Introducing Gamification Elements in Professional Education

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Abstract

The new trend of introducing gamification in education is revolutionising the engagement of students and trainees with the training process. By adding the innovative aspects of gaming into the training process, the motivation of the students is increased along with the focus and interest into the learning process. This approach is transforming traditional learning into dynamic, interactive format that facilitates deeper understanding. This is even more important when we consider the adult education and the professional upskilling or reskilling, for the purpose of responding to the labor market needs, where the learners are very specific category of already developed professionals, that may commonly also been employed. In this case, time efficiency, visual communication with the learning content and incorporating the "real life" case studies into the learning journey, is of tremendous importance.
In this paper we share our experience in developing and implementing a training aiming to upskilling of professionals in the engineering disciplines, for the subject of design and installation of PV systems in buildings. The training was developed as e-learning training through moodle-based platform, but it was enhanced with adding gamification question sets, that are enabling deepening the experience in learning and providing examples of real situations from the site, that are required to be assessed. The introduced gamification element into the training programme, have enabled more valuable learning experience for the learners, but they are also used as a tool for assessment of the learning success of the trainees. The paper presents our experience in development of the training programme, that includes the gamification elements and shares the results for the piloting process, that was conducted in the frame of the project SEEtheSkills, during March-April 2024, on a representative number of students. The conclusions are toward the identification of the benefits and challenges with introducing digital gamification tools in education and the training process.

Keywords: *gamification, training, interactive learning, upskilling, assessment*

1. Introduction

The rapid advancement of technology is reshaping education, transitioning from teacher-centered to student-centered approaches that prioritise individual needs, learning styles, and backgrounds [1]. This shift is particularly evident among Generation Z (Gen Z), who are digital natives accustomed to interactive, technology-driven learning environments.

Gen Z students favor personalised, activity-based education that incorporates multimedia, collaboration, and real-world applications. Traditional methods like lectures and rote memorisation are less effective for this generation, who prefer engaging, hands-on experiences. Tools such as flipped classrooms, blended learning, and gamification have emerged to enhance student engagement and support personalised learning approaches [2].

Gamification, in particular, has gained prominence as an effective strategy for improving student motivation and performance. By integrating game elements like points, badges, and levels into the learning process, gamification transforms everyday activities into engaging challenges that promote active participation and achievement. According to Kapp (2012), gamification involves the use of game thinking, mechanics, aesthetics, and engagement strategies to motivate learners and enhance educational outcomes [3].

In summary, the evolving educational landscape necessitates the adoption of innovative, technology-enhanced methods that cater to the preferences and needs of Gen Z learners. Gamification stands out as a promising approach to fostering engagement, motivation, and effective learning in this digital age.

2. Gamification in Education – A Brief State-of-the-art

2.1. Definition of Gamification

Karl Kapp (2012) defines **gamification** as the integration of game elements and game-based thinking into non-game contexts to enhance engagement and motivation [3]. This approach leverages game mechanics to improve learning and performance in various settings, including education and business.

In educational environments, gamification incorporates several key features:

- **Users**: Participants such as students, employees, or clients.
- **Challenges/Tasks**: Activities that users perform to achieve specific objectives.
- **Points**: Accumulated through task completion, serving as a measure of progress.
- **Levels**: Stages users pass through based on accumulated points.
- **Badges**: Rewards for completing actions, symbolizing achievements.
- **Ranking**: Users are ranked according to their achievements, fostering a sense of competition.

These elements collectively create a structured and engaging learning experience, motivating users to actively participate and strive for mastery.

2.2. The Differences Between Gamification And Game-based Learning

There are many examples of literature review aiming to diferentiate between the term gamification and game-based learning approach [1-5]. Most common distinction that appears in the literature is definition of gamification as an application of gaming mechanics, techniques and tools (such as badges, point scores and rewards) in non-game environments, while the adoption of serious games in educational contexts is what is known as game-based learning [6].

The main goal of gamification in the educational and training context is to raise the level of motivation and active involvement of participants in an experience. Gamification usually refers to a series of requirements that must be complied with in order to be applied to education. On the oposite, game-based learning allow the student to be able to immerse themselves in scenes and settings that are difficult to express in reality and to be able to act as the protagonist of the first person perspective. When the application takes place in non-virtual environments, they are called "serious games", where learning related to play allows people to acquire new knowledge and new information faster.

The survey reported in [7] reports that 75% of the appearance of the term “gamification” in the literature corresponds to the implementation of gamified elements in the process of education, while only 9% of the sample used gamification as a synonym of game-based learning, considering the use of "serious games" for educational and training purposes. The remaining 16% relate to cases where learner interaction with a “serious games” has been integrated to some extent within a global learning intervention that is gamified.

2.3. Examples of Gamified Tools in the Learning Process

Gamification is already widely used in formal educational contexts, including primary, lower and uper secondary school (with up to 9% occurence of gamified elements in education process) and especially in the university courses (43%). This leaves a great percentage of 48% reported cases of use of gamification in education other than formal, including non-formal and life-long learning professional upskilling [7].

Gamification enhances learning by integrating game elements such as points, badges, leaderboards, and immediate feedback into educational experiences. This approach aims to increase student engagement and motivation by making learning more interactive and rewarding [8].

Unlike transforming learning into a game, gamification involves incorporating specific game mechanics to enrich the educational process. For instance, students earn points for completing tasks, receive badges as visual rewards, and can view their progress on leaderboards. Immediate feedback provides real-time insights into their performance, helping them understand areas for improvement.

The primary goal of gamification is to make education more engaging and motivating, fostering intrinsic motivation among learners. This approach is particularly effective in accommodating diverse learning styles and enhancing participation, especially for students who may find traditional methods challenging.

Several tools facilitate gamification in education. Popular examples include:

- **Socrative**: An assessment tool that offers real-time feedback through interactive quizzes and polls.
- **Kahoot!**: A game-based learning platform that allows educators to create quizzes and games to engage students.
- **Duolingo**: A language learning app that uses gamification to make learning languages fun and interactive.
- **ClassDojo**: A classroom management tool that promotes positive behavior and communication with parents.

Additionally, **Open Badges** are digital credentials that recognize and validate achievements. These badges are verifiable, portable, and contain metadata about the skills and accomplishments they represent. They can be shared across platforms and serve as a testament to a learner's achievements.

Learning Management Systems (LMS) like **Moodle** also support gamification by offering tools to create badges, leaderboards, and track student progress. These platforms provide an environment conducive to gamified learning, enhancing student engagement and motivation [9-10].

In summary, gamification in education leverages game elements to create an engaging and motivating learning environment. By utilizing various tools and platforms, educators can enhance the learning experience, making it more interactive and rewarding for students.

3. Case Study on Introducing Gamification Elements in Professional Upskilling

3.1. Peculiarities of Professional Education

Professional education is very important in the specific sectors that rely equally on skills as they do on the amount and quality of knowledge of the employees. The education of professionals in these sectors faces challenges such as time constraints, financial burdens, and a lack of support. These challenges impact both individuals seeking professional development and the educational institutions and organisations offering it. For individuals the issue are the balance between work and study and concern about the financial burdens, while the organizations may struggle with providing adequate resources, ensuring effective training, and maintaining long-term commitment. Another problem are the generic trainings without proper modularity to fit professionals with different interests and background that do not adequately address the individual needs of employees. Disconnection between training and classroom practice also reduces the impact of professional development.

Many sectors benefit from professional education, with some notably emphasizing the need for it. Fields like teaching, law, and healthcare, often necessitate continuing education to stay current and competent. Additionally, sectors like technology, construction, and engineering benefit from upskilling and staying current with industry trends and regulations, as the rapid pace of technological change necessitates continuous learning and skill development for professionals.

Professional education in the construction industry encompasses a wide range of training and development opportunities, from obtaining formal degrees to earning certifications and engaging in continuous learning. It's crucial for both career advancement and staying current with the latest industry trends and technologies.

3.2. SEEtheSkills Upskilling Approach

Therefore, introduction of novel approaches in education and training especially in specific sector as construction is more than important, to take pace with technological development. This paper elaborates on our experience in developing and implementing training programmes for skilling and upskilling construction professionals within the H2020 project SEEtheSkills, which recognising the challenges for reaching effectiveness of professional education, have included a variety of gamification elements in training process, aiming to increase attractiveness, engagement, effectiveness and availability of upskilling opportunities.

As the new technologies around built environment and its transition to a 4.0 evolution aiming at high performance are reflecting changes and updates on the European Energy Performance of Buildings standards, already recognized at a nationwide level as official methodology in many countries, and eventual to become mandatory at an EU level, the skills for following these new technologies are becoming more and more essential and valuable. The project SEEtheSkills (2021-2024) that was implemented under the call for construction skills in Clean Energy transition program of the European commission is providing a way to

- To show the value of the skills – and make them VISIBLE
- To upskill and learn new things – and VALIDATE the knowledge
- To promote the skills on the labour market – and make them more VALUABLE

The project stands in front of the challenge for energy efficient construction of new and renovation of existing building stocks and aims to act at market level in order to stimulate the demand for previously developed and new or upgraded energy skills [11].

The project have implemented different advanced approaches in the training process as development of e-learning platform with various gamification elements enabled, digital badges for visibility of accomplishment and online digital application for certification of nonformal and informal learning including self-assessment app for self-evaluation of skills for the professional profiles supporting sustainable and contemporary construction practices.

3.3. LMS System as e-Learning Platform

The SEEtheSkills Learning Management System (LMS) is a central on-line platform that is offering trainings for upskilling in some advanced topics in construction [12]. It is built on a Moodle platform in a modular structure; the trainees can either take the full series of courses or just those which are of particular interest. There are 8 webinars developed and available at the SEEtheSkills e-learning platform

- Installation of PV systems in buildings
- Design of PV systems in buildings
- Introductory course in BIM
- BIM for design of PV systems
- Effective data collection for digitization of existing assets
- Effective coordination and clash-detection processes in pre-construction phase
- Cross-craft skills: Thermal comfort and its influence on energy efficiency
- Cross-Craft Skills: Influence of insulation system on energy efficiency

These 8 training courses are offered as self-guided micro learning pieces and followed by accompanying e-guided exam, lead to a certification. The certificate itself is issued in a digital form, through the e-learning platform (Fig. 1). After the enrolment at the course, the access to the training material is granted. There are slide decks recorded as video presentations, reading material, self-assessment quizzes after each course topic to enable navigation throughout the training. This self-assessment quizzes are designed in gamified mode, enabling navigation through the questions and playing for a bigger score by choosing between the listed choices, while obtaining the results in real time (Fig. 2).

The progress through the training is conditioned with successful completion of the previous topic, thus adding the sense of competition and achieving goals. This also enables the trainees to go forward with

their own pace, according to their own dynamics and available time. Each training course finishes with a final qualification exam to get the certification. After finishing the training course, the achieved skillset is officially certified, providing EU-wide visibility and recognition of the acquired competence. Every passed exam results with a SEEtheSkills Professional certification license, as publicly available record of the skills, a passport to a better business, digitally available in the form of a Digital Badge.

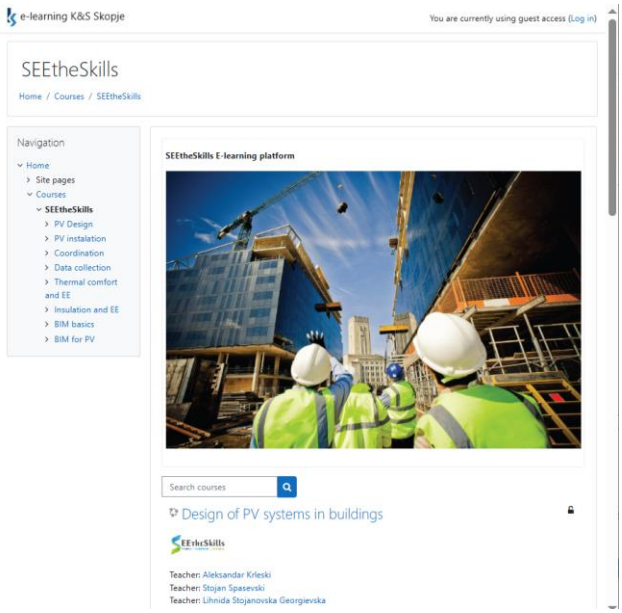

Fig. 1. SEEtheSkills E-learning platform with gamification elements

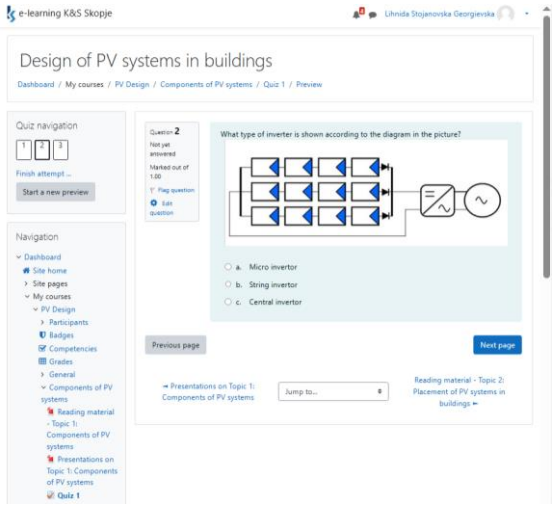

Fig. 2. The self assessment quizzes as a prerequisite for enabling progress to the next topic

3.4. Digital Badges for Certification

The Digital Badges were included as another innovative project result. A web-based solution of Digital Badges include skills, knowledge, and competence that a worker has gained and it contains an information on the education of the worker in formal and non-formal form. They are visual representations of achievements and skills, often used to showcase qualifications or milestones on online platforms. They can be earned by completing courses, training programs, or achieving specific goals. SEEtheSkills issues achievement badges, digital certificates for professional development after completion of a training program, or recognition badges for employee's validated skills earned informally through working experience.

The process of issuing the Digital Badge is automated through the BUS Advisor. The BUILD UP Skills Advisor app is another digital tool aiming to facilitate skills acquiring. It is a free tool for practitioners and craftsmen to look for opportunities for trainings in Europe and some specific EU countries. It also contains a community-managed content repository and can facilitate the use of micro-credentials for personal recognition and lifelong learning. Thus all the professionals that have achieved certification are listed in the Professionals register and as well, earn the SEEtheSkills Digital Badge. This acknowledgement for competences, within the SEEtheSkills project have been issued to more than 3300 professionals from the professionals register.

3.5. Gamified Question Sets

Gamification itself, refers to creating positive experiences in these areas that might improve the morale and productivity of any workplace. There are 6 gamification question sets prepared by SEEtheSkills project and available through BUS Advisor, aiming to powering functional tools of SEEtheSkills area for upskilling. The gamified question sets lead to evaluation of the knowledge and skills in 6 topics:

- Installation of PV systems in buildings
- Design of PV systems in buildings
- Effective data collection for digitization of existing assets
- Effective coordination and clash-detection processes in pre-construction phase
- Cross-craft skills: Thermal comfort and its influence on energy efficiency
- Cross-Craft Skills: Influence of insulation system on energy efficiency

The gamified question sets include 5 specific questions each that refer to certain situation replicating the workplace, and the solution requested is to solve the challenge and select the right approach for solving the problem. The question sets replicate the working environment and real problems or challenges captured from the workplace, that need to be solved with explanation of the proposed solution, thus bringing the whole process of construction closer to the learner. The received feedback includes an extended explanation about the correct answer, serving again the learning purposes. By adding the interactivity and excitement while solving the problem, the learning is made more attractive.

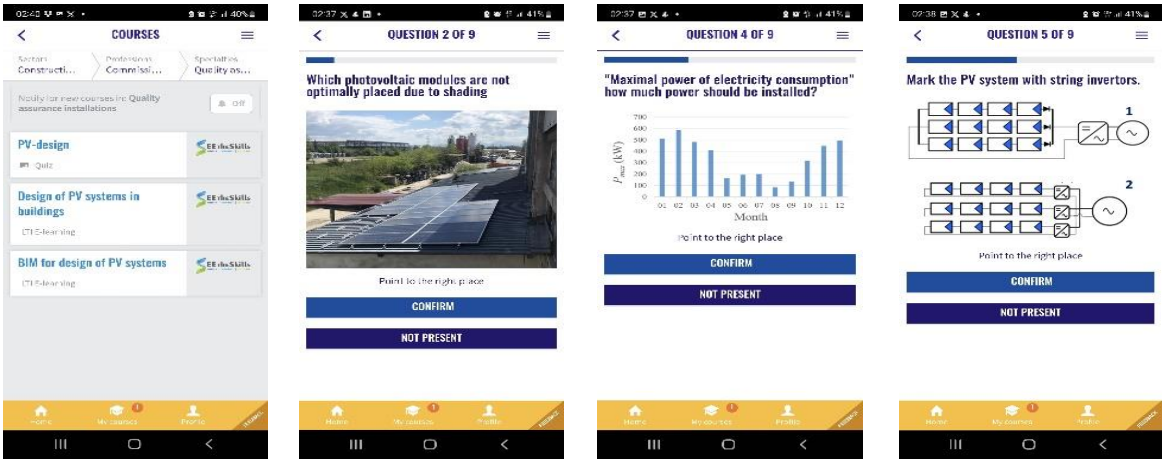

Fig. 3. Learning from mistakes and best practices through gamified question sets

4. Evaluation of the Implemented Approach

4.1. Advantages and Disadvantages of Gamification

The benefits of gamification in the classroom are both motivational and practical. However, as with any innovative teaching method, there are also limitations educators should be aware of [13].

As advantages of gamification the following can be listed:

- Enhanced Engagement: Game mechanics foster excitement and a sense of accomplishment, increasing participation.
- Improved Retention: By presenting lessons in a contextually meaningful way, gamification helps students retain information longer.
- Customisable Learning Experiences: Students can progress at their own pace, making the material more accessible to a wider range of learners.
- Real-Time Feedback: Immediate responses to actions help students correct mistakes and build knowledge actively.
- Collaboration: Many gamified tasks involve teamwork, fostering peer learning and social connection.
- Encourages Persistence: Challenges with achievable rewards pave the way for students to tackle complex tasks without discouragement.

While the advantages of gamification abound, educators must also acknowledge its limitations:

- Can Distract from Key Learning Goals: A poorly designed system may become too focused on winning rewards rather than absorbing knowledge.

- Inequity Issues: Not all learners are naturally competitive. Those less interested in achieving high scores may feel disengaged.
- Time and Resource Intensive: Setting up a gamified learning experience can take significant time, requiring thoughtful research and platform investment.
- Recognising these pros and cons ensures that gamification advantages are balanced against potential challenges.

4.2. Evaluation of Effectiveness of the Implemented Gamified Elements

In order to facilitate the design of evaluation programs a methodological assessment tool was developed. Evaluation 123 is a reference manual that provides a structured overview of important perspectives on training evaluation. The reference manual proposes questions based on standardized and validated instruments and it consists of three different steps, adapted from Kirkpatrick's training evaluation model [14]. It encompass of four levels of evaluation:

- Reaction: This level measures the trainee's immediate reaction to the training program. It focuses on their satisfaction, engagement, and perception of the training experience.
- Learning: This level assesses the amount and depth of knowledge and skills acquired by the trainees during the training program. It evaluates whether the training objectives have been achieved.
- Behavior: This level examines whether trainees apply the learned knowledge and skills in their actual work environment. It assesses whether the training has led to changes in behavior and performance.
- Results: This level evaluates the impact of the training on the organization as a whole. It examines how the training has affected key business outcomes, such as productivity, profitability, and customer satisfaction.

The evaluation process of the developed gamification tools in SEEtheSkills is conducted according to the methodology and approach explained above. The evaluation for the micro learning trainings through e-learning platform was conducted up to the level 2, including the evaluation of knowledge achieved, based on the results of the participants at the final exam (mandatory for certification), while for the gamified question sets, the validation is conducted at level 1, i.e. evaluating the users' reaction. The surveys were organized as on-line questionnaires, conducted on a small representative sample of the users who have previously logged in and used the certain tool, as anonymous on-line survey.

The results from the conducted survey referring the effectiveness of e-learning platform are presented on Fig. 4, while the evaluation of the gamified question sets, showing the identified significant effectiveness of the adapted gamification element is presented on Fig. 5.

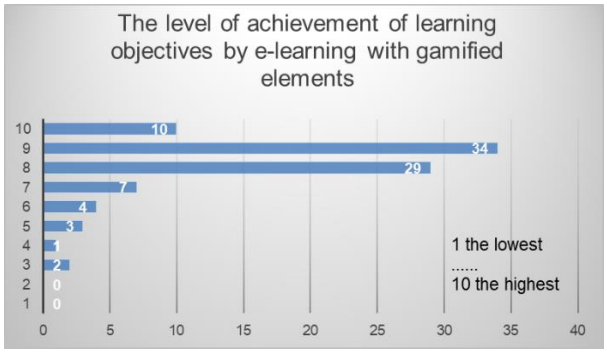

Fig. 4. Effectiveness of e-learning platform

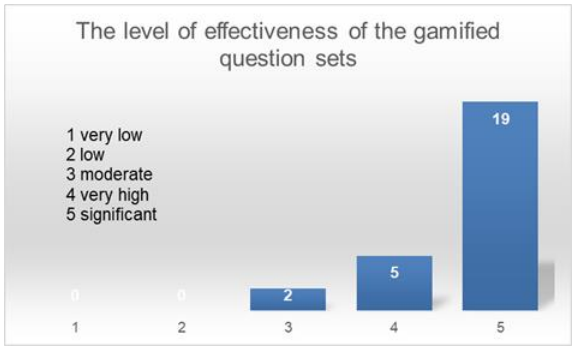

Fig. 5. Effectiveness of gamification question sets

5. Conclusions

Gamification in education is so much more than just an attractive way of learning. It's a method backed by psychological principles to make learning a dynamic, engaging and effective journey. It is based on intentionality and clearly defined goals that align with learners' aspirations. When used

strategically, gamification enables students to learn by doing and approach learning with a sense of joy and discovery.

This paper presents the experience of the authors in implementation of the gamification elements in the training process targeting professionals in construction sector. The case study elaborated here reflects the organisation of a wide upskilling and training process on the topic of energy efficient and sustainable construction, where the learners involved were professionals in the sector including both white collar workers (engineers, architects and technicians) and blue collars directly involved in the construction works (installers, carpenters, roofers etc.). The training schemes developed were implemented through well established e-learning platform, aiming to ensure easy access without restrictions of the time and location, additionally providing different gamification tools like quizzes, easy navigation through the topics, following the achievements and reaching milestons in order to progress to the next topic etc. This approach implemented during the project SEEtheSkills, was then evaluated for the purpose of measuring its effectiveness. The obtained insight into the qualitative indication shows very well acceptance of the approach by the learners and great effectiveness in terms of the success of the learning process.

The presented case study is a good example of adding a novel training approach that include gamification elements to the standard learning approach, showing that only a small set of game elements makes the big difference in increasing the stimulation of the learners. A well-designed gamification system doesn't compete with traditional learning, but instead enhances it through purposeful reinforcement.

REFERENCES

[1] Ciprian V., "Gamification: an innovative teaching method", Galaţi University Press (2021)
[2] "Innovative approaches to teaching and learning in library and information science", Education for Information, 35(2), 53-63, (2019). https://doi.org/10.3233/EFI-199003
[3] Kapp, K., "The Gamification of Learning and Instruction. Game-Based Methods and Strategies for Training and Education. Pfeiffer, San Francisco, CA. (2012)
[4] Oliveira, W., Hamari, J., Shi, L., Toda, A.M., Rodrigues, L., Palomino, P.T. and Isotani, S., "Tailored gamification in education: A literature review and future agenda", Education and Information Technologies, 28(1), pp.373-406. (2023)
[5] Majuri, J., Koivisto, J. and Hamari, J., "Gamification of education and learning: A review of empirical literature", GamiFIN, pp.11-19. (2018)
[6] Dichev, C., Dicheva, D., "Gamifying education: what is known, what is believed and what remains uncertain: a critical review", Int J Educ Technol High Educ **14**, 9 (2017)
[7] Caponetto I., Earp J., Ott M., "Gamification and Education: a Literature Review. Proceedings of the 8th European Conference on Games-Based Learning - ECGBL 2014. 1. 50-57. (2014)
[8] G. Zichermann and C. Cunningham, "Gamification by Design: Implementing Game Mechanics in Web and Mobile Apps", O'Reilly Media, Inc. (2011)
[9] Toimah, T. F., Maulana, Y. I., & Fajar, I., "Gamification model framework and its use in e-learning in higher education. IAIC Transactions on Sustainable Digital Innovation (ITSDI), 3(1), 28-35 (2021)
[10] Portela, F., "Towards an engaging and gamified online learning environment - A real casestudy", Information, 13(2), 80 (2022). https://doi.org/10.3390/info13020080
[11] Stojanovska-Georgievska L., Cerovsek T., Funtik T., Sandeva I., Krleski A., Spasevska H., Ginovska M., "Energy skills as a driver to sustainable construction: current status, needs and proposed actions", Open Research Europe, Issue 6 Page(s) 3:44, ISSN 2732-5121 (2023)
[12] Stojanovska-Georgievska, L., "The value of energy skills – set as the basestone of sustainable construction", Zenodo. (2024)
[13] Cavus, N., Ibrahim, I., Ogbonna Okonkwo, M. O., Bode Ayansina, N. B., & Modupeola, T., "The Effects of Gamification in Education: A Systematic Literature Review", BRAIN. Broad Research in Artificial Intelligence and Neuroscience, 14(2), 211-241. (2023). https://doi.org/10.18662/brain/14.2/452
[14] Falletta, S., "Evaluating Training Programs: The Four Levels: Donald L. Kirkpatrick, Berrett-Koehler", Publishers, San Francisco, CA, 1996, 229 pp.. The American Journal of Evaluation. 19. 259–261. 10.1016/S1098-2140(99)80206-9. (1998).