*GAMification tEcniqueS for entrepreneurial vet Teachers*
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# DIDACTIC METHODOLOGY OVERVIEW

IO1 - GAMEST's research on existing gamification in VET entrepreneurial education

Leading Organisation: University of Santiago Compostela, Spain

# CONTENTS

# FOREWORD

Gamification is the use of game design elements in non-game contexts[1]. The aim of gamification is to foster motivation, effort, loyalty, and other positive factors which are common in games, to improve the users' performance in regard to a given activity. Gamification techniques emerged in the early 2000s, based on the personal recognition of users as the main motivational element, through points, missions, medals, challenges, or awards[2]. With the rise of social networks, social aspects related to both the personal and professional users' environment were also incorporated to the gamification mechanics[3]. Finally, in recent years techniques have been incorporated to personalize gamification techniques, understanding that the motivations and preferences are not the same for every user[4]. Furthermore, different dynamics or gamification strategies have been defined such as narratives, progression, emotions, constraints, and so on, to facilitate the design of gamified solutions[5].

In this context, gamification techniques have been widely used in activities where the active participation of the users is key to the success of such activities. Thus, gamification has been applied in different domains such as health, with the aim of improving the patients' well-being[6]; marketing, to foster users to consume products

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1 S. Deterding, D. Dixon, R. Khaled, and L.E. Nacke, "From game design elements to gamefulness: Defining gamification," Proceedings of the 15th International Academic MindTrek Conference (MindTrek2011) (A. Lugmayr, H. Franssila, C. Safran, I. Hammouda, eds.), pp. 9–15, ACM, 2011.

2 E. D. Mekler, F. Brühlmann, A.N. Tuch, and K. Opwis, "Towards understanding the effects of individual gamification elements on intrinsic motivation and performance," Computers in Human Behavior, vol. 71, pp. 525–534, 2017.

3 J. Hamari, and J. Koivisto, "Working out for likes: An empirical study on social influence in exercise gamification," Computers in Human Behavior, vol. 50, pp. 333–347, 2015.

4 C.S. González, P. Toledo, and V. Muñoz, "Enhancing the engagement of intelligent tutorial systems through personalization of gamification," International Journal of Engineering Education, vol. 32, no. 1, pp. 532–541, 2016.

5 K. Werbach, and D. Hunter, For the win: How game thinking can revolutionize your business. Wharton School Press, 2012.

6 D. Johnson, S. Deterding, K.-A. Kuhn, A. Staneva, S. Stoyanov, and L. Hides, "Gamification for health and wellbeing: A systematic review of the literature," Internet Interventions, vol. 6, pp. 89–106, 2016.

or services[7]; tourism, to encourage tourist engagement and improve its loyalty[8]; industry, to motivate workers in redesigning business processes[9], and so on. However, education is perhaps the domain where gamification techniques have been most implemented and successful[10,11], since they provide an alternative to engage and motivate students during the process of learning in order to improve their social and collaboration skills, personal skills, problem-solving skills, and so on. Subject domains where gamification has been applied are also very broad such as computer science[12], social sciences[13], healthcare[14] or entrepreneurship[15], demonstrating that gamification is a valuable tool to facilitate students to achieve the educational objectives and competences. This paper focuses on studying the current state of the entrepreneurship education based on gamification techniques.

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[7] C.F. Hofacker, K. de Ruyter, N.H. Lurie, P. Manchanda, and J. Donaldson, "Gamification and mobile marketing effectiveness," Journal of Interactive Marketing, vol. 34, pp. 25–36, 2016.

[8] F. Xu, J. Weber, and D. Buhalis, "Gamificationin tourism, " Proceedings of the Information and Communication Technologies in Tourism 2014 (ENTER2014) (Z. Xiang, I. Tussyadiah, eds.), pp. 525–537, Springer, 2014.

[9] O. Korn, and A. Schmidt, "Gamification of business processes: Redesigning work in production and service industry," Procedia Manufacturing, vol. 3, pp. 3424–3431, 2015.

[10] D. Dicheva, C. Dichev, G. Agre, and G. Angelova, "Gamification in education: A systematic mapping study, " Educational Technology & Society, vol. 18, no. 3, pp. 75–88, 2015.

[11] K.M. Kapp, The gamification of learning and instruction: Game-based methods and strategies for training and education. John Wiley & Sons, 2012.

[12] M. Ibáñez-Espiga, A.D. Serio, and C.D. Kloos, "Gamification for engaging computer science students in learning activities: A case study," IEEE Transactions on Learning Technologies, vol. 7, no. 3, pp. 291–301, 2014.

[13] R. Cázar-Gutiérrez, and J.M. Sáez-López, "Game-based learning and gamification in initial teacher training in the social sciences: An experiment with MinecraftEdu, " International Journal of Educational Technology in Higher Education, vol. 13, p. 2, 2016.

[14] L. McCoy, J.H. Lewis, and D. Dalton, "Gamification and multimedia for medical education: A landscape review, " Journal of the American Osteopathic Association, vol. 116, no. 1, pp. 22–34, 2016.

[15] D.A. Isabelle, "Gamification of entrepreneurship education," Decision Sciences Journal of Innovative Education, DOI: https://doi.org/10.1111/dsji.12203, 2020.

Entrepreneurship education has certain features that differentiate it from other subjects such as computer science, social sciences, or healthcare[16]. On the one hand, there is no general agreement on whether entrepreneurship is an innate set of attributes or whether they can be taught and learned by students[17,18,19]. On the other hand, most studies have not been able to establish a direct alignment between learning and entrepreneurship behaviors[20]. To address these issues, research in entrepreneurship education has focused on identifying a set of competencies or skills that are particularly suited to entrepreneurship[21,22,23] such as skills to organize the work and develop innovative products and services; skills to recognize market gaps and exploit market opportunities; personal skills like self-awareness, emotional maturity, willingness to accept responsibility, or creativity; or social skills like communication, collaboration, responsibility, conflict resolution or readiness to work together with others. Based on this background, learning processes in entrepreneurship make use of innovative learning strategies and contents to foster these skills in students' behavior, so that educational objectives are not only focused on devising a new product or service or on running a business, but also on bringing out these skills during the learning process.

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16 J.L. Ruiz-Alba, A. Soares, M. A. Rodríguez-Molina, and A. Banoun, "Gamification and entrepreneurial intentions," Journal of Small Business and Enterprise Development, vol. 26, no. 5, pp. 661–683, 2019.

17 R.B. Mellor, G. Coulton, A. Chick, A. Bifulco, N. Mellor, and A. Fisher, Entrepreneurship for everyone: A student textbook. SAGE Publications, 2008.

18 C. Boulton, and P. Turner, Mastering Business in Asia: Entrepreneurship. John Wiley & Sons, 2005.

19 C. Henry, F. Hill, and C. Leitch, "Entrepreneurship education and training: Can entrepreneurship be taught? Part I," Education + Training, vol. 47, no. 2, pp. 98–111, 2005.

20 A. Fayolle, C. Verzat, and R. Wapshot, "In quest of legitimacy: The theoretical and methodological foundations of entrepreneurship education research," International Small Business Journal, vol. 34, no. 7, pp. 895–904, 2016.

21 A. Tittel, and O. Terzidis, "Entrepreneurial competences revised: Developing a consolidated and categorized list of entrepreneurial competences," Entrepreneurship Education, vol. 3, p. 1–35, 2020.

22 W.L. Smith, K. Schallenkamp, and D.E. Eichholz, "Entrepreneurial skills assessment: An exploratory study," International Journal of Management and Enterprise Development, vol. 4, no. 2, p. 179–201, 2007.

23 M. Lackéus, "Entrepreneurship in education: What, why, when, how," Tech. Rep. Background paper, Entrepreneurship 360, 2015.

Taking this into account, gamification and game-based learning are two of the most suitable strategies for entrepreneurship education since both focus on the motivation and engagement to promote changes in users' behavior. Game-based learning describes an environment where game content and game play enhance knowledge and skills acquisition, and where game activities involve problem solving spaces and challenges that provide players/learners with a sense of achievement[24]. Game-based learning strategies are usually implemented through serious games, which are games that do not have entertainment, enjoyment, or fun as their primary purpose[25,26]; when the focus is on education, this purpose is to learn. Concerning game-based learning, a great effort has been made in the last decade to develop solutions for entrepreneurship education[27,28,29,30,31,32], because they have a major

[24] M. Qian, and K.R.Clark, "Game-based learning and 21st century skills: A review of recent research," Computers in Human Behavior, vol. 63, pp. 50–58, 2016.

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

[26] T. Susi, and M.J.P. Backlund, "Serious games: An overview," TechReport HS-IKI-TR-07-001, School of Humanities and Informatics University of Skövde, Sweden, 2007.

[27] F. Bellotti, R. Berta, A.D. Gloria, E. Lavagnino, F.M.Dagnino, M. Ott, M. Romero, M. Usart, and I.S. Mayer, "Designing a course for stimulating entrepreneurship in higher education through serious games," Proceedings of the 4th International Conference on Games and Virtual Worlds for Serious Applications (VS-GAMES 2012) (A.D. Gloria and S. de Freitas, eds.), vol. 15 of Procedia Computer Science, pp. 174–186, Elsevier, 2012.

[28] F. Bellotti, R. Berta, A.D. Gloria, E. Lavagnino, A. Antonaci, F.M. Dagnino, M. Ott, M. Romero, M. Usart, and I.S. Mayer, "Serious games and the development of an entrepreneurial mindset in higher education engineering students," Entertainment Computing, vol. 5, no. 4, pp. 357–366, 2014.

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[31] D. Williams, "The impact of SimVenture on the development of entrepreneurial skills in management students," Industry and Higher Education, vol. 29, no. 5, pp. 379–395, 2015.

[32] A. Protopsaltis, S. Hetzner, S.A. Borotis, T. M.Connolly, and T. Hainey, "How to teach entrepreneurship using serious games and web 2.0," Proceedings of the IEEE 14th International Conference on Advanced Learning Technologies (ICALT 2014) (D.G. Sampson, J.M. Spector, N.-S. Chen, R. Huang, and Kinshuk, eds.), pp. 227–229, IEEE Computer Society, 2014.

impact on developing the students' personal, social, and technical skills[33,34]. Most of these solutions generally obtain relevant results, which agrees with other works that evaluate the acquisition of students' competences and skills[35,36]. However, the main drawback of serious games is the significant effort required to design and develop a game, as well as to personalize it to the students' profile (e.g., age, or curricula). In general, it is not feasible for an entrepreneurship teacher to develop a game from scratch, and most games already developed cannot be easily adapted to the students' prior knowledge and skills.

Concerning gamification, the number of works in the literature based on these techniques is lower than expected, especially when compared to game-based learning proposals[37]. This lack of works shows that gamification methodologies for entrepreneurship education are not mature enough, although there are some proposals trying to formalize it[38]. There exist works that define methodologies combining gamification mechanics with serious games, typically simple games or minigames[39,40,41,42,43]: serious games are used as learning content in several learning

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33 I. Mayer, A. Wetters, and J. Spaans, "Game-based entrepreneurship education: Identifying enterprising personality, motivation and intentions amongst engineering students," Journal of Entrepreneurship Education, vol. 17, no. 2, pp. 217–244, 2014.

34 K. Fellnhofer, "Changing entrepreneurial intention and behaviour: A digital game-based learning environment dedicated to entrepreneurship education," Journal for International Business and Entrepreneurship Development, vol. 8, no. 4, pp. 378–404, 2015.

35 R. Newbery, J. Lean, and J. Moizer, "Evaluating the impact of serious games: The effect of gaming on entrepreneurial intent," Information Technology & People, vol. 29, no. 4, pp. 733–749, 2016.

36 J. Fox, L. Pittaway, and I. Uzuegbunam, "Simulations in entrepreneurship education: Serious games and learning through play," Entrepreneurship Education and Pedagogy, vol. 1, no. 1, pp. 61–89, 2018.

37 Subhash, and E. A. Cudney, "Gamified learning in higher education: A systematic review of the literature," Computers in Human Behavior, vol. 87, pp. 192–206, 2018.

38 H. Breuer, S.K. Gudiksen, C. Abril, and C. Lehmann, "Gamification and games as facilitation methods for innovation and entrepreneurship," Proceedings of XXXI SPIM Innovation Conference (ISPIM 2019) (I. Bitran, S. Conn, C. Gernreich, M. Heber, K. Huizingh, O. Kokshagina, M. Torkkeli, and M. Tynnhammar, eds.), pp. 1–21, ISPIM, 2019.

39 N. Denk, U. Rohsner, B. Ertl, T. Wernbacher, and A. Pfeiffer, "A social network game for encouraging girls to engage in ICT and entrepreneurship: Findings of the project MIT-MUT," Proceedings of 3rd European Conference on Social Media (ECSM 2016) (C. Bernadas, and D. Minchella, eds.), pp. 63–70, 2016.

activities to develop in most cases technical skills, whereas gamification mechanics are related to the general design of the solution. The rest of the works follow more traditional methodologies, which make use of gamification mechanics to foster collaboration, social interaction, and creativity, and where learning activities take place in virtual environments to improve the students' engagement[44,45,46,47]. Most of these works highlight the benefits of applying gamification for entrepreneurship education at the university, high school, and even secondary school levels, but very

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[40] F. Bellotti, R. Berta, A.D. Gloria, E. Lavagnino, A. Antonaci, F.M. Dagnino, and M. Ott, "A gamified short course for promoting entrepreneurship among ICT engineering students," Proceedings of the IEEE 13th International Conference on Advanced Learning Technologies (ICALT 2013) (A. Lugmayr, H. Franssila, C. Safran, and I. Hammouda, eds.), pp. 31–32, IEEE Computer Society, 2013.

[41] F.M. Dagnino, A. Antonaci, M. Ott, E. Lavagnino, F. Bellotti, R. Berta, and A.D. Gloria, "The eSG project: A blended learning model for teaching entrepreneurship through serious games," Proceedings of the 10th European Conference on Innovation and Entrepreneurship (ECIE 2015) (R. P. Dameri, and L. Beltrametti, eds.), pp. 147–156, 2015.

[42] B. Fonseca, A. Pereira, R. Sanders, V. Barracho, U. Lapajne, M. Rus, M. Rahe, A. Mostert, T. Klein, V. Bojovic, S. Bosnjak, L. Morgado, Z. Bosnjak, J. Carvalho, I. Duarte, A. Casaramona, A. Soraci, H. Paredes, P. Martins, R. Gonçalves, P. Neves, R.R. Nunes, J. Lima, and J. Varajão, "PLAYER: A European project and a game to foster entrepreneurship education for young people," The Journal of Universal Computer Science, vol. 18, no. 1, pp. 86–105, 2012.

[43] A. Antonaci, F.M. Dagnino, M. Ott, F. Bellotti, R. Berta, A.D. Gloria, E. Lavagnino, M. Romero, M. Usart, and I. Mayer, "A gamified collaborative course in entrepreneurship: Focus on objectives and tools," Computers in Human Behavior, vol. 51, pp. 1276–1283, 2015.

[44] D. Craven, "Gamification in virtual worlds for learning: A case study of PIERSiM for business education," Gamification in Education and Business (T. Reiners, and L. C. Wood, eds.), pp. 385–401, Springer, 2015.

[45] D. Lamprinou, and F. Paraskeva, "Gamification design framework based on SDT for student motivation," Proceedings of the 2015 International Conference on Interactive Mobile Communication Technologies and Learning (IMCL 2015), pp. 406–410, IEEE Computer Society, 2015.

[46] F. Grivokostopoulou, K. Kovas, and I. Perikos, "Examining the impact of a gamified entrepreneurship education framework in higher education," Sustainability, vol. 11, no. 20, pp. 5623:1–17, 2019.

[47] I. Krajger, W. Lattacher, and E. J. Schwarz, "Creating and testing a game-based entrepreneurship education approach," The Challenges of the Digital Transformation in Education (T. Reiners, and L.C. Wood, eds.), pp. 697–709, Springer, 2020.

little attention in the literature has been paid at the vocational education and training (VET) level[48,49].


**Figure 1. Badges and challenges, implemented as progress bar for a VET application in entrepreneurship education**

In this document, an experimental study about the use of gamification for developing entrepreneurial skills in vocational education and training (VET). This study has been made within the framework of the GAMEST project, and its results highlight both the strengths and weaknesses of gamification techniques from the perspective of the countries of the project partners.

## GAMIFICATION

Gamification is the use of game design elements in non-game contexts. Following the MDA framework[50], in a gamification-based application three components can be distinguished: mechanics, dynamics, and aesthetics. The **mechanics** perspective describes the components of the game at the level of data representation and

[48] D. Bayona-Cuallado, A. Soler-Domínguez, E. Granell-Miguel, and J. Ramos-Mezquita, "When fun comes into the classroom: Using gamification to engage students and entrepreneurs in vocational education and training," Proceedings of the 12th Annual International Technology, Education and Development Conference (INTED 2018) (L.G. Chova, A.L. Martínez, and I.C. Torres, eds.), pp. 249–255, IATED Academy, 2018.

[49] T. Ylikoski, and E. Oksanen-Ylikoski, "Gamification and working life cooperation in an e-learning environment," eLearning Papers, vol. 39, pp. 53–62, 2014.

[50] R. Hunicke, M. Leblanc, and R. Zubek, "MDA: A formal approach to game design and game research", Proceedings of the AAAI Workshop on Challenges in Game AI (D. Fu, and J. Orkin, eds.), AAAI Press, 2004.

algorithm. The **dynamics** perspective involves the runtime behavior of the mechanics acting on player inputs and outputs over time. Finally, the **aesthetics** perspective describes the desirable emotional responses evoked in each player when he/she interacts with the game system.

From the point of view of education, the mix of dynamics and aesthetics perspectives may be considered as the learning strategies used to implement the learning design, which describes the learning activities to be performed by the participants in the unit of learning, including how they interact each other. Therefore, as the aim of this document is to present the didactic methodology to be followed in a course for gamification-based entrepreneurship education, we will focus on game mechanics and dynamics.

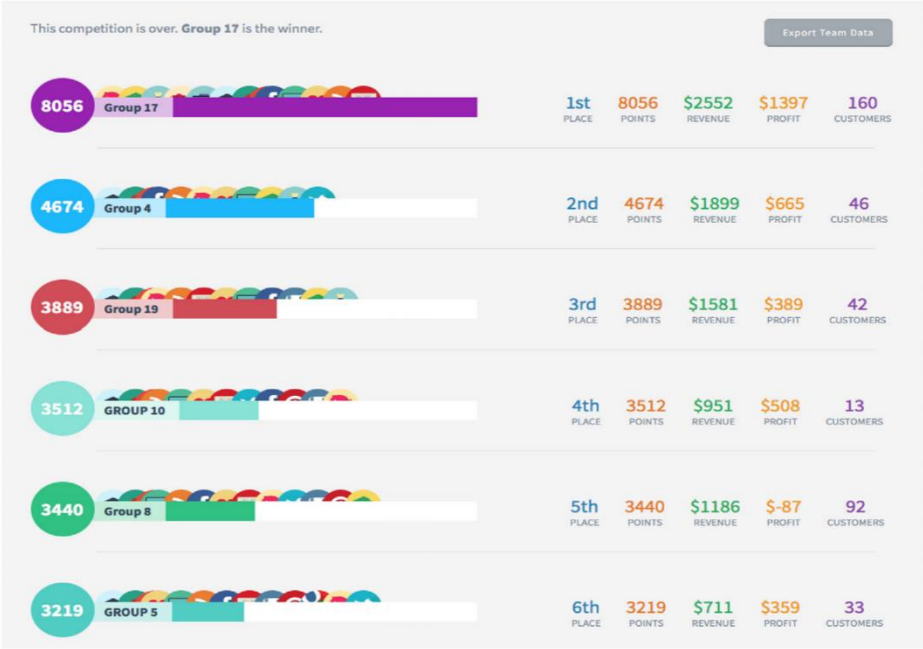


**Figure 2. Leaderboard used in a VET application in entrepreneurship education.**

## GAME MECHANICS

Game mechanics are constructs of rules and feedback loops intended to produce an enjoyable experience, and, therefore, they are considered as the building blocks that can be applied and combined in order to gamify any non-game context, such as an entrepreneurship course. With the generalized development of gamification applications, over the years a wide number of game mechanics have been proposed[51,52]. However, the most used are the following:

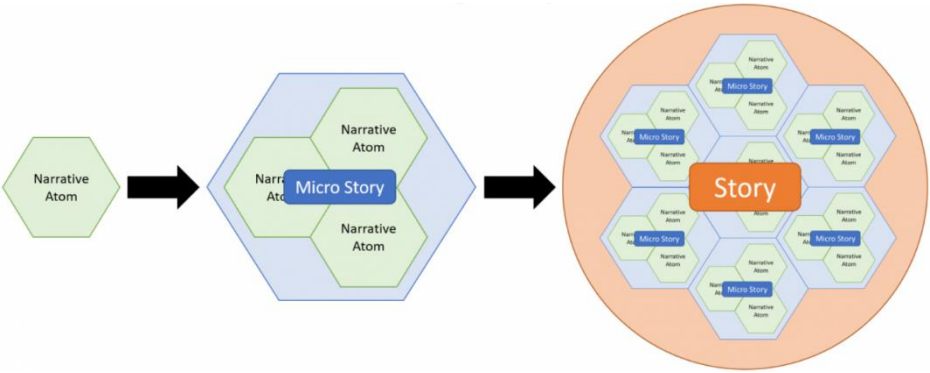


**Figure 3. Narrative mechanics as a set of micro stories assembled between them.**

- Points are the basic units for measuring the performance in gamification, providing an instant feedback to the player that drives its motivation.
- *Badges* refer to trophies or awards for the accomplishment of a particular activity. They are a form of virtual achievement by the players when they have accumulated a certain number of points. Figure **Error! Reference source not found.** shows an example of badges, represented as trophies, such as they are used in a VET application for entrepreneurship education.

[51] Bunchball, "What are game mechanics?" https://www.bunchball.com/gamification/game-mechanics

[52] Bunchball, "Gamification 101: An introduction to the use of game dynamics to influence behavior," White paper Gamification 101, 2010. https://www.bunchball.com/gamification101

- *Leaderboards* are elements to rank players in descending order based on the points of each one. They bring in the social aspect of points and badges and are a powerful component for driving competition between players. Figure **Error! Reference source not found.** shows an example of leaderboard, where points and ranking related to each player is presented.
- *Challenges* require players to achieve an objective by overcoming specific obstacles. It is a powerful game mechanic to keep players interested and motivated, testing their knowledge and allowing them to apply it.
- *Narrative* draws the players into a story within the game, offering them a chance to build their own experience through a given context (space and time), bounded by the system logic. Figure **Error! Reference source not found.** shows the narrative mechanics as a set of atom stories that must be assembled in order to compose a complete story[53].
- *Journey* considers that the player is on a personal journey and incorporates this element into the experience. *Progress* is the most common implementation of this game mechanics since it provides feedback to the player on where he/she is in the journey, encouraging him/her to take the next step. Figure **Error! Reference source not found.** shows an example of a journey, implemented as a progress bar that represents the different stages of the journey and the achievements of the player.

## GAME DYNAMICS

### 1.1. Game dynamics

Game dynamics are related with the interaction rules between the game players, and the game strategy and activities that these players will perform in the gamified activity. In the implementation of these techniques game mechanics are used to enhance the motivation and engagement of players. From an educational point of view, game techniques include both the learning design and learning methodology followed in a course. Over the years a number of game dynamics have been

[53] A. Marczewski, "Introduction to gamification Part 10: Narrative", 2019. https://www.gamified.uk/2019/09/17/introduction-to-gamification-part-10-narrative/

proposed, however, according the state-of-the-art the most used of these game dynamics in entrepreneurship education are the following:

- *Collaboration* is the process in which players work together for achieve a common objective or benefit. This technique can be considered as opposed to working in competition, although both techniques can be combined in a same course, depending on the activities to be performed and the competencies to be developed in them. Figure **Error! Reference source not found.** shows a collaborative work between players in an entrepreneurship course[54].
- *Competition* enables players to challenge each other to achieve the high score at some activity in order to win a reward, while the other players get a consolation prize.
- *Creativity* allows players to create their own content and express themselves. This technique may be combined with social and collaboration since this content can be develop between several players. In Figure **Error! Reference source not found.** players are also developing a creativity-based dynamics.
- *Exploration* gives players the chance of moving and exploring through contents or applications trying to find their boundaries or limits.
- *Social* focuses on working the relations and interaction between the players. It is usually combined with collaboration techniques where there is a common goal to be achieved by the teams.
- *Strategy* makes player think about what they are doing, why they are doing it and how it might affect the objectives of the experience.

[54] R. Patricio, and R. Morozumi, "Gamification for service design and Innovation: ideaChef® method and tool", Proceedings of the Conference on Service Design Proof of Concept (ServDes 2018), pp. 1212–1228, Linköping University Press, 2018.

Figure 4. Collaboration between players in a entrepreneurship education activity[54].

| TECHNICAL | MANAGERIAL | ENTREPRENEURIAL | PERSONAL MATURITY |
|---|---|---|---|
| Skills to design and produce a product or service | Management skills for planning, organizing, supervising, directing, networking, etc. | Business concept skills to develop a business plan or to present it | Self-Awareness skills or the ability to reflect and be introspective |
| Skills to manage supplies and raw material | Marketing/Sales skills for identifying customers, distribution channels, supply chain, etc. and engage with them | Environmental scanning skills to be able to recognize market gaps or exploit market opportunities | Accountability skills or the ability to take responsibility for resolving a problem |
| Skills to manage an office or a production space | Financial skills for managing financial resources, accounting, budgeting, etc. | Advisory board and networking skills or how to balance independence with seeking assistance | Emotional Coping skills or the emotional ability to cope with a problem |
| Skills to manage a plant and its equipment, or the technology and production processes. | Legal skills for organization form, risk management, privacy and security, etc. | | Creativity skills or the ability to produce a creative solution to a problem |
| | Administrative skills including the ability to align an organisations structure and strategy | | |
| | Higher-order skills for constant learning and problem-solving | | |

Figure 5. Entrepreneurship skills framework[59]

## ENTREPRENEURIAL SKILLS

Entrepreneurship education aims to change students' mindsets through, behaviors, skills, and capabilities[55]. What should be taught, and which skills need to be developed is a matter of debate. Several studies have been carried out to identify both the knowledge and skills needed by entrepreneurs[56,57,58,21]. However, the

[55] J. Chang, and A. Rieple, "Assessing students' entrepreneurial skills development in live projects," Journal of Small Business and Enterprise Development, vol. 20, no. 1, pp. 225–241, 2013.

[56] G. Gorman, D. Hanlon, and W. King, "Some research perspectives on entrepreneurship education, enterprise education and education for small business management: A ten year literature review," International Small Business Journal, vol. 15, no. 3, p. 56–77, 1997.

heterogeneity of definitions and competence frameworks still illustrate certain confusion about what should be taught. The competence framework used in this study was defined by Smith et al.[22] and classifies the entrepreneurial skills in four meta-categories:

- **Technical**. Numerous studies have found that successful entrepreneurs had technical skills beyond just producing the product or service. These persons are able to exploit their technical or job experience to create new ventures.
- **Managerial**. Entrepreneurship requires a competent management in order to run smoothly and optimize the potential for profit and growth. Management skills are applied to areas like planning, marketing, finance, legal, accounting, and human resources.
- **Entrepreneurship**. The skills to recognize and exploit market opportunities, being able to articulate a business plan, or using networking opportunities, are the essence of entrepreneurship for some.
- **Personal maturity**. The abilities to recognize and improve on weaknesses but also to take personal responsibility for resolving problems. Emotional coping skills are an important part of this category to help persons to manage their feelings and stress in the entrepreneurial ecosystem.

Where each category is further broken down, as depicted in Figure **Error! Reference source not found.**. As we can see, this model considers a total of seventeen skills, which were considered critical to embark on entrepreneurial activities from a study carried out in UK's higher education[59]. GAMEST project is being also developed taking into account the framework and the three strategic axes defined in the final report

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[57] S. Mitchelmore, and J. Rowley," Entrepreneurial competencies: A literature review and development agenda," International Journal of Entrepreneurial Behavior and Research, vol. 16, no. 2, p. 92–111, 2010.

[58] E. Kyndt, and H. Baert, "Entrepreneurial competencies: Assessment and predictive value for entrepreneurship," Journal of Vocational Behavior, vol. 90, pp. 13–25, 2015.

[59] P.D. Hannon, "Teaching pigeons to dance: Sense and meaning in entrepreneurship education," Education and Training, vol. 48, no. 5, pp. 296–308, 2006.

"Entrepreneurship in higher education, especially within non-business studies" of the European Commission[60]:

- **Axis 1**: Training students in what is needed to set-up a business but also in how and manage its growth.
- **Axis 2**: Developing entrepreneurial skills that are needed to identify and exploit business opportunities.
- **Axis 3**: Raising awareness and motivation, that is, developing the entrepreneurial drive among students.

These axes organize entrepreneurship education as a way to prepare students for entrepreneurial practice, and considers skills, knowledge and attitude as the key components of competence[23]. However, the report does not define the skills to account for, which is why the axes have to be complemented with another competence framework. As detailed in Smith's competence framework[43], it can also be grouped in the axes defined by the European Commission, without any major change.

How entrepreneurship education should be taught and how to make students more entrepreneurial is a also matter for debate, however[61]. Many researchers claim that the better way is to apply a learning-by-doing approach[62], but the question of learning-by-doing what needs to be properly answered. However, developing entrepreneurial experience through traditional class-based discussions of case studies is still the most common approach. Hybrid approaches, such as gamification,

[60] European Commission, "Entrepreneurship in higher education, especially within non-business studies," Tech. Rep. Final report of the expert group, European Commission, 2006.

[61] H. Matlay, "The impact of entrepreneurship education on entrepreneurial outcomes," Journal of Small Business and Enterprise Development, vol. 15, no. 2, pp. 383–396, 2008.

[62] D. Politis, "The process of entrepreneurial learning: A conceptual framework," Entrepreneurship Theory and Practice, vol. 29, no. 4, pp. 399–424, 2005.

are gaining ground recently[63] and are envisaged to play an important role in teaching entrepreneurial skills, as they complement the ability of educators[64].

The GAMEST project seeks precisely to promote the teaching of these skills and knowledge, as well as attitude change through game-based mechanics. It should be mentioned that GAMEST will develop only few skills, since fostering all skills is out of the scope of this project. As we will see in the results section, this selection was based on the relevance that teachers give to those skills and their potential to be improved by gamification, but also considering that vocational education can take place at the post-secondary level but also in further education or in higher education level.

## GAMEST PROJECT

The **GAMEST** project (**GAM**ification t**E**chnique**S** for entrepreneurial vet **T**eachers) is funded in the ERASMUS+ Program (2019-1-RO01-KA202-063211).The project is realized thanks to the collaboration of VET providers, gamification experts, and SMEs involved in entrepreneurial sector and digital content development, from four different European countries: in Romania, the University Dunarea de Jos in Galati; in Slovenia, the School Center Novo Mesto; in Italy, Prism Consulting and FVB-The Hive; and, in Spain, the University of Santiago de Compostela.

GAMEST focuses on VET teachers, trainers and coaches involved in entrepreneurial educational field. Therefore, the main project participants are VET providers. Moreover, the project is expected to reach also other professional categories and stakeholders, such as VET teachers involved in other educational field, gamification experts and start uppers coach. **The project general objective of GAMEST is to support the promotion of high-quality and innovative teaching based on the application of gamification strategies.** The project identifies in gamification an innovative vehicle to teach entrepreneurial contents, increasing learners' engagement in the subject matter, and enhancing skills of both educators and

[63] L.A. Collins, A.J. Smith, and P.D. Hannon, "Applying a synergistic learning approach in entrepreneurship education," Management Learning, vol. 37, no. 3, pp. 335–354, 2006.

[64] M.B. Low, and I.C. MacMillan, Entrepreneurship: Past research and future challenges, pp. 131–154. Berlin, Heidelberg: Springer Berlin Heidelberg, 2007.

learners. To achieve this general objective, GAMEST will pursue two specific objectives:

- Define the state of the art of gamification applied in entrepreneurial education and detect to what extent the target group is already engaged with gamification practices. Thus, GAMEST will analyze the current situation of gamification application in entrepreneurial training developing surveys about current level of awareness of gamification for each country and a final research (**intellectual output 1**). As a corollary of this intellectual output, a **didactic methodology** used in the development of an online course and in the creation of video tutorials will be proposed. The focus of the current document is this intellectual output.
- Strengthen gamification skills and their application knowledge for VET educators. To achieve this objective, GAMEST will produce both an online course and relative didactic material for gamification training (**intellectual output 2**), including video-tutorials on the use of gamification in entrepreneurial VET educational field (**intellectual output 3**). These video-tutorials are conceived to be a vehicle for the intellectual output 2, namely its practical part, in which the acquisition of previously tackled didactic methodologies will be furtherly set. However, the videos function is not only to deliver a mere tutorial but is also to supply an opportunity to make VET teachers, trainers and coaches aware of the existence of new and innovative methodologies with which to teach entrepreneurship.

GAMEST wants to have long-term impact on VET system. Empowering VET trainers through the supply of innovative didactic methodology framework based on gamification will give to VET learners the possibility to learn and to acquire new skills more easily. Therefore, GAMEST aims at reducing the gap between learners and teachers and giving to the target group the practical tool to teach necessary skills to access to entrepreneurial labor market.

## PILOT ABOUT GAMIFICATION IN VET ENTREPRENEURSHIP EDUCATION

Our study aimed to investigate how to improve entrepreneurship education by means of gamification, but from the perspective of VET educators. Teachers play an important role in introducing pedagogical innovations in the classroom, especially

technology-related innovations[65]. Therefore, attitude toward gamification is an important predictor to measure their disposition to apply it. This can be conceptualized both from their knowledge-level as well as from the use of gamification as a teaching. The actual use can also provide useful insights on the role that gamification plays in entrepreneurship education.

This study was also conducted to identify the skills that are more relevant but also that are better suited to be adapted to improve the gamification skills of teachers. This suitability can be determined by the importance that teachers associate to each skill, within the framework of entrepreneurial competencies. However, it should also be measured based on the difficulty of applying game mechanics to that skill. In line with these objectives, we posit the following research questions:

**RQ1** What is the current level of application of gamification in VET for entrepreneurship?

**RQ2** Which are the gamification techniques most frequently applied in the entrepreneurship courses developed by the VET teachers?

**RQ3** Which are the most relevant entrepreneurial skills that can benefit from the use of gamification?

**RQ4** Which is the methodology and didactic materials to be developed in the course about gamification in entrepreneurship education?

## Participants

The population is formed by a total of 103 teachers, where 23 where from Italy, 26 from Romania, 28 from Slovenia, and 26 from Spain. The study was conducted between December 15th, 2019 and May 15th, 2020 and included a total of 55 different VET organizations. All participants were VET teachers of entrepreneurship education in secondary, post-secondary or further education. We also included higher education level, delivered at academies or vocational schools, but not at universities or colleges since this group was out of the scope of this project. The sample comprised teachers from secondary education and from vocational schools.

[65] J. Ketelhut, and C.C. Schifter, "Teachers and game-based learning: Improving understanding of how to increase efficacy of adoption," Computers & Education, vol. 56, no. 2, pp. 539–546, 2011.

Table **Error! Reference source not found.** summarizes the features of this population.

## Instrument and data collection

Considering the characteristics of this population and the nature of the data (teachers' personal perceptions of gamification and entrepreneurship), we used a questionnaire as a tool for data collection. Capturing perceptions through direct questions is difficult since perceptions are complex cognitive features. Therefore, in this paper we asked about levels of perceptions using series of statements with gamification or with entrepreneurship. In most cases, questions were structured as five-point Likert type (*0 = not at all* to *5 = total*) or using rankings from the less important to the most important option.

The questionnaire was composed of two blocks (see appendix A). **In the first block (questions 1-14) we establish the knowledge and level of application of gamification by VET educators**. Questions have been arranged following linear pathways of answers (affirmative/negative) depending on the experience of the teacher in gamification. **In the second one (questions 15-41), we asked for the relevance that teachers assign to each one of the 17 entrepreneurial skills**. In this second block we also grouped questions around the 4 categories of skills previously mentioned in Section 3 in order to

| Country | # Teachers | # Organizations |
|---|---|---|
| **Italy** | 23 | 21 |
| **Romania** | 26 | 21 |
| **Slovenia** | 28 | 7 |
| **Spain** | 26 | 6 |
| **TOTAL** | 103 | 55 |

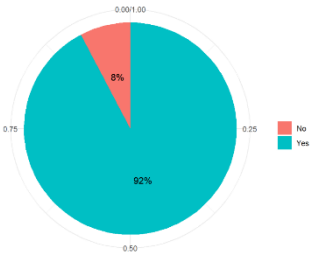
**Table 1. Characteristic of the population that participate in the experimental study.**

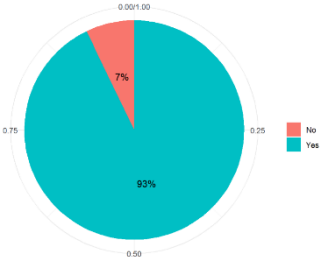
identify at least one skill in each category. Each sub-block has 6 questions, where the first one seeks to establish educators' preferences regarding which skill of this category is more relevant. The remaining questions explore his experience and attitude towards the use of gamification to teach any of the skills of this category.

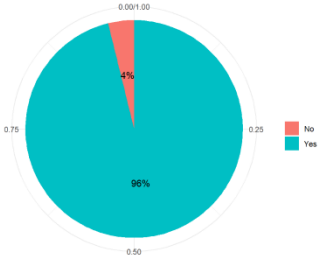
## Block I: Knowledge and level of application of gamification by VET educators

This block contains **14 questions** related to the knowledge and the use of gamification techniques in courses of entrepreneurship education. Some of these questions define the educational context in which gamification is used (questions from Q10 to Q14), whereas the answers to the rest of questions show the knowledge of VET teachers about gamification and the features of the courses that apply gamification. Therefore, the results of these questions (**questions from Q1 to Q9**) will help us to select the contents of the didactic material related to both the game mechanics and dynamics. In the following, we describe the results of these questions for all the countries.

**Q1 Do you know what gamification is?** As can be seen from the results of the questionnaire related to this question (Figure **Error! Reference source not found.**), there is a high knowledge about what gamification is among the VET teachers from all countries: greater than 90% for all the countries, with an average of 93%, being the higher for Slovenia (96%) and the lower for Spain (91%). **This high knowledge of the VET teachers about gamification will allow us to draw conclusions about the results of the experimental study.**



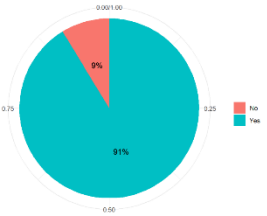
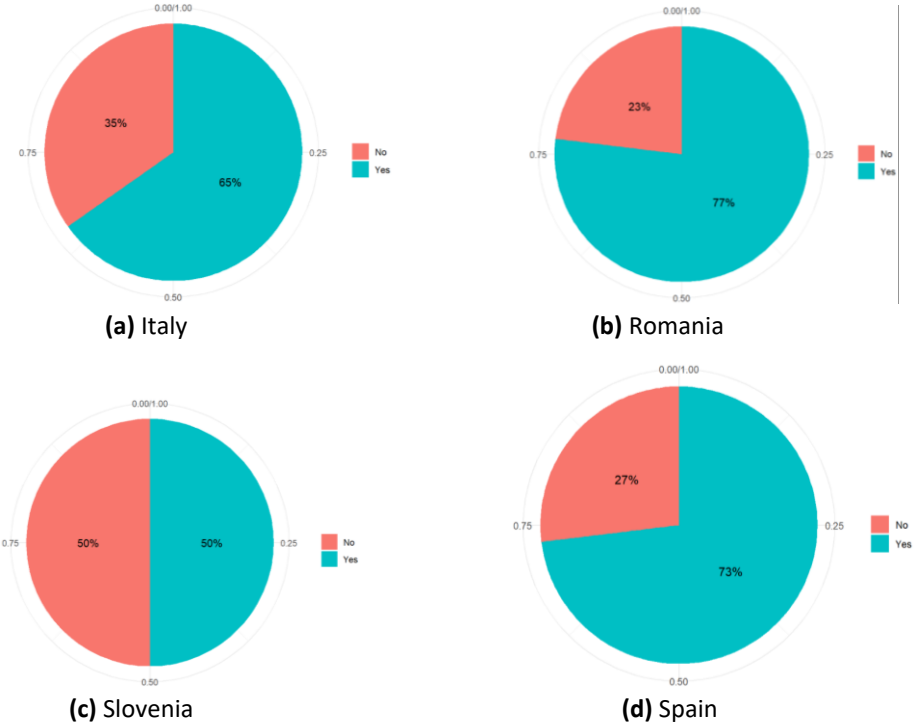



**Figure 6. Answers to the question *Do you know what gamification is?***

**Q2 Have you ever used gamification in your courses?** Related to this question, there exist some variability between the respondents' answers from all countries (Figure 7), ranging from the 77% for Romania to the 50% for Slovenia, with an average of 66% for all countries. Near to this value is the percentage of VET teachers in Spain and Italy that have ever put gamification in practice for their entrepreneurship courses (73% and 65%, respectively).

However, from teachers which are not using gamification techniques in their courses, in Italy and Spain **anyone** will consider to use this kind of techniques in the future, whereas for Slovenia and Romania this percentage is very high (93% and 83%, respectively). The average for all the countries is 51.40%. This important difference among the perceptions of teachers from Spain and Italy with respect to Slovenia and Romania is probably due to the obstacles that prevent the use of gamification techniques have not been used.

**Q4 What are the main obstacles that prevent you from using gamification in courses?** In this question, teachers assign a value from 1 to 6 to each option related to the obstacles in applying gamification in courses, where 1 is the less important obstacle and 6 is the most important one.




**(a)** Italy **(b)** Romania

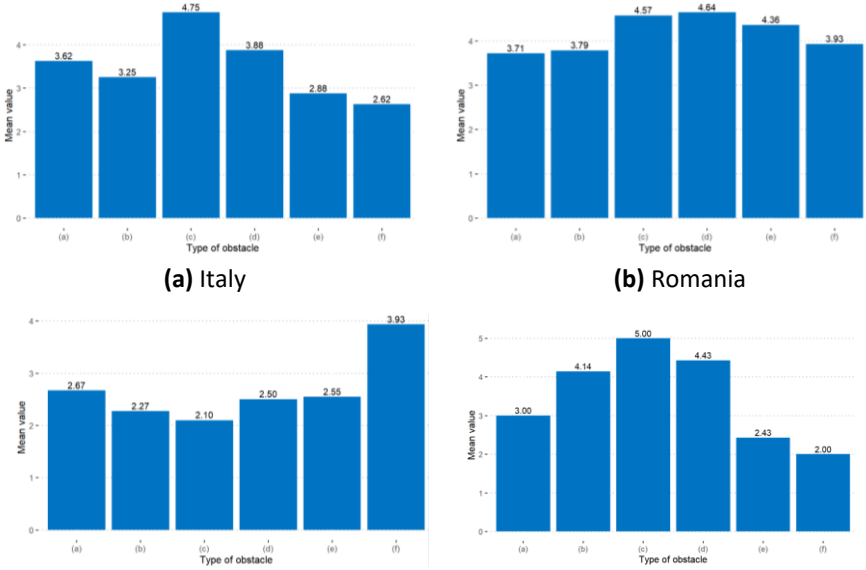
**(c)** Slovenia **(d)** Spain

**Figure 7. Answers to the question *Have you ever used gamification in your courses?***

As can be seen in Figure 8, the respondents' answers for Spain and Italy are somewhat similar: the main obstacles are related to the lack of information about how to apply gamification techniques and the types of games that could be used for gamification. In Romania, however, there is some uniformity between the reasons that prevent the use of gamification techniques: all of them are marks between 3.71 and 4.64, in a scale of 6. Finally, in Slovenia the main reason is the lack of an e-learning platform that supports the use of gamification techniques in courses, which

is probably related with the second reason, the time to implement gamification in the development of courses.

Summarizing, if we analyze the results from all countries as a whole, the two main obstacles that prevent teachers from using gamification are the lack of information about how to apply it (4.05 in a scale of 6) and the specifics about its mechanics (3.90), in addition to other factors such as the time needed to develop gamified contents (3.23) or the difficulty of implementing this approach in their course (3.33). These factors act as an entry barrier that prevents teachers from applying gamification techniques to a larger extent. Therefore, **these results justify the development of didactic material to VET teachers in gamification techniques applied to entrepreneurship education.**




**(a)** Italy **(b)** Romania

**(c)** Slovenia **(d)** Spain

**Figure 8. Answers to the question *What are the main obstacles that prevent you from using gamification in your courses?* Where (a) it takes a lot of time to implement gamification in my courses; (b) it is difficult to use gamification in my courses; (c) I have not enough information about how to apply gamification in my courses; (d) I don't know what are the specific types of games that can be applied for gamification; (e) the delivered curricula limit the possibility of using gamification; and (f) our educational institution has not an e-learning platform as support for gamification implementation.**

**Q5 How long have you been using gamification in your courses?** With respect to the period in which VET teachers have maintained their courses gamified (Figure 9), most of teachers in all the countries have applied these kind of techniques between 1 year and 5 years or more than 5 years: 52.20% for Italy, 58% for Romania, 46.40% for Slovenia, and 53.90% for Spain The average for all the countries is 52.40%. These values are taken from all respondents, including those which have not applied gamification in their courses. Therefore, if we just select answers from teachers that have used gamification, the percentage of them that maintain gamified activities between 1 year and 5 years or more than 5 years is of 73.39% for all the countries, being 80.06% for Italy, 75.32% for Romania, 92.80% for Slovenia, and 73.73% for Spain. Therefore, **once gamification is applied in entrepreneurship courses, they are usually maintained during a long period.**

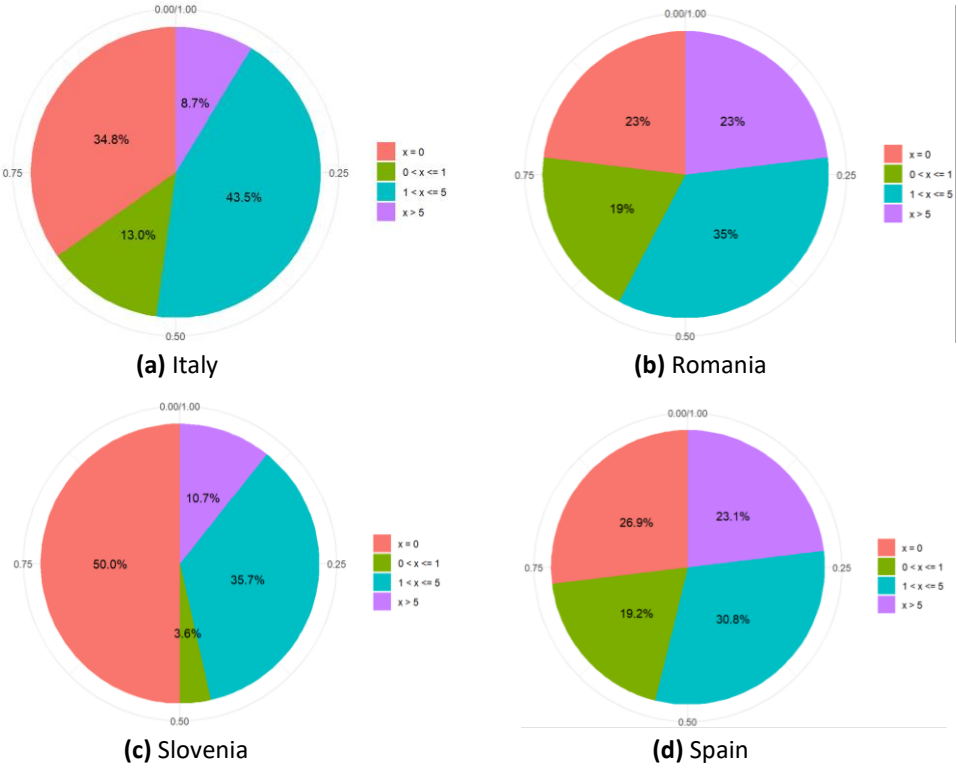
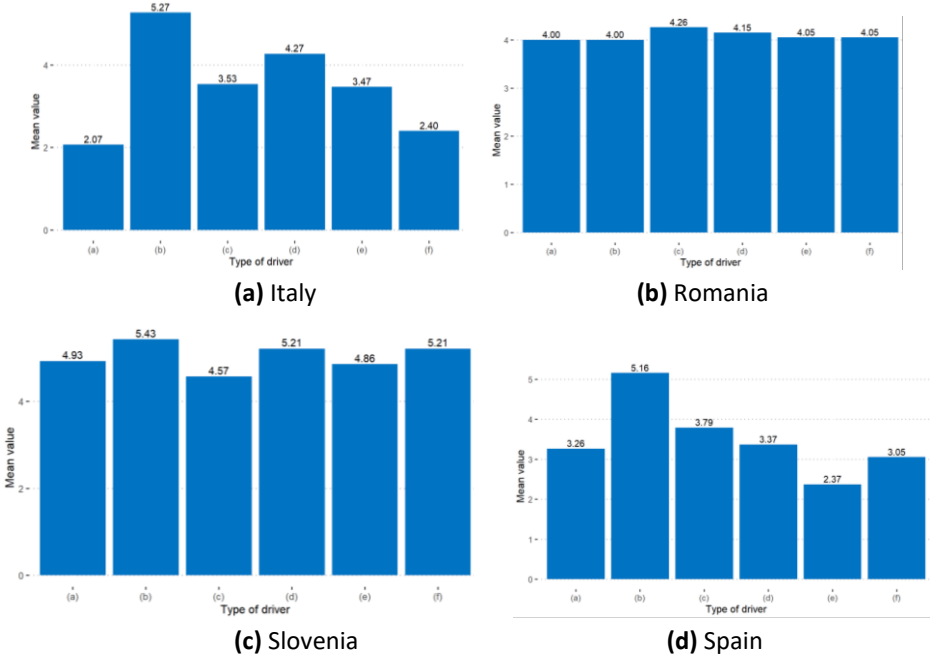



**Figure 9. Answers to the question *Have you ever used gamification in your courses?***

**Q6 What are/were the drivers that encourage/encouraged you to use gamification in your courses?** In this question, teachers assign a value from 1 to 6 to each option related to the drives that encourage them to use gamification in courses, where 1 is the less important driver and 6 is the most important one.

As can be seen in Figure 10, the respondents' answers from Romania and Slovenia are highly uniform in their values: they range from 4.05 to 4.26 for Romania, and from 4.86 to 5.43 (except for the enhancement of the students' learning performance, which is of 4.57). However, the respondents' answers from Italy and Spain are heterogeneous, being the gamification promotion of the students' motivation and engagement (5.27 and 5.16 for Italy and Spain, respectively), the enhancement of the learning performance and academic achievement (3.53 and 3.79 for Italy and Spain, respectively), and the psychological and behavioral changes (4.27 and 3.37 for Italy and Spain, respectively) the most important drivers. **These three drivers are also the most relevant ones when we analyze the average values for all the countries, which is consistent with the findings of other proposals in the state of the art.**



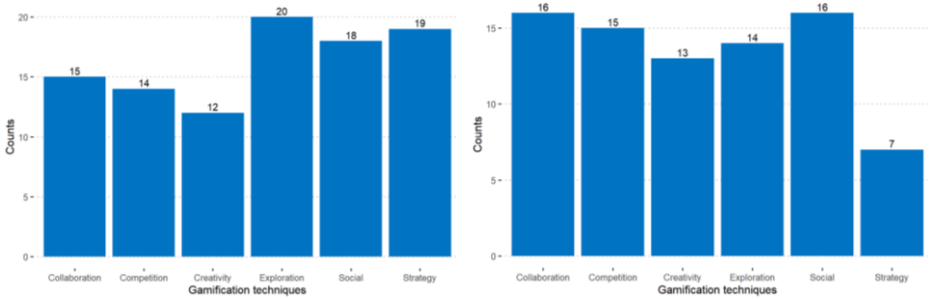

**(a)** Italy **(b)** Romania

**(c)** Slovenia **(d)** Spain

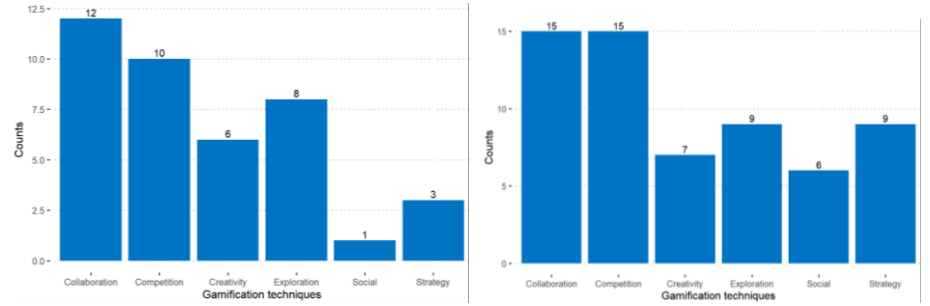
**Figure 10. Answers to the question *What are/were the drivers that encourage/encouraged you to use gamification in your courses?* Where (a) gamification can improve students' recall and retention; (b) gamification can promote students' motivation and engagement; (c) gamification enhances students' learning performance and academic achievement; (d) gamification can determine psychological and behavioral changes; (e) gamification can provide instant feedback that allows students to check their progress; and (f) gamification can provide variate learning experiences in students.**

**Q7 Which one of the following gamification techniques have you used in your courses?** In this question, teachers select several gamification dynamics that have used in their entrepreneurship courses. That is, each teacher can select more than one answer/dynamic, meaning that the number of answers is not necessarily the same as the number of teachers.

As can be seen in Figure 11, collaboration and competition are the most used dynamics in Romania (19.75%, 16/71 answers, for collaboration, and 18.52%, 15/71 answers, for competition), Slovenia (30%, 12/60 answers, for collaboration, and 16.67%, 10/60 answers, for competition), and Spain (24.59%, 15/71 answers, for both collaboration and competition). However, in Italy although these dynamics are




**(a)** Italy **(b)** Romania




**(c)** Slovenia **(d)** Spain

**Figure 11. Answers to the question *Which one of the following gamification techniques have you used in your courses?***

important, having the 15.30% (15/98) and 14.29% (14/98) of answers for collaboration and competition, respectively, they are not the most relevant, which are exploration, social and strategy, with 20.41% (20/98), 18.37% (18/98), and 19.39% (19/98) of answers, respectively. This difference between Italy and the other three countries could be related with the combination of several dynamics used in the entrepreneurship courses, although a deeper analysis is needed to justify this sentence.

From a global point of view, the most used dynamics for developing learning strategies are collaboration and competition, being 22.97% (51/222) and 22.07% (49/222), respectively. This is expected considering the nature of entrepreneurship, where it is usually necessary teamwork for achieving the goal of creating and developing a business idea, but this process is ruled out by competition in a market to promote the products or services. The next two most used techniques by VET

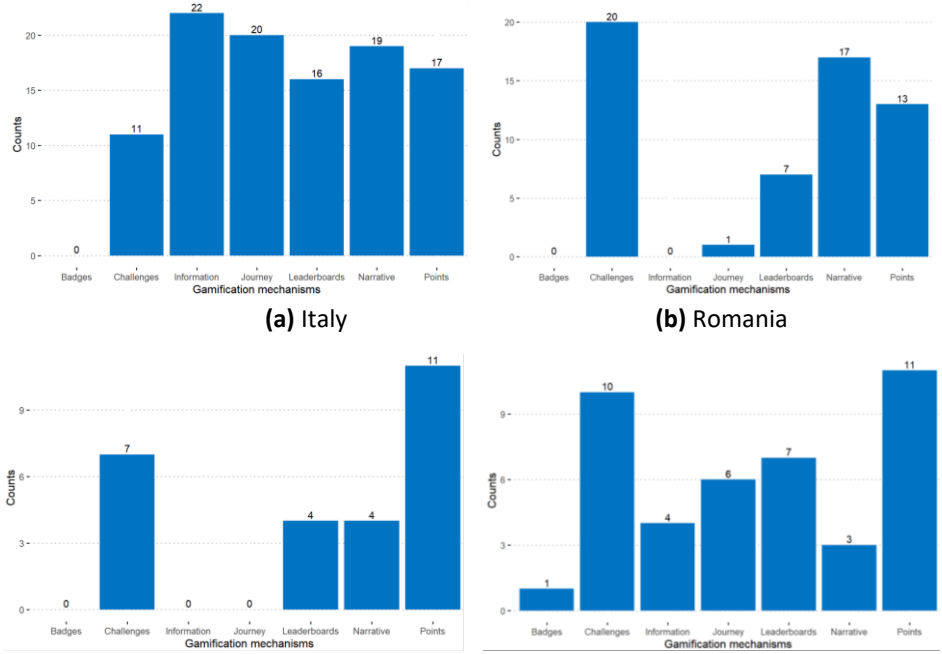
teachers are creativity and exploration, with 16.67% and 15.31%, respectively. Note that social has been applied by 12.61% of teachers, but this percentage may be partially framed by collaborative dynamics, where the social interaction between team members is needed to achieve the objectives. Therefore, we consider that social techniques are subsumed in collaboration, at least from the perspective of the GAMEST training and methodology.

**To gain knowledge in game dynamics used in entrepreneurship education, we propose the development of didactic materials focused on collaboration, competition, social, and creativity.**

**Q8 Which one of the following gamification mechanics have you used in your courses?** In this question, teachers select several gamification mechanics that have been used in their entrepreneurship courses. As for question Q7, the number of answers is not necessarily the same as the number of teachers that participated in the questionnaire.

As can be seen in Figure 12, there exist a high heterogeneity between the countries in the use of the different game mechanics. For instance, in Italy the most relevant mechanics are information and journey, with 20.95% (22/105) and 19.08% (20/105) of answers, respectively. However, in Romania and Slovenia **anyone** has applied information and journey has been considered only once in Romania. Therefore, we need to analyze the results from a global point of view, where there are two game mechanics that stand out from the rest: challenges and points, which have been applied by the 29.17% (41/168) and 24.40% (49/168) of teachers, respectively. The next most used game mechanics are narrative and leaderboards, with 14.88% (25/168) and 16.67% (28/168) of answers, respectively. However, leaderboards are related with points and, even, badges, where social aspects are incorporated to the gamified experience. Therefore, from the point of view of training we could consider the binomial points/leaderboards as an only entity.

**To gain knowledge in game mechanics used in entrepreneurship education, we propose the development of didactic material focused on leaderboards, narratives, and challenges.**

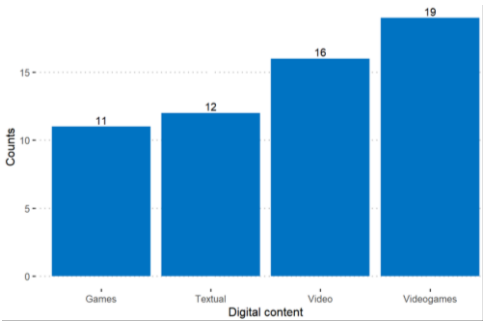



**(a)** Italy **(b)** Romania

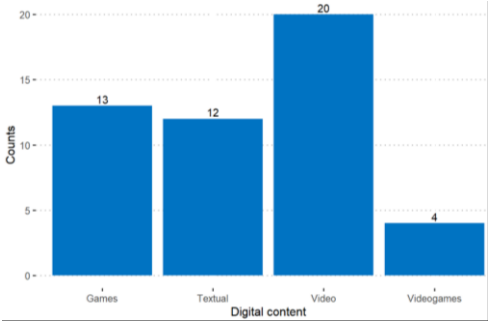
**(c)** Slovenia **(d)** Spain

**Figure 12. Answers to the question *Which one of the following gamification mechanics have you used in your courses?***

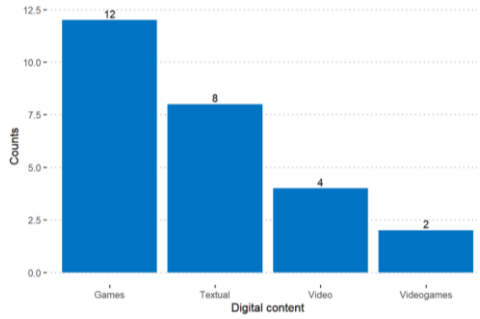
**Q9 Which type of digital contents do you use in your gamification activities?** As can be seen in Figure 13, in Slovenia and Spain the most used content are non-digital games, with 46.15% (12/26) and 45.45% (15/33) of answers, respectively, whereas videogames were the first selection for teachers in Italy, with 32.76% (19/58), being the last one in the other three countries, Romania, Slovenia, and Spain, with 8.16% (4/49), 7.69% (2/26), and 9.09% (3/33) of answers, respectively. Furthermore, videos are mainly applied in Italy and Romania, with 27.59 (16/58) and 40.82% (20/49), respectively. This heterogeneity between the types of digital contents used in the courses is probably due to the availability of the contents, particularly videogames and videos.



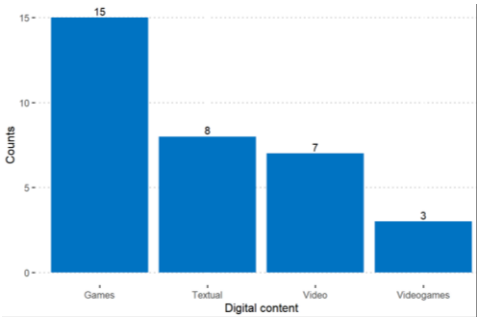

**(a)** Italy




**(b)** Romania




**(c)** Slovenia



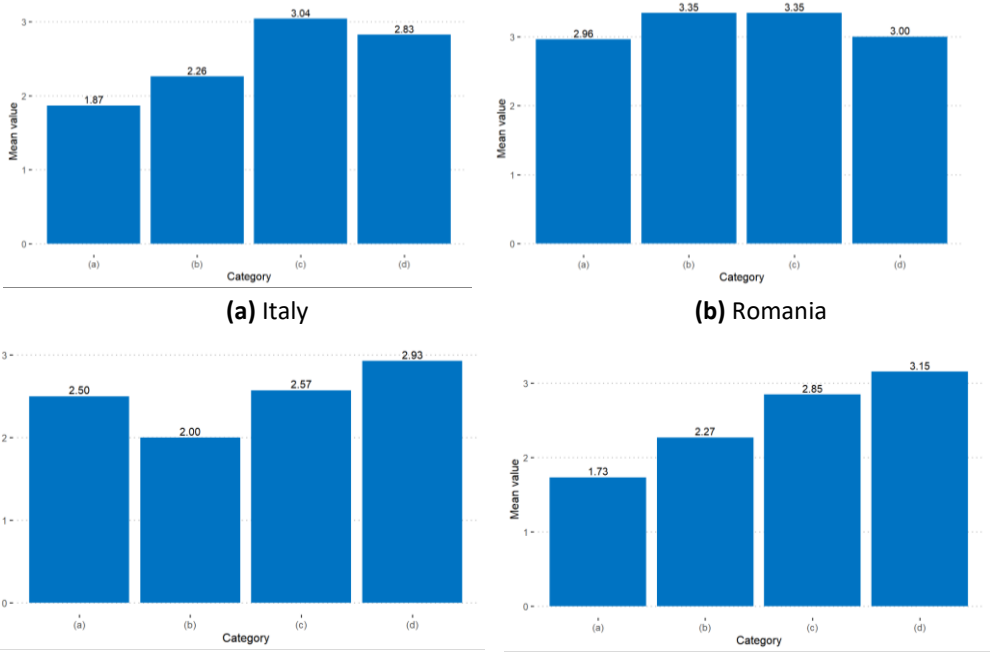

**(d)** Spain

**Figure 13. Answers to the question *Which type of digital contents do you use in your gamification activities?***

## Block II: Analysis of the entrepreneurship competences in education

Questions 18 to 41 of the questionnaire were defined to extract the opinion of teachers with respect to the entrepreneurial competences and skills. Figure 14 shows the ratings that teachers of each country assign to the categories of the competency framework mentioned in Section 3. Although there is not a clear result, *personal maturity* category has the better ratting in Slovenia and Spain, while *entrepreneurial* category has the better ratting in Italy and Romania. If we aggregate the results of all countries, these two categories also turn out to be the best rated by the teachers with a score of 2.98 and 2.94 in a scale of 4, respectively, advantaging the managerial

and technical skills in more than 0.5 points. Surprisingly, the personal maturity category scores higher than entrepreneurship. Many authors consider the latter category as the very definition of what an entrepreneur is. However, in order to take advantage of it, it is important to strengthen personal skills, and the results show precisely this behavior with regard to the two lowest scoring categories, teachers give more importance to managerial than to technical skills. One possible reason is that technical skills are more difficult to teach without contextualizing them in a particular domain. Managerial skills are also essentials in the context of entrepreneurship, although these can be considered transversal skills needed in any business venture.



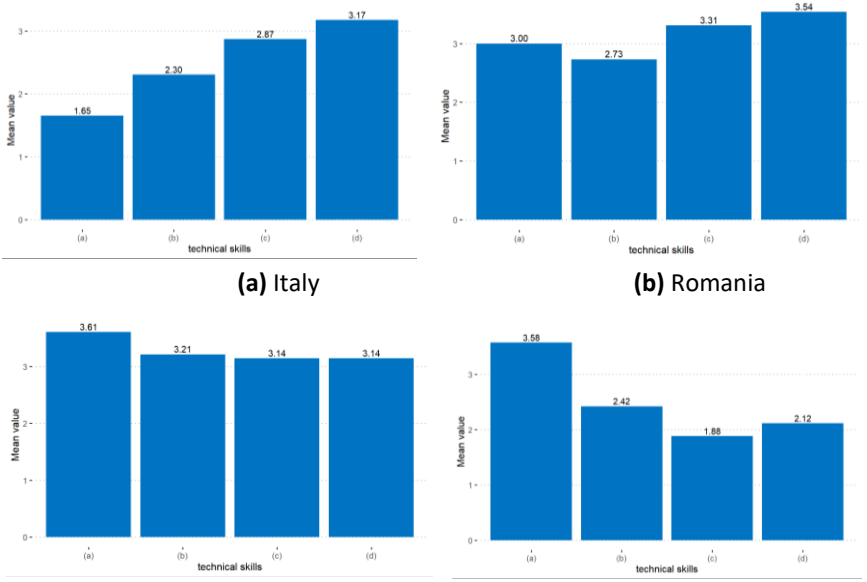

**(a)** Italy **(b)** Romania

**(c)** Slovenia **(d)** Spain

**Figure 14. Rating of the entrepreneurial skills categories.**

## Analysis of the technical skills category

Figure 15 shows the relevance that VET teachers assign to the four skills that compose this category (Question 18). Italian and Romanian VET teachers consider the skill to manage the production process and technology the most important, while Slovenian and Spanish chose the skills related to produce the product or service. In the aggregated data of all countries, both skills also obtain the better ranking with a score of 3.01 and 2.99, respectively. It should be noted that Italian and Spanish teachers assess these skills in the opposite way, while Romanian and Slovenian teachers are in the middle. These may be an indicator that the teaching of this category is quite different in each country. The other skills, namely the management of supplies and the management of the office space obtain lower results, scoring 2.69 and 2.81, respectively.

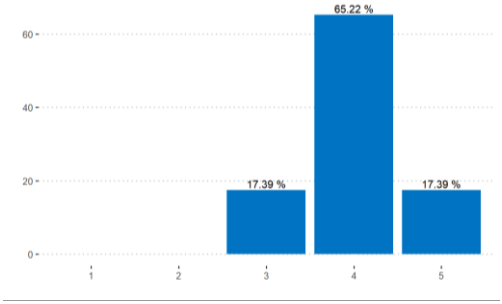



**(a)** Italy **(b)** Romania

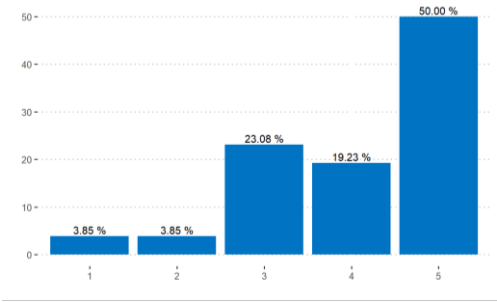
**(c)** Slovenia **(d)** Spain

**Figure 15. Rating of the technical skills on a scale from 1 to 4, where (a) stands for the skills necessary to produce the product or service, (b) for the skills to manage supplies and raw materials, (c) for the skills to manage an office or a production space, and (d) for the skills to manage the production process and technology.**

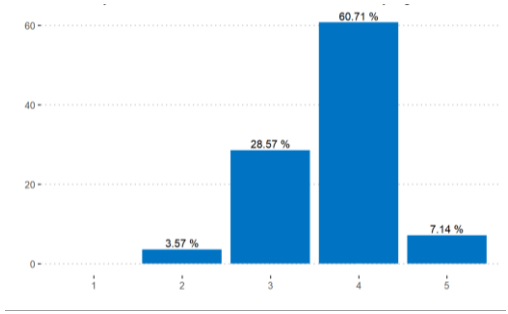
The ratio of VET teachers that train their students in this category reaches about 75% in the aggregated data of all country (Question 19). Romania turns out to be the country where these skills are most taught, with 88% of application, while in Spain only 62% of teachers teach this part of entrepreneurship education. In Italy and Slovenia, the percentage reaches the 74% and 75%, respectively. Figure 16 shows to what extent VET teachers of each country think that a gamification-based approach could enhance the teaching of the technical skills (Question 20). Romanian teachers are the most confident about the contribution of gamification to the teaching of these skills, and 50% of them think that students training would improve to a very large extent. The other three countries also have high hopes in what this technology can bring and consider that it would improve to a large extent the development of these skills, with a range that goes from 50% to 65%. However, only 49% of VET



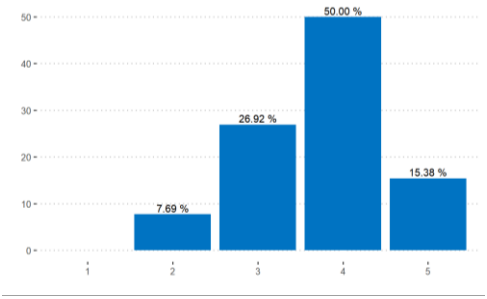

**(a)** Italy




**(b)** Romania



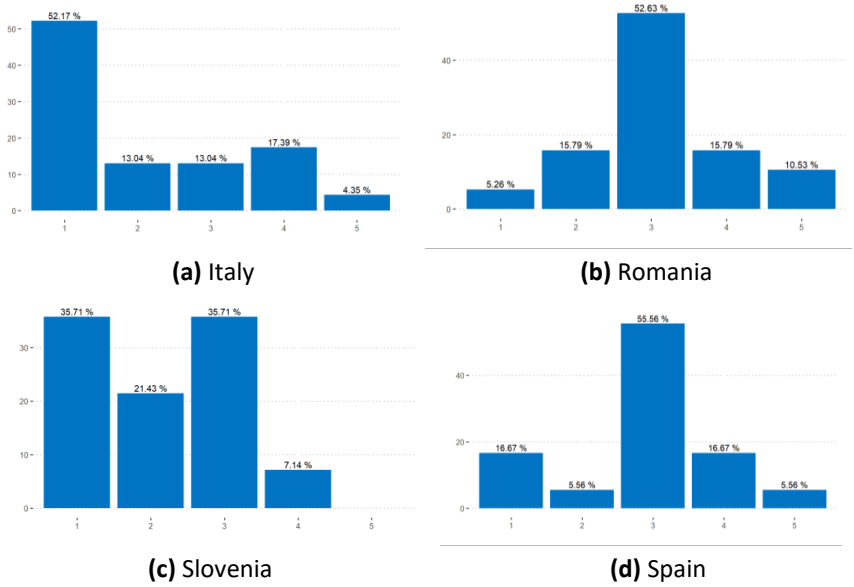

**(c)** Slovenia




**(d)** Spain

**Figure 16. Answers to the question *To what extent you think that a gamified approach could enhance the development of the aforementioned skills?* Where answers are on a scale from 1 = not at all to 5 = a very large extent.**

teachers have applied it to this category (Question 21). If we analyze these data by country, two clearly differentiated behaviors can be observed. In Romania and Spain 69% and 58% of VET teachers use gamification to teach these skills, respectively, but in Italy and Slovenia this percentage decreases to 39% and 32%, respectively. These results are consistent with the charts depicted in Figure 17 which represent, on a scale from 1 to 5, the answers to the question of how often teachers use gamification to teach these skills in their course (Question 22). As we can see, Romanian and Spanish teachers use more often gamification than their Italian and Slovenian colleagues. In Italy, 52.17% of teachers never use gamification, and 13.04% use it rarely. The percentages are less drastic in Slovenia, where 35.71% never use it and 21.43% use it rarely. In Slovenia, Romania and Spain, occasional use is the most common answer. Frequent and continuous use is a minority in all countries and




**(a)** Italy **(b)** Romania

**(c)** Slovenia **(d)** Spain

**Figure 17. Answers to the question *How often have you used gamification to teach any of the technical skills?* Answers are on a scale from 1 to 5 where 1 = never, 2 = rarely, 3 = sometimes, 4 = often, 5 = always.**

represents 21.74% in the Italian case, 7.14% in the Slovenian case, 26.32% in the Romanian case, and 22.23% in the Spanish case. These numbers show the gap between usefulness and use, since while most teachers agree on the benefits that gamification could bring to the teaching of technical skills, there are barriers prevent them from applying them in their courses.

## Analysis of the managerial skills category

Figure 18 shows the relevance that VET teachers assign to the six skills that compose this category (Question 23). Management skills are the best rated by teachers in Italy, Slovenia and Spain, and the second best in Romania. For the rest of skills there is also a certain consensus among the different countries. In Italy, Romania and Spain, marketing/sales skills are particularly well rated, although in the Romanian case the gap between the different skills is only a few tenths. Higher-order skills also excel in Italy, Slovenia and Spain. The aggregated data confirm the above statements, and managerial marketing/sales, and higher-order skills are rated with 5.04, 4.54, and 4.44, respectively, while financial skills stays off the podium with a 4.13 rating. In contrast to technical skills, there is greater consensus on the relative importance of management skills among the four countries analyzed, which may be an indicator of a greater synergy in how they approach the teaching of this part of entrepreneurship education.

The ratio of VET teachers that train their students in this category reaches about 70% in the aggregated data of all country (Question 24), 5% lower than the technical skills. Slovenia with 57% is the country where these skills are least trained while Spain with 85% is the one in which these skills are most trained.

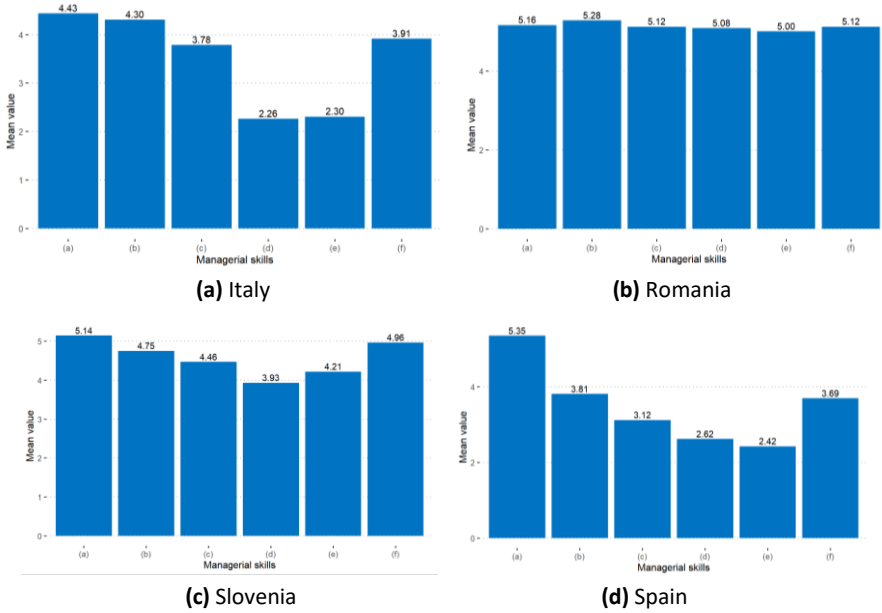
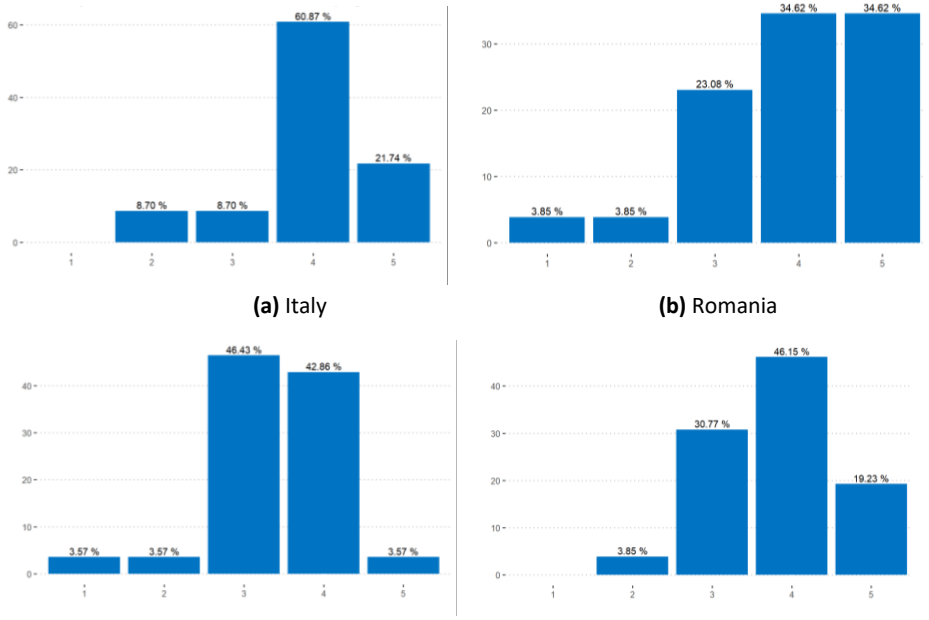



**Figure 18. Rating of the managerial skills on a scale from 1 to 6, where (a) stands for management skills, (b) for marketing/sales skills, (c) for financial skills, (d) for legal skills, (e) for administrative skills, and (f) for higher-order skills.**

Figure 19 shows to what extent VET teachers of each country think that a gamification-based approach could enhance the teaching of the managerial skills (Question 25). Romanian teachers are again the most confident about the contribution of gamification, and 34.62% of them think that students training would improve to a large extent. The other three countries also have high hopes in what this technology can bring. In fact, if we consider the data of the four countries, 45. 63% of VET teachers think that it would enhance the development of these skills to a large extent, while 19.42% to a very large extent. However, only 51.5% of VET teachers have applied gamification to this category (Questi on 26). If we analyze these data by country, the behavior already observed during the analysis of the technical skills is repeated and Romanian and Spanish teachers use far more often gamification than their Italian and Slovenian colleagues. Specifically, 69% of Romanian teachers and 65% of Spanish teachers teach these skills, but this percentage decreases to 30% and 39% for Italian and Slovenian teachers. Despite this, we haven't found a behavioral pattern between expectations and usage from

the aggregated data. On a case-by-case basis, Romania stands out as the country where expectations and usage of gamification are most aligned, which may indicate that its application is having the desired results.




**(a)** Italy **(b)** Romania

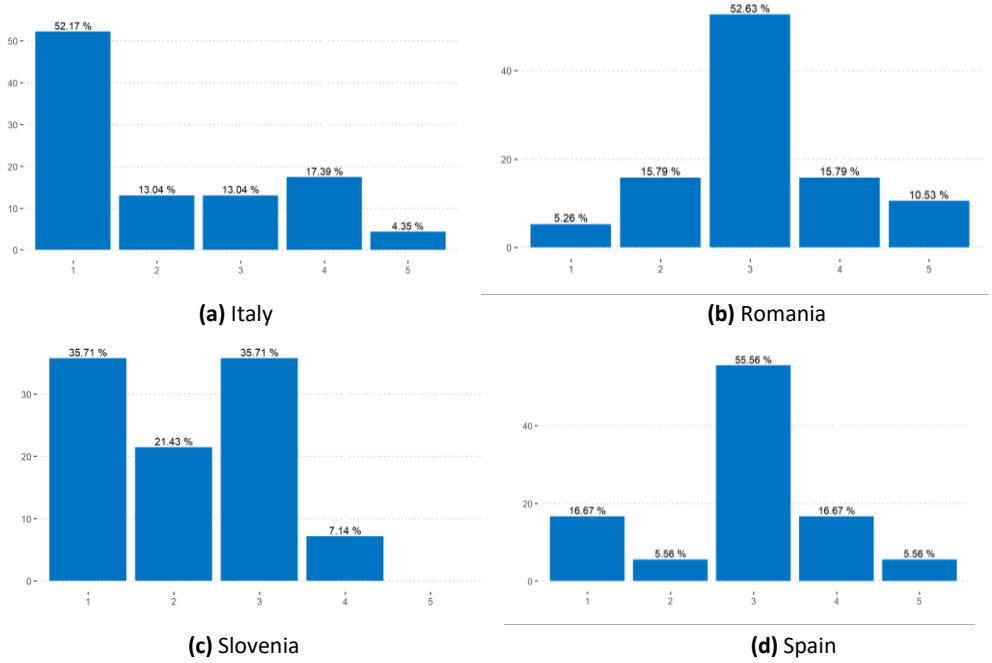
**(c)** Slovenia **(d)** Spain

**Figure 19. Answers to the question *To what extent you think that a gamified approach could enhance the development of the managerial skills?* Where answers are on a scale from 1 = not at all to 5 = a very large extent.**

Figure 20 represents, on a scale from 1 to 5, the answers to the question of how often teachers use gamification to teach these skills in their course (Question 27). Romanian and Spanish teachers use more but also more often gamification than their Italian and Slovenian colleagues. This is consistent with the results previously analyzed of Question 26 since 30% more teachers in these two countries use gamification for this purpose.

This may also indicate the extent to which this technology is established in education, as the same trends are seen as for technical skills. In the case of Italy, of the 30% of teachers who used gamification (Question 26), 56.62% stated that they do use it anymore and 13 .04% almost never. In the case of Slovenians, these percentages

move to 26.67% and 20%. Clearly, the experience of these teachers in applying gamification techniques has not met their expectations. However, given that teachers' expectations of gamification are much higher, there is a greater likelihood that the barriers to its development are structural or lack of training. It is also worth mentioning that both in Romania and Spain the preferential use is occasional. If we consider the aggregated data from all countries, 16.22% of teachers use gamification frequently but only 6.76% always use it to develop training in these skills.




**(a)** Italy **(b)** Romania

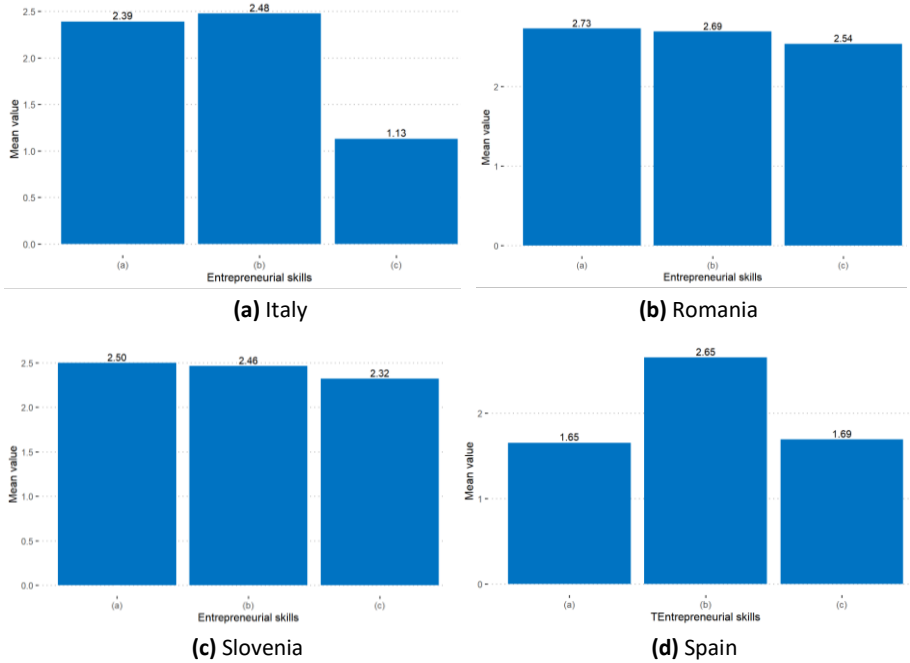
**(c)** Slovenia **(d)** Spain

**Figure 20. Answers to the question *How often have you used gamification to teach any of the managerial skills?* Answers are on a scale from 1 to 5 where 1 = never, 2 = rarely, 3 = sometimes, 4 = often, 5 = always.**

## Analysis of the entrepreneurial skills category

Figure 21 shows the relevance that VET teachers assign to the five skills that compose this category (Question 28). Environmental scanning skills, which develop the abilities to recognize market gaps or exploit market opportunities, are the best rated by teachers in Italy and Spain with 2.48 and 2.65, respectively, and the second best in Slovenia and Romania with 2.46 and 2.69, respectively. Business conceptualization skills, which are needed to create and present a business plan, rank first in Slovenia and Romania with 2.50 and 2.73, respectively, and second in Italy with 2.39. The scoring of these two skills is very similar in all countries, although environmental scanning stays ahead of business conceptualization in the aggregated data of all countries (2.57 versus 2.32). Networking skills take last place on this podium in all countries but Spain where it gets the second-best score with 1.69, nearly tied with the 1.65 obtained by business conceptualization skills. It may be surprising that environmental scanning has a higher score than the ability to make a business plan, however, it is a key factor to help entrepreneurs to understand what is happening both inside and outside their organization and to increase the probability that the strategies developed will be appropriately reflected. This skill is crucial since changes in the environment can have a great impact on their business.

Results show that 73% of VET teachers train their students in this category in the aggregated data of all country (Question 29), nearly tied with the technical skills. Slovenia and Spain with 53% and 69% are the countries where these skills are least trained while Italy and Romania with 83% and 88% are the ones in which these skills are most trained.




**(a)** Italy **(b)** Romania

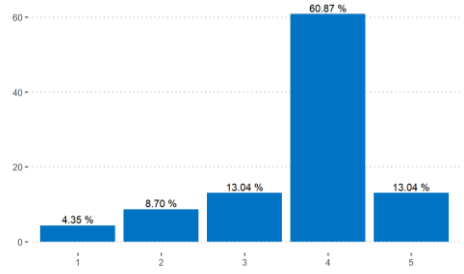
**(c)** Slovenia **(d)** Spain

**Figure 21. Rating of the entrepreneurial skills on a scale from 1 to 3, where (a) stands for skills to develop a business plan, (b) for the skills needed to recognize market gaps or exploit market opportunities, and (c) for networking skills.**

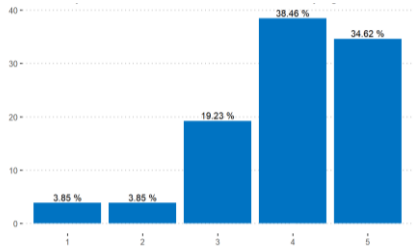
Figure 22 shows to what extent VET teachers of each country think that a gamification-based approach could enhance the teaching of the entrepreneurial skills (Question 30). The results are almost the same as for the technical and managerial skills, which indicates that teachers see gamification as a transversal technology independent of the subject or topics to develop. Romanian teachers are again the most confident about the contribution of gamification, and 34.62% of them think that students training would improve to a large extent. If we use the aggregated data of the four countries, 40.60% of VET teachers think that it would enhance the development of these skills to a large extent, while 17.48% to a very large extent. These percentages are lower than those obtained by managerial skills (45.63 and 19.42) and even lower than those obtained by technical skills (48.54 and 22.33). There are several possible interpretations of these results. One of them is that the other two categories are more technical and therefore teachers consider that the use

of gamification can motivate and increase the participation of their students. However, further studies should be made to confirm this theory.

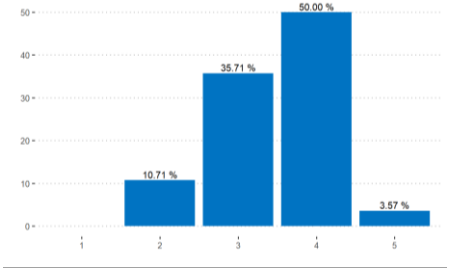
Only 45% of VET teachers have ever applied gamification to this category (Question 31). If we aggregate the data of the four countries, Romania and Spain stand out with an application rate of 65% and 69%, respectively. On the other side, Italy and Slovenia only reach 39% and 25%, respectively. Although the results from Italy and Slovenia may seem different (there is a 14-point gap between the two), they are not so different when we consider that 83% of Italian teachers train these skills while only 53.6% of Slovenian teachers do. In practice both situations are very similar as 46.98% and 46.64% of Italian and Slovenian teachers who develop these skills apply gamification, respectively. It is also worth mentioning that this relationship is also fulfilled on the opposite side. Thus, the ratios of application/skill teaching in Romania and Spain are also very similar, being 73.86% and 72.46%, respectively.



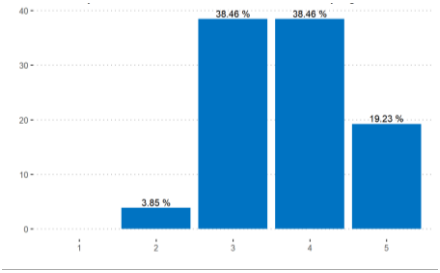

**(a)** Italy




**(b)** Romania



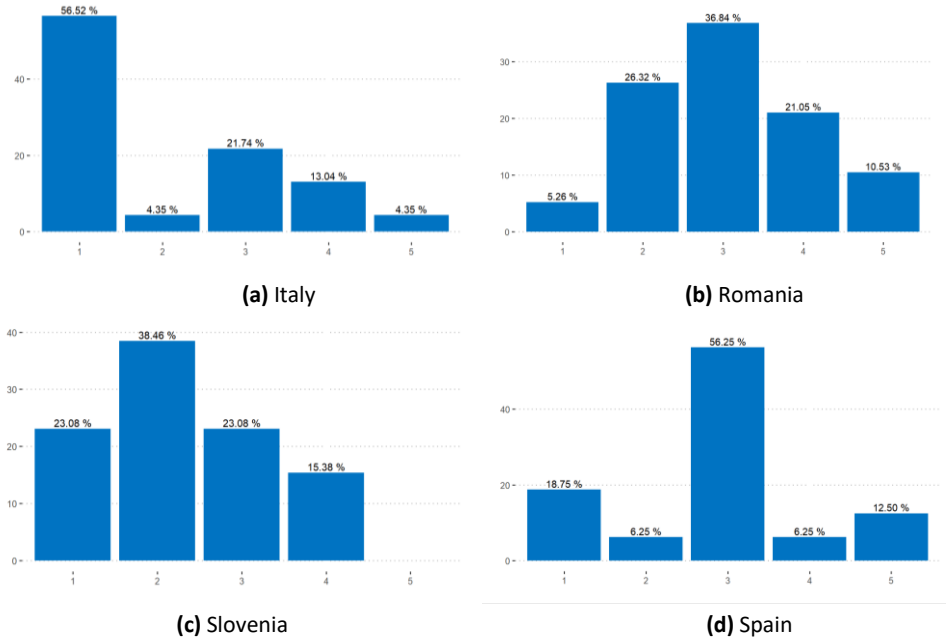

**(c)** Slovenia




**(d)** Spain

**Figure 22. Answers to the question *To what extent you think that a gamified approach could enhance the development of the entrepreneurial skills?* Where answers are on a scale from 1 = not at all to 5 = a very large extent.**

Related to the former question, Figure 23 shows the answers to the question of how often teachers use gamification to teach entrepreneurial skills in their course (Question 32). Romanian teachers do use more but also more often gamification than their European colleagues. In fact, 21.05% of them use often gamification to teach these skills, while 10.53% do it always. Their results are very similar to those previously discussed for the technical and managerial skills. This scenario also applies to Italian, Slovenian and Spanish teacher, although with a much lower usage rate. As we previously mentioned, these results indicate that gamification is way more established as teaching methodology in Romania than in the other examined countries.




**(a)** Italy **(b)** Romania

**(c)** Slovenia **(d)** Spain

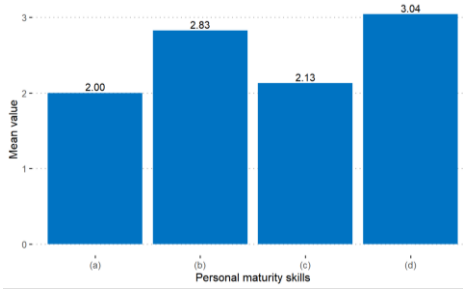
**Figure 23. Answers to the question *How often have you used gamification to teach any of the entrepreneurial skills?* Answers are on a scale from 1 to 5 where 1 = never, 2 = rarely, 3 = sometimes, 4 = often, 5 = always.**

## Analysis of the personal maturity skills category

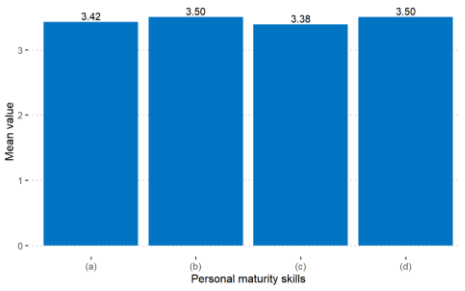
Figure 24 shows the relevance that VET teachers assign to the four skills that compose this category (Question 34). Teachers rank creativity as the most relevant skill in three of the four countries. Specifically, Italy, Romania, and Spain score creativity with 3.04, 3.50, and 3.19, respectively. Creativity is also the better ranked skill when all data are aggregated with 3.28 in a scale of 4, while accountability, emotional coping and self-awareness skills receive 3.17, 2.86, and 2.56, respectively. Many authors are of the opinion that creative thinking is the must have "skill" of an entrepreneur. Furthermore , and in addition to their own creative ability, entrepreneurs may interact with creativity in different contexts. Therefore, teachers can easily design different scenarios to enhance the development of this skill.

The best ranked skill in Slovenia and Romania is accountability with 3.50. This skill is also ranked second best in Italy and Spain and is another key for entrepreneurs' success. Entrepreneurs have hundreds, if not thousands, of opportunities thrown their way every day. These may not be top priorities, but they still consume valuable time. An entrepreneur must be able to make a clear path to achieving his goals, even when everything else seems to be standing in the way. Emotional coping and self-awareness received the lower scores in all countries. This may be because these are personal skills that are more difficult to develop without real entrepreneurship experience.

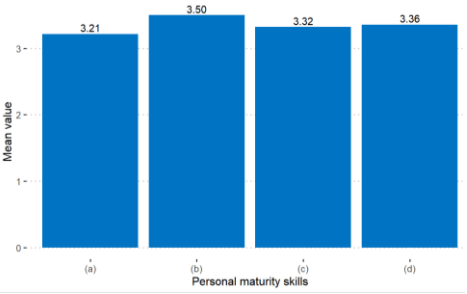
Aggregated results show that 81% of VET teachers train their students in personal maturity skills (Question 35), which is the highest percentage among the four categories of the competency framework. Slovenia and Spain with 75% and 69% are the countries where these skills are least trained while Italy and Romania with 87% and 92% are the ones in which these skills are most trained



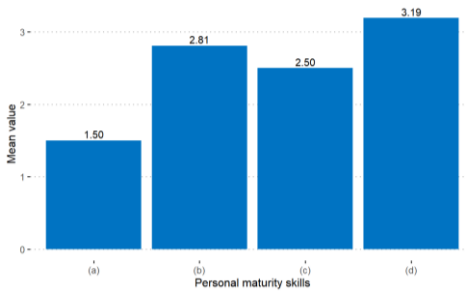

**(a)** Italy




**(b)** Romania




**(c)** Slovenia



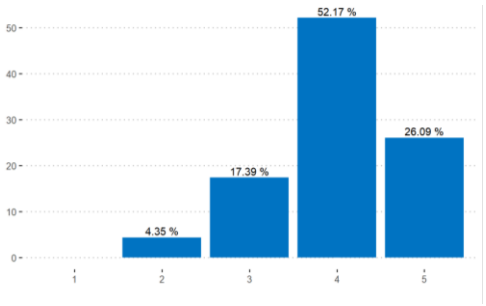

**(d)** Spain

**Figure 24. Rating of the personal maturity skills on a scale from 1 to 4, where (a) stands for self-awareness skills, (b) for accountability skills, (c) for emotional coping skills, and (d) for creativity skills.**

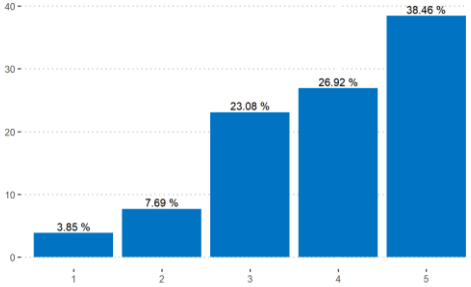
Figure 25 shows to what extent VET teachers of each country think that a gamification-based approach could enhance the teaching of the personal maturity skills (Question 36). The results depicted in this figure are very similar to those obtained for technical, managerial and entrepreneurial skills for all countries but Spain. In this case, Spanish teachers clearly see in gamification a means for the improvement of personal maturity skills, which is more marked than for the previous skills categories. All teachers think that gamification can improve their teaching, 38.46% of them to a large extent while 23.06% to a very large extent. There are many reasons that can justify this behavior but, as mentioned above, the difficulty of training these skills is a clear possibility. Therefore, VET teachers see in gamification a possible solution for the design of more realistic learning scenarios.

However, only 51.5% of VET teachers have ever applied gamification to this category (Question 37). If we analyze this data by country, Romania and Spain stand out with an application rate of 69% and 58%, respectively. On the other side, Italy and Slovenia only reach 47.8% and 32%, respectively. The ratio between teachers that

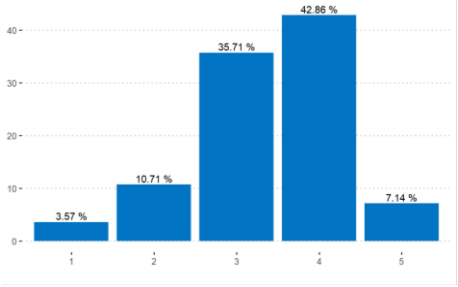
train their students in this skill and use gamification for such purpose also differentiates the countries in the former two classes. Romania and Spain reach coverage of 75% and 84%, respectively, while Italia and Slovenia drop to 54.9% and 42.6%, respectively.



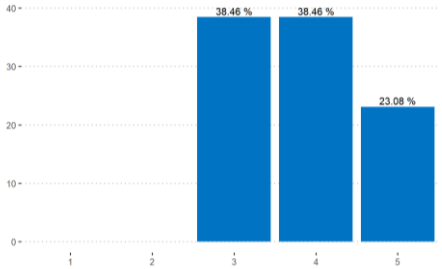

**(a)** Italy




**(b)** Romania



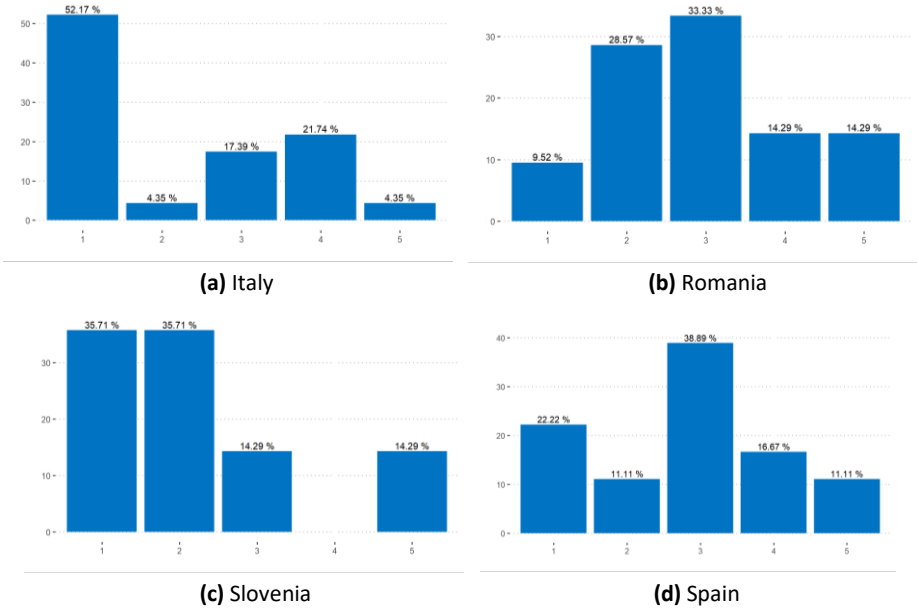

**(c)** Slovenia




**(d)** Spain

**Figure 25. Answers to the question *To what extent you think that a gamified approach could enhance the development of the personal maturity skills?* Where answers are on a scale from 1 = not at all to 5 = a very large extent.**

Finally, Figure 26 shows the answers to the question of how often teachers use gamification to teach personal maturity skills in their course (Question 38). Romanian and Spanish teachers do use more but also more often gamification than their European colleagues. 14.29% of Romanian teachers use often gamification to teach these skills, while another 14.29% do it always. In the case of Spanish teachers, 16.67% of them use often gamification and 11.11% always. Italian teachers also use more gamification to teach personal maturity skills than in the other skills categories. We should also highlight the results of Slovenia. If we re-check the results obtained for the other categories, teachers do not use regularly gamification for teaching skills, and at most they use with some frequency some gamification approach. However, in the case of personal maturity skills, 14% of them use always gamification for this teaching. It should be mentioned that this percentage is almost the same as the percentage of teachers who frequently use gamification in the other categories, so the most likely cause of this increase is the shift from one option to another. However, this is also a clear indication that Slovenian teachers consider this category as the most suitable for applying gamification.




**(a)** Italy **(b)** Romania

**(c)** Slovenia **(d)** Spain

**Figure 26. Answers to the question *How often have you used gamification to teach any of the personal maturity skills?* Answers are on a scale from 1 to 5 where 1 = never, 2 = rarely, 3 = sometimes, 4 = often, 5 = always.**

## Contextualization of video-tutorials

Taking into account the results of the questionnaire regarding the entrepreneurial competence framework and its skills, the video-tutorials should try to **contextualize the training in gamification of teachers within scope of entrepreneurial and personal maturity skills**.

## Conclusions

Table 2 summarizes the conclusions of the analysis performed in this subsection, where the units of a basic course on gamification are identified (**introduction**, **game mechanics**, and **game dynamics**), including the description of its main contents, according the results of the block I of this experimental study.

**Table 2. Features of the didactic material about gamification.**

| Unit | Didactical contents |
|---|---|
| **Introduction** | - Concept of gamification.<br>- Game and gamification.<br>- Game mechanics and dynamics.<br>- MDA framework.<br>- Applications in education and entrepreneurship. |
| **Game mechanics** | - Points, Badges, Leaderboards.<br>- Challenges.<br>- Narrative. |
| **Game dynamics** | - Collaboration and Competition.<br>- Creativity.<br>- Social.<br>- Exploration. |

## Annex

# [GAMEST] WP3 – IO1 Questionnaire

This questionnaire is composed by three blocks.
In the first one (questions 1-14) we want to establish the knowledge and level of application of gamification by VET providers. Also, the questions have been arranged following linear pathways of answers (affirmative/negative lines of thoughts).
In the second one (questions 15-41) we ask for the description of the use of gamification in entrepreneurial education.
Specifically, questions 15-38 are organized according the 17 entrepreneurial skills identified by Smith **[1]**.
In this second context, our objectives are to:

(1) Identify the relevance of each skill set for VET educators.
(2) Identify the most relevant skill within each skill category.

In addition, for each category we want to:

(3) Identify educators' attitude towards gamification.
(4) Identify potential gamification activities.

Questions 39-41 ask for the impressions of educators about the application of gamification in entrepreneurial education.

The last block wants to highlight the particularities of each partner's country and the related target group (this block is not mandatory).

**Main references:**


[1] Smith, W. L., Schallenkamp, K. A., & Eichholz, D. E. (2007). Entrepreneurial skills assessment: An exploratory study. International Journal of Management and Enterprise Development, 4(2), 179–201.

[2] CEE, Consortium for Entrepreneurship Education (2012). Entrepreneurship competency model. URL: http://www.careeronestop.org/competencymodel/pyramid.aspx?entre=Y

[3] European Commission (2008). Final report of the expert group: Entrepreneurship in higher education, especially within non-business studies. URL: http://ec.europa.eu/DocsRoom/documents/2214/attachments/1/translations/en/renditions/native

## Block I – dedicated to the knowledge and level of application of gamification by VET providers

### 1. Gamification-related questions

**[Q1]** Do you know what gamification is? (Filter question)

**[Q2]** Have you ever used gamification in your courses? (Yes/No)

If the answer to [Q2] is no:

**[Q3]** Would you consider using gamification techniques in your teaching? (Yes/No)

**[Q4]** What are the main obstacles that prevent you from using gamification in your courses?

Please rate them from *1= the less important* to *6 = the most important*.

a) it takes a lot of time to implement gamification in my courses;
b) it is difficult to use gamification in my courses;
c) I have not enough information about how to apply gamification in my courses;
d) I don't know what are the specific types of games that can be applied for gamification;
e) the delivered curricula limit the possibility of using gamification;
f) our educational institution (college, high school, faculty etc.) has not an e-learning platform as support for gamification implementation;
g) other barriers (please, detail) …….

If the answer to [Q2] is yes:

**[Q5]** How long have you been using gamification in your courses?

a) less than 1 year;
b) between 1 and 5 years;
c) more than 5 years.

**[Q6]** What are/were the drivers that encourage/encouraged you to use gamification in your courses?

Please rate them on a scale from *1 = the less important* to *6 = the most important*.

a) gamification can improve students' recall and retention;
b) gamification can promote students' motivation and engagement;
c) gamification enhances students' learning performance and academic achievement (such as higher order thinking skills, declarative and procedural knowledge, test performance etc.);

d) gamification can determine psychological and behavioral changes (such as fosters self-efficacy, stimulates students to actively participate in class activities, promotes collaboration skills);
e) gamification can provide instant feedback that allows students to check their progress;
f) gamification can provide variate learning experiences in students;
g) other drivers (please, detail) …….

**[Q7]** Which one of the following gamification techniques have you used in your courses?

You can choose more than one answer.

a) Competition
b) Collaboration
c) Exploration
d) Strategy-based learning
e) Creativity-based learning
f) Social-based learning
g) None of the above (Please, specify a different one)

**[Q8]** Which one of the following gamification mechanism have you used in your courses?

You can choose more than one answer.

a) Points
b) Badges
c) Challenges
d) Leaderboards
e) Narrative
f) Journey
g) Progress information
h) None of the above (Please, specify a different one)

**[Q9]** Which type of digital contents do you use in your gamification activities?

You can choose more than one answer.

a) Video-based narrative
b) Textual-based narrative
c) Games
d) Videogames.

**[Q10]** Have you ever used a gamified environment? (Yes / No)

If the answer to [Q10] is yes:

**[Q11]** Did you observe that a gamified environment enhances students' engagement and motivation?

Please rate your answer on a scale from *1 = not at all* to *5 = a very large extent*.

**[Q12]** Did you observe that a gamified environment enhances students' cooperation with peers?

Please rate your answer on a scale from *1 = not at all* to *5 = a very large extent*.

**[Q13]** Did you observe that a gamified environment enhances students' self-esteem?

Please rate your answer on a scale from *1 = not at all* to *5 = a very large extent*.

**[Q14]** Did you observe that a gamified environment enhances students' learning performance and achievement?

Please rate your answer on a scale from *1 = not at all* to *5 = a very large extent.*

### Block II – dedicated to entrepreneurial education

## 2. Application of gamification in entrepreneurial education questions

Based on your experience in applying gamification to entrepreneurial education:

**[Q15]** To what extent do you consider that students' entrepreneurial (declarative and procedural) knowledge levels increased after participating in gamified learning activities?

Please rate your answer on a scale from *1 = not at all* to *5 = a very large extent.*

**[Q16]** To what extent do you consider that participating in gamified learning activities has increased psychological and behavioral changes in students (stimulation to actively participate in class activities, promotion of collaboration skills, fostering of self-efficacy).

Please rate your answer on a scale from *1 = not at all* to *5 = a very large extent.*

**[Q17]** To what extent do you consider that students' interest for entrepreneurship increased after participating in gamified learning activities?

Please rate your answer on a scale from *1 = not at all* to *5 = a very large extent*.

## 3. Technical skills: "Skills necessary to be successful in one's line of business"

**[Q18]** According to your opinion, please rate by relevance the following entrepreneurial technical skills.

Please rate them from *1 = the least relevant* to *4 = the most relevant*:

a) The skills necessary to produce the product or service.
b) The skills to obtain them, as necessary.
c) The skills to match needs and availability.
d) The skills to identify and obtain them.

**[Q19]** Do you train your students in the aforementioned skills in your course on entrepreneurship? (Yes/No)

**[Q20]** To what extent you think that a gamified approach could enhance the development of the aforementioned skills?

Please rate your answer on a scale from *1 = not at all* to *5 = a very large extent.*

**[Q21]** Have you ever used gamification to teach any of the aforementioned skills? (Yes/No)

**[Q22]** If yes, how often have you used gamification to teach any of the aforementioned skills?

Please rate your answer on a scale from 1 to 5 where *1 = never, 2 = rarely, 3 = sometimes, 4 = often, 5 = always*.

**[Q23]** If the answer is not *1 = never*, please describe in your own words the type/s of gamified activity/ies you mostly used.

## 4. Managerial skills: "Skills needed to organize the work on a day-to-day basis"

**[Q24]** According to your opinion, please rate by relevance the following entrepreneurial managerial skills.

Please rate them from *1 = the least relevant* to *6 = the most relevant:*

a) Management skills for planning, organizing, supervising, directing, networking, etc.
b) Marketing/Sales skills for identifying customers, distribution channels, supply chain, etc.
c) Financial skills for managing financial resources, accounting, budgeting, etc.
d) Legal skills for organization form, risk management, privacy and security, etc.
e) Administrative skills to use other people in the business.
f) Higher-order skills for constant learning or problem-solving.

**[Q25]** To what extent you think that a gamified approach could enhance the development of the aforementioned skills?

Please rate your answer on a scale from *1 = not at all* to *5 = a very large extent.*

**[Q26]** Have you ever used gamification to teach any of the aforementioned skills? (Yes/No)

**[Q27]** If yes, how often have you used gamification to teach any of the aforementioned skills?

Please rate your answer on a scale from 1 to 5 where *1 = never, 2 = rarely, 3 = sometimes, 4 = often, 5 = always*.

**[Q28]** If the answer is not *1 = never*, please describe in your own words the type/s of gamified activity/ies you mostly used.

## 5. Entrepreneurial skills: "Skills needed to develop innovative products and services and to generate solutions to emerging needs in the marketplace"

**[Q29]** According to your opinion, please rate by relevance the following entrepreneurial skills.

Please rate them from *1 = the least relevant* to *3 = the most relevant:*

a) Business concept skills to develop a business plan or to present it
b) Environmental scanning skills to be able to recognize market gaps or exploit market opportunities
c) Advisory Board and Networking skills or how to balance independence with seeking assistance

**[Q30]** Do you train your students in the aforementioned skills in your course on entrepreneurship? (Yes/No)

**[Q31]** To what extent you think that a gamified approach could enhance the development of the aforementioned skills?

Please rate your answer on a scale from *1 = not at all* to *5 = a very large extent*.

**[Q32]** Have you ever used gamification to teach any of the aforementioned skills? (Yes/No)

**[Q33]** If yes, how often have you used gamification to teach any of the aforementioned skills?

Please rate your answer on a scale from 1 to 5 where *1 = never, 2 = rarely, 3 = sometimes, 4 = often, 5 = always*.

**[Q34]** If the answer is not *1 = never*, please describe in your own words the type/s of gamified activity/ies you mostly used.

## 6. Personal maturity skills: "Skills needed to attain self-awareness, emotional maturity, ability and willingness to accept responsibility, and creativity"

**[Q35]** According to your opinion, please rate by relevance the following personal maturity skills.

Please rate them from *1 = the least relevant* to *4 = the most relevant*:

a) Self-Awareness skills or the ability to reflect and be introspective
b) Accountability skills or the ability to take responsibility for resolving a problem
c) Emotional Coping skills or the emotional ability to cope with a problem
d) Creativity skills or the ability to produce a creative solution to a problem

**[Q36]** Do you train your students in the aforementioned skills in your course on entrepreneurship? (Yes/No)

**[Q37]** To what extent you think that a gamified approach could enhance the development of the aforementioned skills?

Please rate your answer on a scale from *1 = not at all* to *5 = a very large extent*.

**[Q38]** Have you ever used gamification to teach any of the aforementioned skills? (Yes/No)

**[Q39]** If yes, how often have you used gamification to teach any of the aforementioned skills?

Please rate your answer on a scale from 1 to 5 where *1 = never, 2 = rarely, 3 = sometimes, 4 = often, 5 = always*.

**[Q40]** If the answer is not *1 = never*, please describe in your own words the type/s of gamified activity/ies you mostly used.

## 7. Skill category relevance

**[Q41]** According to your opinion, please rate by relevance the former skills categories

Please rate them from *1 = the least relevant* to *4 = the most relevant*:

a) Technical skills
b) Managerial skills
c) Entrepreneurial skills
d) Personal maturity skills.

**Block III – dedicated** to highlight the particularities of each partner country and the related target group

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