goals set in the context of lifelong learning, but also the effectiveness of their proposed evaluation model, which covers a wider range of this issue and shows clearly greater validity, was proven.

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INTRODUCTION

The value of the modern game is located in its attractiveness. Unlike traditional and mandatory learning procedures, which are rarely entertaining, participants spend a lot of time with such modern entertainment formats (Fasli & Michalakopoulos, 2005). The concept of lifelong education can be summarized in the fact that all people of all ages are in a process of continuous learning, which due to its permanence becomes more enjoyable and effective if the learning time can be combined with entertainment (Bagust, 2008, Jones, N.2007). This redefinition of perspective has also affected play, which through its different aspects effectively contributes to achieving the goals set in a pleasant learning environment (Georgopoulos and Tsaliki 2003, Caillois, 1992). In order to study how design, development, and evaluation of educational board games can fit into Higher Education, a semester course teaching this specific thematic was designed in the Graduate Program "Environmental Education" at the University of the Aegean in the course of "Design, Implementation, and Evaluation of Environmental Education Programs". The course was taught in the spring semester in three consecutive years of study. The outline of the course included the teaching of the feasibility study to create social games, the design and manufacturing of a draft in detail, and the assessment with the proposed new model, which was based on an update of the older computer model MEEGA+ (Moustakas, 2020). From the students' deliverables, a collection of about sixty original educational board games was created, which in most cases were made with reusable materials and aimed at promoting a balanced model of economic development and ecological conservation, in the model of sustainability. These games were evaluated with the proposed evaluation model MEEGA++, (relevant research data are listed below) and were included in a Greek-language three-volume collective edition, in which all the details of the project were analyzed (Moustakas, & Fokiali, 2018a, Moustakas, & Fokiali, 2018b, Fokiali, & Moustakas, 2017). For the evaluation of board games, the creation of an evaluation model was the basis of which was the model MEEGA+ (Model for the Evaluation of Educational

studied, Games), which places great emphasis on the player experience and perceptual learning. At the same time, however, elements and parameters of other models and theories were included, such as (Florou, 2017):

- Structural features, which make a game attractive according to Prensky, (Prensky, & Meimaris, 2009).
- Features of Rogers' theory of diffusion of innovation, influencing the adoption of educational games.
- Model of learning through serious games, (Yusoff, 2009).
- Classification categories of serious games, (Breuer, & Bente, 2010).
- Stages of systematic evaluation of educational games, Giani Petri, & Gresse von Wangehheim, 2017).
- GameFlow model evaluation criteria (Sweetser, & Wyeth, 2005).

The research results were initially discussed in an open day, which was held to inform the teachers of Rhodes at the Butterfly Environmental Training Center, during which the findings of the research effort were presented and a large number of educational board games were exhibited.

THEORETICAL FRAMEWORK

Serious games: Great theorists of modern education, such as John Dewey, Maria Montessori, and Johan Heinrich Pestalozzi, have highlighted the need for a different type of education based on the experience of the learner, in a pleasant and attractive context. Game-centered learning is an educational activity organized in the form of play, combining learning and entertainment (edutainment). It includes a) a scenario, which creates a virtual environment and specific conditions, involving the student in a targeted experience, and b) the learning mechanism, which activates the student's learning processes and contributes to the achievement of the set goals (Michael, & Chen, 2006). An important factor in the success of designing an educational game is the relationship between the script and the learning mechanism. In order to maintain a high degree of "edutainment", ie an ideal combination of education and entertainment, the learning mechanism must be integrated into the script and the general "experience" (gameplay), for the interested party to learn while playing. The games have some typical characteristics, which define and shape their structure and design, such as the goals, the number of participants and their role, the environment, the rules, the rewards and the penalties, the conditions of victory or defeat, etc. a. (Salen, & Zimmerman, 2003). In particular, according to Alessi and Trollip (2001) these characteristics of games are (Konzack, 2002):

- The goals, which logically pre-exist the game and shape its very existence. The objectives can be known from the beginning or be disclosed to the players throughout the course of the game.
- The rules define the same frame and shape the experience and everything required for the proper development of the game.
- Scenario refers mainly to the plot, which is associated with all the parameters of the game.
- Feedback, the ability of a game to be varied as a result of the player choices.
- Competition is the basis of a game, according to which each player competes with themselves, their teammates, some "machine" or time.
- Security is a feature of a game, offered through the simulation procedure as it allows players to experiment in a safe environment.
- Space or the environment in general, directly perceived or imaginary, is determined both by the structural integrity, and the imaginary framework, created by the game scenario.
- Time is one of the most important parameters of games.
- Interaction is directly related to the overall experience of the players and includes two levels, the individual, that is, the player's relationship with the game material, and the social, which refers to the player's relationship with the other participants, when they exist.
- The instructions are an extension of the rules of the game and are usually given at the beginning, without of course precluding their progressive provision during the development of its plot.
- The options offered (mainly in electronic games) provide the ability to customize and adapt the games to the characteristics and interests of the players.
- Knowledge can be offered from the outset, be it either overt or hidden, or be discovered slowly by repetition and soaking up the game's strategy.

The term "serious games" originated from the field of video games in trying to distinguish some of them, which target not just pure entertainment but serve some "serious" objective. The definition of the term "serious games" often varies. Clark Abt (1970) perceives them mainly as MATHEMATICS games, which can be used at school, while Abt as games that support a serious target in a fun environment (Laamarti, Eid, & Saddik, 2014). For Zyda (2005) Serious Games is more of a mental contest, conducted according to specific rules and communication strategies in a fun context to achieve specific educational goals (Zyda, 2005). For Zyda in serious games, the pedagogical purpose is subordinate to the story and the component of the entertainment comes first (Susi, Johannesson, & Backlund, 2007). Serious games combine fun with learning and thereby are very connected to the term «Edutainment», derived from the composition of the English words «education» and «entertainment» and refer to every effort to make learning more fun (Breuer & Bente, 2010). Given that serious games are used in various fields, are based on different learning approaches, are implemented in different environments, and of course deal with various issues, it is extremely difficult to identify and classify them, and therefore no system is fully accepted (Breuer & Bente, 2010). The most commonly used criteria are the type, educational content, and scope of the game. Prensky mentions eight kinds of games, such as action games, adventure games, fighting games, puzzle games, role-playing games, simulation games, sports games, and strategy games (Prensky & Meimaris, 2009). Patrick Felicia (Patrick, 2011) found that existing classifications use a small number of criteria and proposed a comprehensive classification system for these games, which he calls "The Gameplay/Purpose/Scope(G/P/S) model" and take into account both dimensions of serious games, namely fun and learning.

Evaluation of educational games: For (Panagiotakopoulos, Pierrakeas, & Pintelas, 2003), evaluation is a systematic collection, analysis, and interpretation of data, referred to all the factors that determine a product to determine the effectiveness and efficiency of the whole or individual parameters. In this case, the evaluation of an educational intervention is designed to measure the level of success by evaluating the rate of achievement goals, that were set and that includes, besides learning, all the features that make it up (Branch, 2009).

Types of evaluation: The evaluation may be cumulative, accounting, or summative when carried out at the end of a training process to evaluate the final product. In this case, the overall achievements are being examined to ascertain whether and to what extent an educational intervention achieved its objectives (Thomas Connolly et al, 2009). Conversely, an evaluation is formative when applied over the entire duration of the training procedure, continuously monitoring its course. Formative evaluation is the evaluation of the process itself and it is trying to identify the factors that need dynamic improvement during the effort.

Characteristics of the ideal evaluation framework: According to (Mayer, 2012) an effective evaluation framework for serious games should include the following features:

- Broad in scope.
- Comparative.
- Standardized.
- Specific.
- Flexible.
- Triangulated.
- Validated.
- Multi - leveled.
- Fast and non-time consuming.
- Multi-purposed.
- Expandable.
- Unobtrusive.

A further systemic evaluation with the empirical study format according to Giani Petri & Gresse von Wangenheim, (2017) includes the following phases:

- Scoping.
- Planning.
- Operation.
- Analysis.
- Interpretation.
- Presentation & package.

Models and Evaluation Scales

Kirkpatrick's four-level framework: Kirkpatrick's evaluation framework consists of four levels and is a framework that was developed to be assessing training and was the theoretical background of many evaluation frameworks of educational games. Kirkpatrick's evaluation framework includes the following levels (T. Connolly et al., 2008):

- **Level 1:** Includes the **Reaction,** which refers to the reaction of the participant in the educational game in our case and is related to the evaluation of the degree of satisfaction and emotions in general.
- **Level 2:** This level focuses on **Learning and** concerns the increase of their knowledge and skills as well as the change of attitudes of the learner.
- **Level**: The 3rd level of the evaluation framework focuses on the behavioral changes (**Behavior**) of the employee as a result of the educational process.
- **Level 4:** Refers to the **Results,** as a continuation of the previous level, examining the (positive) effect that is derived from the changes in the trainee after the educational intervention.

The GameFlow model that aims to evaluate enjoyment: (Fu et al., 2009) report that according to Bernhaupt, Eckschlager, and Tscheligi (2007) a viable idea for evaluating the user experience in games is the GameFlow model. The GameFlow model was the idea of Sweetser and Wyeth (Sweetser & Wyeth, 2005) and combines the use of several heuristic information (heuristics), usability, and positive user experience. Csikszentmihalyi considering enjoyment as a concept similar to the concept of flow proposed the GameFlow model, which includes eight elements that could cause the experience of flow and hence shape the user experience. The elements in the GameFlow model are concentration, challenge, skills, control, immersion, clear objectives, social interaction, and feedback (Sweetser & Wyeth, 2005).

The EGameFlow scale: It was developed to measure the enjoyment of the learner in e-learning games and incorporates this concept of flow, as a model of evaluation of players' pleasure (Fu et al, 2009). The GameFlow scale focuses more on improving the skills of users, failing to adequately describe the increase in knowledge. The EGameFlow scale (Fu et al, 2009) is a questionnaire measuring subjective views, regarding the advantages of a game mainly from the standpoint of users' pleasure and comprises eight dimensions:

- Concentration.
- Clear goals.
- Improving knowledge.
- Challenge.
- Autonomy.
- Feedback.
- Immersion.
- Social Interaction.

The MEEGA model: The MEEGA model (Model for the Evaluation of Educational Games) of Savi, Wangenheim, & Borgatto, (2011) is a well-defined educational games evaluation model, which offers a holistic assessment of the quality of educational games (Giani Petri, etc.., 2016). It is widely used and measures the reaction of the participants after the completion of the student's participation in the game, using a standard questionnaire. It is a short process, which offers a quick evaluation, without requiring educators to have academic knowledge of educational theories, evaluation theories, and statistical analysis of research data. It aims to evaluate a particular educational ordination game in terms of the motivation offered to participants, the overall user experience, and of course learning, which is the main target of any educational game. Concerning the first agent, motivation, the analysis is performed having ARCS of Keller as the base model, the name of which is the acronym of factors Attention, Relevance, Confidence, and Satisfaction.

The MEEGA+ model: Although the MEEGA model has been developed greatly and is a "mature" educational games evaluation tool, Giani Petri et al. developed the sophisticated model MEEGA+, which includes variations, obtained after evaluating the validity of the conceptual construction and the reliability of the measurement method of the initial model (Giani Petri et al, 2016). At the same time, the new model aims to determine the measurement tool for evaluating the perceived quality of educational games, emphasizing on the one hand on the player experience and the other hand on perceived learning. Regarding the player experience, which is the main factor for "upgrading" the model, the quality factor is established as a term which refers to the "deep" participation of users and contains among other things the feelings, the enjoyment, and the interactions with the game itself, the other players, and the environment. The player experience is determined by the following eight characteristics, such as (Giani Petri et al., 2016):

- Fun.
- Challenge.
- Focused Attention.
- Satisfaction.
- Confidence.
- Social interaction.
- Relevance.
- Usability.

The proposed MEEGA++ model: The proposed MEEGA++ model uses the general framework of the MEEGA+ model by Giani Petri et al. (2016) as a basis, but trying to give more weight to the validity of the tool by introducing more parameters in each evaluation axis of educational games. In particular, the reformed MEEGA++ model includes nine general game evaluation axes and a tenth that refers exclusively to educational games for the environment and sustainable development. These axes - parameters are (table 1):

- The game type.
- The theme and scope of the game.
- The purpose and goals.
- The scenario.
- The interaction.
- The experience.
- Construction.
- Learning.
- The ability to customize and

- Supporting the objectives of Environmental Education and Education for Sustainable Development.

The first factor refers to the type of game and may include knowledge, luck, strategy, role-playing, card games as well as combinations of them in board games, electronic games, puzzle games, etc. The thematic and scope factor records the category of the subject and assesses the attractiveness of the thematic and title. In the section of purpose and objectives, the objectives and the desired results are evaluated, paying special attention to the clarity and progressiveness of the objectives. An important factor is a scenario, which is largely what can grab the participants' attention and allow the game make them achieve their educational goals. In this context, its attractiveness, originality, outcome, level of simulation, and complexity are evaluated. At the same time, importance is given to the stimuli it offers, to the level of challenge and involvement of the participants, but also to the rules that govern it, luck and achievements. The next evaluation factor of the proposed model is interaction, which evaluates the possibilities and how the participants can interact with each other, but also with the game. This section lists feedback and rewards, player control and sense of control, the effects of mistakes, and social interaction. The next factor evaluates the overall experience of the educational game. In particular, the interest, the fun it offers, the emotional involvement of the players in relation to the immersion - absorption that it causes is recorded. At the same time, the ease, the attention required, the duration as well as the fatigue caused by the game to the players are evaluated. The same section includes the level of competition, confidence building, and quality of instruction. The construction of the game is the next evaluation factor and refers to its quality and aesthetics, design, selected materials, dashboard or interface for electronic games, functionality, usability, auxiliary material, and of course its cost. Learning is an important factor in educational games. In this field, the principles of learning and the educational content of the game are identified as well as the possibilities for improving the knowledge and the skills they offer. Problem-solving strategies, progressiveness, support, memory activation, and maintaining cognitive engagement also play an important role. The last evaluation factor is the adaptability of the game to the particularities and interests of the player. This includes the existence of graded levels, the progressiveness, the adaptation of the game to the number of players, but also the possibility of participation for People with Special Needs. In the case of the evaluation of games created for the environmental awareness and education of the participants, in addition to their evaluation, the support of the principles of environmental education and education for sustainable development is checked. Their contribution to environmental awareness and the acquisition of environmental knowledge, skills, and attitudes is evaluated. At the same time, an important factor is the emergence of real environmental problems and the process of solving these problems.

METHODOLOGY

Research methodology: The methodological planning of this research intervention included on the one hand the application of this course to undergraduate and postgraduate students of the Department of Preschool Education and Educational Planning of the University of the Aegean for four years from 2016 to 2020 and on the other hand the creation of educational board games.

For the evaluation of the effort in the context of the first axis, the following was used:

- Observation of the general picture and the co-operation of the participants, in particular during the design, construction, and testing phase of board games;
- Evaluation of game parameters; and
- Application of an experimental scheme of multiple measurements (BEFORE - AFTER) for the evaluation of the acquired knowledge.

Table 1. Board games quality features category and their Evaluation parameters

Category board games quality features	Evaluation parameters For educational board games
GAME TYPE	Game type
THEMATIC - SCOPE	Thematic
	Theme attractiveness
	Title
	Thematic index
PURPOSE - OBJECTIVES	Purpose
	Objectives - Aimed results
	Clarity of objectives
	Progressive goals
	Target group
	Targeting index
Scenario	Scenario attractiveness
	Outcome
	Originality
	Simulation level
	Complexity
	Analysis
	Stimuli
	Challenge
	Involution
	Luck
	Rules
	Achievements: Score - resources - time etc.
	Scenario index
INTERACTION	Interaction
	Feedback
	Rewards
	Player control
	Sense of control
	Forgiveness of mistakes
	Social interaction
	Interaction index
EXPERIENCE	Overall experience
	Interest
	Fun
	Emotional involvement
	Immersion - Absorption
	Ease
	Fatigue – Workload
	Caution
	Competition
	Feedback
	Duration - Time
	Self-confidence
	Well written instructions
	Experience index
CONSTRUCTION	Quality of construction
	Aesthetics
	Selection of materials
	Dashboard
	Planning
	Functionality
	Ease of use
	Auxiliary material
	Cost
	Construction index
LEARNING	Learning principles
	Educational content
	Improving knowledge
	Improving skills
	Problem-solving strategies
	Progressiveness
	Memory activation
	Maintaining cognitive engagement
	Support
	Relevance
	Challenge
	Learning index
ADAPTABILITY	Ability to adapt to the level of the player-team
	Existence of levels
	Progressiveness
	People with Disabilities - Problems
	Adjustable number of players
	Adjustment index
Overall game quality index	

EDUCATION FOR SUSTAINABLE DEVELOPMENT	Principles of Environmental Education
	Principles of Education for Sustainable Development
	Contributes to environmental awareness
	Contributes to the acquisition of environmental knowledge
	Environmental problem
	Problem-solving process
	Environmental indicator

Table 2. Evaluation model of educational board games

Category Quality Features	Parameters for evaluating educational board games	Measurement	M.O. Content Validity Check	Three-year research Games evaluation
GAME TYPE	Game Type	Category	4.4	-
THEMATIC - SCOPE	Thematic	Thematic	4.3	-
	Theme attractiveness	1-5	4.5	4.0
	Title	1-5	4.2	4.0
	Thematic index	MO 1-5	4.4	4.0
PURPOSE - OBJECTIVES	Purpose	Description	4.8	-
	Objectives - Aimed results	1-5	4.7	4.0
	Clarity of objectives	1-5	4.3	4.0
	Progressive goals	1-5	3.8	3.1
	Target group	Description	4.0	-
	Targeting index	MO 1-5	4.3	3.7
SCENARIO	Scenario attractiveness	1-5	4.5	3.8
	Outcome	1-5	3.5	3.8
	Originality	1-5	4.3	4.0
	Simulation level	1-5	3,4	3.6
	Complexity	1-5	3.6	3.6
	Analysis	1-5	3.1	3.6
	Stimuli	1-5	3.5	3.7
	Challenge	1-5	3,4	3.7
	Involution	1-5	3,4	3.8
	Luck	1-5	3.9	3.7
	Rules	1-5	4.2	4.4
	Achievements: Score - resources - time etc.	1-5	4.0	3.8
	Scenario index	MO 1-5	3.7	3.8
INTERACTION	Interaction	1-5	4.1	3.9
	Feedback	1-5	4.4	3.8
	Rewards	1-5	4.0	3.7
	Player control	1-5	3,4	3.1
	Sense of control	1-5	3,4	3.1
	Forgiveness of mistakes	1-5	3.3	2.7
	Social interaction	1-5	3.8	3.9
	Interaction index	MO 1-5	3.8	3.5
EXPERIENCE	Overall experience	1-5	4.8	3.8
	Interest	1-5	4.5	3.9
	Fun	1-5	4.8	3.9
	Emotional involvement	1-5	3.9	3.6
	Immersion - Absorption	1-5	3.5	3.7
	Ease	1-5	4.1	4.2
	Fatigue - Workload	1-5	4.3	4.0
	Caution	1-5	3.6	4.0
	Competition	1-5	4.4	3.9
	Feedback	1-5	3.3	3.3
	Duration - Time	1-5	4.2	3.8
	Self confidence	1-5	4.0	3.8
	Well written instructions	1-5	4.9	4.3
	Experience index	MO 1-5	4.2	3.9
CONSTRUCTION	Quality of construction	1-5	4.9	4.0
	Aesthetics	1-5	4.7	4.0
	Selection of materials	1-5	4.6	4.1
	Dashboard	1-5	4.8	4.0
	Planning	1-5	4.5	4.0
	Functionality	1-5	4.2	4.1
	Ease of use	1-5	4.3	4.2
	Auxiliary material	1-5	4.4	4.2
	Cost	1-5	4.8	4.1
	Construction index	MO 1-5	4.6	4.1
LEARNING	Learning principles	1-5	4.5	3.5
	Educational content	1-5	4.6	3.8
	Improving knowledge	1-5	4.7	4.1
	Improving skills	1-5	4.4	3.1
	Problem solving strategies	1-5	4.1	2.8
	Progressiveness	1-5	3.6	3.1
	Memory activation	1-5	3,4	3.9
	Maintaining cognitive engagement	1-5	3.9	4.0
	Support	1-5	3.8	3.7
	Relevance	1-5	3.6	4.0
	Challenge	1-5	3.5	3.7
	Learning index	MO 1-5	4.0	3.6
ADAPTABILITY	Ability to adapt to the level of the player-team	1-5	4.4	3.3
	Existence of levels	1-5	4.2	2.9
	Progressiveness	1-5	4.3	3.1
	People with Disabilities - Problems	1-5	4.9	1.1
	Adjustable number of players	1-5	4.8	3.5
	Adjustment index	MO 1-5	4.5	2.8
Overall game quality index		1-5	4.2	3.7
EDUCATION FOR SUSTAINABLE DEVELOPMENT	Principles of Environmental Education	1-5	4.8	3.8
	Principles of Education for Sustainable Development	1-5	4.6	3.7
	Contributes to environmental awareness	1-5	4.9	4.1
	Contributes to the acquisition of environmental knowledge	1-5	4.8	4.1
	Environmental problem	1-5	4.5	3.0
	Problem solving process	1-5	4.0	2.4
	Environmental indicator	MO 1-5	4.6	3.5

During these four years, 205 students participated in the courses, 160 in the Postgraduate program and 45 in the Undergraduate program, of which 67% were women and 33% were men. At the observation stage for the analysis of the general picture and the cooperation of the students, a qualitative analysis of the content of the recorded information was carried out. To evaluate the parameters of the games, each game was evaluated by the research coordinators according to the parameters of the proposed MEEGA++ model, which is calibrated to a gradation scale of five (5) grades, the first corresponds to the worst rating and the fifth to the best. At the end of the educational process, the games were also evaluated by the students with a grading scale of five (5) grades, where the first corresponds to the worst grade and the fifth to the best and were checked and then a correlation analysis of the two values was performed, that of the researchers according to the MEEGA++ model and that of the participating students, who played the games according to Pearson's r. In the context of the experimental research of multiple measurements, the knowledge of the students at the testing stage of the games was evaluated, once before the start of the game and once after to test the acquisition of the cognitive goal of the games with "right-wrong" questions. In this case, the analysis was performed per question with the McNemar statistical criterion, while the overall comparison was performed with the Wilcoxon statistical criterion, as it was found with the Kolmogorov – Smirnov criterion, that the prices did not follow a normal distribution (p <,05) (Tsaousis, Roussos, 2012). Regarding the second axis, the effort was focused on the bibliographic research of the relevant theories and the analysis of the existing evaluation models as well as on the control of the content validity of the proposed model. The analysis of the results of the design process of the assessment tool, in which all the students participated, revealed the absence of several parameters, which limit the holistic description, especially in the sections describing the scenario, the experience, the construction, the learning, and the adaptability. At the same time, the level of validity of the existing and proposed parameters was checked, through the evaluation of their importance, with the provision of a research tool, which consisted of a five-point evaluation scale of each parameter, (1 = "Not at all important", 2 = "A little important", 3 = "Moderately important" 4 = ”Very important" and 5 = "Most important") and also an open-ended question for each case. The parameters that are considered important and are selected from this tool are the ones with an average of over 3.5, ie over 70% of the rating. Also important was the contribution of the participants' observations for each parameter, a process that contributed to their identification, improvement, and finally to their selection in the proposed model (Tsaousis 2012).

RESULTS

Regarding the second axis, which refers to the design of an evaluation model for educational board games, from the analysis of bibliographic data, but also the prices of M.O. of the evaluations of the participants in the context of content validity control, the following integrated evaluation model was formulated. The proposed MEEGA++ model, (presented in Table 2), includes the definition of the game type, the objectives, and the parameters related to the scenario. The following are characteristics that determine the type and level of interaction and the overall experience of the players as well as the construction and the ability to adapt the games to the prevailing conditions. Finally, an important section is the one that refers to learning, while an additional one was added to evaluate the support of the objectives of Environmental Education and Education for Sustainable Development. From the analysis of the results of the evaluation of the games that were developed by the Postgraduate students during the three years, the games were evaluated with a total of 3.7 (with a lower value of 1 and a higher value of 5). In the field of application, the index was 4.0, in the field of targeting the planned games were evaluated with 3.7, while in terms of the scenario with 3.8. Encouragement of interaction was assessed at 3.5 and overall experience at 3.9, while significant work was recorded in the construction sector, where the games were rated 4.1.

In the field of learning, both the general index and the index which referred to the Education for Sustainable Development were 3.6. Finally, the lowest rating, of course over 50% of the scale, was recorded in the index for the possibility of adapting the games to the respective conditions, with a value of 2.8. From the analysis of the research data of the evaluations of the students who participated in the research, it seems that the specific games were evaluated as particularly remarkable (M.O. 3, 9), while the value of the degree of correlation of the two evaluations, that of the researchers according to the MEEGA++ model and that of the participating students, who played the games, was r =,826, which indicates a very high relationship between the values of the two measurements and consequently that the MEEGA ++ model has high levels of validity.

CONCLUSION

The value of an educational game is located in its attractiveness, unlike traditional learning processes, which are obliged and forced. In this context, a six-month course was designed, which comprehensively teaches how to design, build, evaluate, study and experimentally test the effectiveness of educational board games. From the whole process, it can be concluded that this educational intervention is an excellent teaching experience, which contributes, in addition to achieving the cognitive goals, to the cultivation of cooperation and the development of creativity. At the same time, it seems that the proposed course, for the teaching of how to design and implement educational board games in Higher Education can be applied with very good results in both the Undergraduate and Postgraduate Programs of Pedagogical Departments. The model manages to describe - holistically evaluate educational games, covering more dimensions and aspects than previous evaluation models. Regarding the design of the evaluation model of games of this kind, our integrated MEEGA++ model shows higher levels of validity and therefore describes the issue more fully. Finally, from the evaluation of the specific games, that were developed in the courses during these four years, it seems that students should be encouraged to invest more in the field of adapting the games to the characteristics of the teams and players, and especially to the needs of People with Disabilities, a parameter that recorded the lowest value in the evaluation.

REFERENCES

Alessi, M. S. and Trollip, S. R. 2001. Multimedia for learning: methods and development. Boston, MA: Pearson Education.

Andreopoulou, P. and Moustakas, L. 2019. Playful Learning and Skills Improvement. Open Journal for Educational Research, 3 1 , 25-38.

Bagust, P. 2008. Journal of Media & Cultural Studies 22, No. 2, pg. 213–226.

Bali, M. 2016. 9 Mistakes to Avoid When Designing Educational Games. Connected Learning in Teaching Practice.

Bachvarova, Y., Bocconia, S., Van der Polsa, B., Popescuc, M. and Roceanuc, I. 2012. Measuring the effectiveness of learning with serious games in corporate training. Procedia Computer Science 15 2012 221 – 232.

Boocock, S. S. and Coleman, J. S. 1966. Games with simulated environments in learning. Sociology of Education, 39, 215-236.

Branson, R.K. 1978. The interservice procedures for the design of instruction. Pittsburgh: American Institutes for Research.

Caillois, R. 1992. Les jeux et les homes. Paris: Gallimard, pg. 42-43.

Clark, D., Tanner-Smith, E. and Killingsworth, S. 2014. Digital Games, Design and Learning: A Systematic Review and Meta-Analysis. Menlo Park, CA: SRI International.

Dimitriadis, S. 2015. Learning theories and educational software. Game-centered Learning. Athens: Association of Greek Academic Libraries. In Greek.

Georgopoulos, A. & Tsaliki, E. 2003. Environmental education. Athens: Gutenberg, pp. 71–75. In Greek.

Fasli, M. and Michalakopoulos M., 2005. Supporting Active Learning Through Game-like Exercises, Proceedings of the Fifth IEEE International Conference on Advanced Technologies ICALT'05.

Fokiali, P. and Moustakas, L. 2017. Design and production of games as educational tools in the context of lifelong learning I. Collective Volume. Thessaloniki: K. & M. Ant. Stamouli. In Greek.

Jones, N. 2007. A Visual Anthropological Approach to the "Edutainment" of BODY WORLDS. The American Journal of Bioethics, 7, 4 pg. 40 — 42.

Kiilia, K., Freitasb, S., Arnabb, S. and Lainema, T. 2012. The Design Principles for Flow Experience in Educational Games. Procedia Computer Science 15 2012 78 – 91.

Kotsidou, D. 2016. Utilization of the process of designing board games in the learning process of preschool education: Development, implementation and evaluation of an educational online guide. University of Piraeus Department of Digital Systems. In Greek.

Konzack L. 2002. Computer Game Criticism: A Method for Computer Game Analysis.

McFarlane, A., Sparrowhawk, A. and Heald, Y. 2002. Report on the Educational Use of Games. TEEM Teachers Evaluating Educational Multimedia.

Michael, D. R. and Chen, S. 2006. Serious games: Games that educate, train, and inform. Thomson Course Technology.

Moustakas, L. 2020. Design of an Educational course in Higher Education for teaching thw Design and creation of educational games. International Journal of Innovation and Research in Educational Sciences, 7 3 , 192-207.

Moustakas, L. and Fokiali, P. 2018. Board games and lifelong learning. Design, construction and evaluation. Editing a Collective Volume. Thessaloniki: K. & M. Ant. Stamouli. In Greek.

Moustakas, L. and Fokiali, P. 2018. Design and production of games as educational tools in the context of lifelong learning II. Editing a Volume. Thessaloniki: K. & M. Ant. Stamouli. In Greek.

Moustakas, L. and Tsakiris, I. 2018. Game as a Learning Tool in Environmental Education. International Journal of Innovation and Research in Educational Sciences, 5 6 , 645-649.

Prensky, M. 2001. Digital Game-Based Learning. New York: McGraw-Hill.

Prensky, M. 2003. Digital game-based learning. ACM Computers in Entertainment, 1 1 , 1-4.

Piaget, J. 1951. Play, dreams, and imitation in childhood. New York: W.W. Norton & Company.

Price, S., Rogers, Y., Scaife, M., Stanton, D. and Neale H. 2003. Using 'tangibles' to promote novel forms of playful learning. Interacting with Computers, 15 2

Resnick, M. 2007. Sowing the seeds for a more creative society. Learning and Leading with Technology. Retrieved July 27, 2021, from website http://web.media.mit.edu/~mres/papers/Learning-Leading.pdf

Richard, B. 2007. Does Game-Based Learning Work? Results from Three Recent Studies. Advanced Distributed Learning. 1 1 , 1-12.

Salen, K. and Zimmerman, E. 2003. Rules of Play: Game Design Fundamentals. Cambridge, MA: The MIT Press.

Tavoulari, Mr. 2011. Solving authentic problems through collaborative writing in a 2.0 Web environment in higher education. Postgraduate work. Piraeus: University of Piraeus.

Van Rooij, R. 2007. The 5/10 Method: A method for designing educational games. Netherland: Utrecht University

Vincent, A., Eben, M., Matthew, E. and Amy, O. 2010. Toward a framework for the analysis and design of educational games. IEEE International Conference on Digital Game and Intelligent Toy Enhanced Learning. Taiwan.

Yusoff, A., Crowder, R., Gilbert, L., Wills, G. 2009. A Conceptual Framework for Serious Games. In the 9th IEEE International Conference on Advanced Learning Technologies ICALT 2009 , 21-23.

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