Original article

PROJECT-BASED LEARNING IN LIFELONG EDUCATION

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Abstract: This article explores the concept of project-based e-learning focusing on its application in lifelong education. Learing through projects contributes to building competences in project management that are transferable to real-world project environments. This article presents a detailed review of the project-based e-learning as part of lifelong education. This is achieved through the analysis of characteristics, advantages and challenges of project-based e-learning, identifying and highlighting its key elements, as well as various approaches for model implementation. The research includes data collection through online survey and analysis of the attitudes and experiences of employees in relation to project-based learning. The research results provide insight into the strengths and weaknesses of this approach from the angle of employees in different industries, as well as their engagement and motivation. Lastly, the article explores the integration of project-based e-learning with traditional educational methods, focusing on complementary aspects of these two paradigms.

Keywords: E-learning; Lifelong education; Project-based learning; Project management.

1. INTRODUCTION

Lifelong learning is becoming increasingly relevant in modern society, leading to a growing demand for new and innovative learning approaches that enable the continuous development of knowledge and skills. In this context, project-based e-learning represents an intriguing and promising concept that combines the power of digital technologies with project-based learning methods.

Project-based learning is a crucial step to effective project management since for any successful project it is of essential value to customize and adapt educational approaches, which project-based learning excels at. In this context it is also important to consider the demand on the job market, making sure that concepts of project management are included in formal and informal education.

Despite the growing amounts of research on project-based learning, relatively few papers have examined the implementation of project-based learning as a part of lifelong education, especially from the perspective of proffessionals among several diverse industries. Existing research approaches mostly cover project-based learning in formal education contexts such as schools and universities, leaving a research gap on how project-based e-learning works in professional environments and adult learning.

This paper addresses that gap by providing emipirical insights into employees' experiences, attitudes, and motivational factors related to project-based e-learning. The novel contribution of this paper lies in combining theoretical analysis and quantitative data collected through a questionnaire, thus offering a perspective on how project-based e-learning supports professional development and

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motivation in lifelong learning context. Moreover, the paper contributes to the discussion on integrating project-based methods with traditional learning models to enhance engagement and adaptability in adult education.

This paper explores the concept of project-based e-learning and its application in lifelong education. It does so through theoretical frameworks, practical examples, technological aspects, future perspectives, as well as ethical and legal implications. By analyzing the definition, characteristics, advantages, and challenges of project-based e-learning, as well as implementation models, the paper will highlight the key elements of this learning approach.

The first part of the paper focuses on practical aspects. It covers the applications of project-based e-learning in lifelong education through case study research, practical examples, evaluation of its effectiveness and impact on professional development, as well as integration with traditional educational methods. The second part is centered on a study conducted through an online survey, which included respondents from a population of employed individuals with diverse demographic characteristics. Based on all the findings, the paper will provide a comprehensive overview of the concept and application of project-based e-learning and lifelong education, with a focus on benefits, challenges, and future research directions.

2. PROJECT-BASED LEARNING AS A PART OF LIFELONG LEARNING

Project-based e-learning is an innovative approach to education that is increasingly being applied across all types of learning, enabling students to acquire practical skills and solve real-world problems through projects. Project-based e-learning is becoming more prevalent in a wide range of educational contexts throughout lifelong learning, and case studies reveal the advantages and challenges of this approach (Al-Kamzari & Alias, 2025).

An example of a case study relates to the analysis of a project-based learning model used for online professional development courses for teachers. In this case, teachers were engaged in instructional projects focused on integrating technology into the classroom. In collaboration with colleagues, teachers developed innovative socio-constructivist learning methods that incorporated the use of digital tools and resources. The research demonstrated not only the technical advancement of teachers but also the improvement of their communication skills and their overall ability to effectively share knowledge with other students (Dede, 2006).

Research shows that project-based learning can have a significant impact on professional development and personal growth. In a case study focused on learning through projects in the field of arts, participants had the opportunity to explore their creative interests and develop artistic projects that incorporated multimedia approaches. This study demonstrated that project-based learning enabled participants to express their ideas in an innovative way while simultaneously developing skills such as teamwork, communication, critical thinking, and project management (Bryman, 2016).

A suitable example is the CFA Research Challenge student competition in financial analysis. In this competition, participants are tasked with providing an investment recommendation for a specific company that has been selected as the subject of investment analysis for that year. During the process of developing their analysis, participants have the opportunity to visit the target company to gain insight into its business model, conduct interviews with management, and obtain additional necessary information (Ferenčak et al., 2020).

It is also important to mention hackathons as one of the best examples of project-based e-learning. In competitions like these, students collaborate to find innovative solutions to real-world challenges. Hackathons involve the practical application of theoretical knowledge, teamwork, creativity, innovation, rapid prototyping, mentorship, evaluation, and reflection. Such competitions enhance not only professional skills but also communication skills, critical thinking, creativity, and many others (Resch et al., 2025).

One example of the successful implementation of project-based e-learning in lifelong learning is a project by Garrison & Vaughan (2008) in which programming course students worked on developing real software solutions for local nonprofit organizations. This project allowed participants not only to apply their theoretical knowledge in practice but also to work with clients, understand their needs, and deliver products that have an immediate impact on society. This example illustrates how project-based learning can connect education with real-life experiences, fostering professional skill development while simultaneously contributing to the community (Garrison & Vaughan, 2008).

Project-based learning also contributes to the improvement of technical skills that are used in the modern business world. Through working on projects, participants encounter various digital tools and platforms. This is particularly useful for jobs in IT, engineering, and similar fields where digital skills are just as important as everyday tasks. Additionally, through e-learning, they have the opportunity to use technology that supports virtual computing assistance (Blumenfeld et al., 1991). Additionally, the flexibility provided by e-learning contributes to adapting to different learning styles and needs of individuals, which is particularly important, especially in the context of lifelong learning, where participants often face different obligations and time constraints (Means et al., 2014).

Another example comes from the domain of healthcare education, where medical students participated in virtual simulations of surgeries and clinical cases. By using simulation and virtual reality, students were able to gain practical skills and make decisions in a virtual environment that simulates real medical scenarios. These projects allow students to work on their clinical thinking and teamwork skills, which is crucial for their professional development. Also, the students were able to review their decisions and learn from their mistakes, which further strengthened their learning and prepared them for the real challenges in medical practice. (Cook & Triola, 2014).

Another important example can be found in the field of management, where the participants of the online MBA program developed business strategies for entrepreneurial projects. Participants worked in international teams and used collaborative tools for project planning and management. Through this process, participants were able to learn about market opportunities, how to develop a business plan and present their ideas to potential investors. This example shows that project-based e-learning can be a useful experience in the development of entrepreneurial skills (Bell, 2010). Beneficiaries who are engaged in projects that encourage innovation and creativity in solving problems often develop entrepreneurial thinking. In addition, project-based e-learning allows users to expand their network of professional contacts, which is crucial for successful business (DeCoito & Briona, 2023).

This research highlights the importance of personalization in project-based e-learning, where participants can choose topics that interest them, thereby increasing the likelihood of successful learning (Coffield et al., 2004).

Also, research shows that users of project-based learning are more frequent and active in further professional development and education throughout their lives. This may be interpreted as a sign that this type of learning also has a positive impact on their motivation for advancement (Gijbels et al., 2005).

Project-based evaluation of e-learning shows that this approach has a long-term impact on professional development, especially in the context of lifelong learning. Participants who have taken part in this type of education often mention that the skills and knowledge they have acquired have improved their work and made them more competitive in the labor market (Barrows & Tamblyn, 1980). This is especially true for sectors experiencing rapid change, where continuous education is necessary to stay relevant in the profession. For example, in the IT sector, where new technologies and practices are constantly emerging, participants in project-based e-learning can quickly acquire new knowledge that can be applied immediately, thereby increasing their value in the labor market (Diana el al., 2021).

Mentorship plays a key role in the successful implementation of project-based e-learning, especially in the context of lifelong learning. This learning approach often requires the support and guidance of experienced experts to ensure that participants make the most of their educational experience. Mentoring helps participants to set goals, provide feedback and solve problems they encounter while working on projects. This type of support is especially relevant in e-learning.

Mentorship in project-based e-learning can be seen as a process by which participants develop autonomy and self-confidence (Kalla et al., 2022). Through interaction with the mentor, participants learn how to take responsibility for their learning, set goals, and develop strategies to achieve these goals. This intervention not only contributes to academic success, but also to the professional development of the participants, preparing them to take on leadership roles in their professional environment (Anderson & Shannon, 1988).

When it comes to project-based e-learning, the quality of mentorship can significantly impact learning outcomes. Research shows that participants who received mentoring support achieve better results, develop a deeper understanding of the material, and express a higher level of satisfaction with their educational experience (Jacobi, 1991).

Moreover, mentors in project-based e-learning can help their students build professional networks and contacts. During collaboration on projects, students often have the opportunity to work with mentors and establish connections with other experts in their field. These professional contacts can provide support, resources, and career development opportunities, adding value to project-based e-learning (Kram, 1985).

The integration of project-based e-learning with traditional educational methods presents both a challenge and an opportunity to enhance the quality of education within lifelong learning (Sukackė et al., 2022). Traditional learning methods, which rely on lectures, seminars, and textual materials, still play an important role in educational systems. However, with the development of digital technologies and changes in labor market demands, there is a growing need for more dynamic and interactive learning approaches, such as project-based e-learning. By combining these two approaches, it is possible to leverage the advantages of both and create educational programs that are efficient, flexible, and tailored to the needs of modern learners (Gherheș et al., 2021).

Project-based e-learning enables students to acquire practical knowledge and skills through work on real projects, while traditional methods provide the necessary theoretical foundation. For example, within an educational program, students can use lectures and seminars to gain fundamental knowledge on a particular topic and then apply that knowledge by working on a project that simulates real-life situations in a professional environment. This approach allows students to connect theoretical knowledge with practical experience, which is essential for developing competencies needed in the labor market (Garrison & Vaughan, 2008). Participants in project-based learning are generally more satisfied than those attending traditional forms of education (Blumenfeld et al., 1991). The integration of project-based e-learning with traditional methods can have a significant impact on the development of critical thinking, creativity, and problem-solving skills among learners. By combining these approaches, educational programs can ensure that students develop not only technical skills but also abilities essential for innovation and adaptation to change (Garrison & Vaughan, 2008).

Student interactivity and engagement, which are crucial for the success of project-based learning, can be enhanced through the use of digital tools and platforms that enable collaboration and communication between students and teachers. Traditional educational approaches often rely on passive learning, where students primarily focus on listening and taking notes. On the other hand, e-learning allows for active student participation in the educational process through discussions, collaborative projects, and real-time idea exchange (Means, et al., 2014).

The role of teachers in this integrated model is also changing, shifting from the traditional role of lecturers to facilitators of learning. Teachers become mentors and guides who support

students in their learning process rather than merely transmitting knowledge. (Anderson & Shannon, 1988). One of the challenges of integrating these approaches is adapting educational institutions and policies. Many educational institutions still operate under models that favor traditional methods and structures, which can hinder the implementation of innovative approaches such as project-based e-learning. Therefore, it is crucial that educational policies and institutions remain flexible and willing to adapt in order to support new educational models (Means, et al., 2014).

One of the key aspects of integrating these methods is aligning curricula and ensuring that project-based e-learning is not just an addition but an integral part of the educational process. This means that the learning objectives and outcomes of both approaches should be aligned, and activities and assignments should be designed to support each other (Kolodner et al., 2003). The successful integration of project-based e-learning and traditional methods requires a holistic approach that takes into account all aspects of the educational process. From the curriculum and lesson plans, through teacher training and technical support, to the evaluation and adaptation of educational programs, every element must be carefully planned and implemented to achieve optimal results. When all of these elements are aligned, an integrated approach can significantly enhance the quality of lifelong learning and ensure that students acquire the necessary competencies for success in their professional careers and lifelong learning (Garrison & Vaughan, 2008).

3. METHODOLOGICAL FRAMEWORK OF RESEARCH

The methodological framework of the research on project-based e-learning as part of lifelong learning includes a series of key steps and techniques that enable the collection, analysis, and interpretation of data to gain a comprehensive insight into the effectiveness, challenges, and impacts of this educational method. This framework encompasses research designs, data collection methods, analysis techniques, as well as ethical considerations that ensure the validity and reliability of the research.

The first step in the research process is defining the goals and hypotheses of the study. The main goal is to investigate the population's familiarity with project-based e-learning through an online survey, to determine how they have encountered it, identify the main motivators in project-based e-learning, and explore the advantages and obstacles from the population's perspective. With that in mind, the main hypotheses of the research are:

H1: The majority of respondents have encountered project-based e-learning in some form during their education or work.

H2: The main motivators in project-based e-learning are predominantly intrinsic in nature.

H3: The most significant advantage of project-based e-learning is the development of so-called “soft skills” and the interactivity that results in a more engaging learning process.

H4: The most significant obstacle in project-based e-learning is the time-consuming nature of project-based e-learning.

After defining the goals and hypotheses, selecting the research design is crucial for ensuring valid and reliable results. In research on project-based e-learning, mixed research designs that combine quantitative and qualitative methods are often used (Creswell & Plano Clark, 2017). In this study, a quantitative method was employed. Quantitative methods, such as surveys and experimental designs, allow for the measurement and analysis of statistically significant data on the effectiveness of e-learning (Yin, 2018).

This study used an online survey containing a total of 39 questions, including six socio-demographic questions, ten questions examining experience with project-based e-learning, i.e., whether and how respondents have encountered this form of learning, eight questions focused on examining motivational factors, with four questions aimed at examining extrinsic motivational factors and four focused on intrinsic motivational factors. Among other things, these motivational factors support perceived value. Then, eleven questions were directed at examining respondents' attitudes towards project-based e-learning. The last questions were two open-ended questions for additional comments and two questions investigating the interest in further participation in project-based e-learning and the likelihood of recommending

this form of learning. Most of the responses were formulated using a Likert scale.

The psychometric properties of the questionnaire were examined to ensure the reliability and validity of the instrument. The internal consistency of the scale was evalueated using Cronbach's alpha coefficient, which indicated high reliability (α=.950). Sampling adequacy was confirmed by Kaiser-Meyer-Olkin measure of .898 and Bartlett's test of sphericity showed statistical significance (χ^2 =1582.869, p< .001), thus confirming that the data is suitable for factor analysis.

Exploratory Factor Analysis (EFA) with Varimax rotation extracted three components with eigenvalues greater than 1, explaining 69.021% of the total variance. The first component represented intrinsic motivational factors, the second captured extrinsic motivational factors, while the third component represented attitudes towards project-based learning. All items loaded above .50 on their respective components, demonstrating a clear and interpretable structure consistent with theoretical expectations.

After data collection, data analysis represents a crucial phase of the methodological framework. Quantitative data are typically analyzed using statistical techniques, including descriptive statistics, correlations, and regression analysis, in order to determine relationships between variables and test hypotheses (Field, 2013). For the purposes of this study, SPSS software was used to examine correlations and descriptive statistics.

Ethics in research is particularly important, especially when investigating educational methods and their implementation. Researchers must ensure that all participants in the study are informed about the purpose and procedures of the research and that they are granted appropriate rights, including the right to privacy and anonymity (Resnik, 2018). It must also be ensured that the data collected during the research is used solely for the purposes for which they were collected and that they are kept secure in order to protect the identities of the participants.

The methodological framework of this research on project-based e-learning as part of lifelong learning encompasses all aspects, from defining goals and hypotheses to data collection and analysis, ethical considerations, and reporting the results. This comprehensive approach allows for a detailed exploration and understanding of the population's perspective on project-based e-learning (Bryman, 2016; Braun & Clarke, 2006; Creswell, 2014; Creswell & Plano Clark, 2017; Field, 2013; Garrison & Vaughan, 2008; Resnik, 2018; Yin, 2018).

4. ANALYSIS OF RESULTS

Analysis of the results of the research on project-based e-learning as part of lifelong learning represents a key part of the research process, as it allows for the interpretation and evaluation of the effects and impact of this educational method. This process involves systematically examining the collected data, interpreting the findings in the context of the research questions and hypotheses, and drawing conclusions that can inform future practices and policies in the field of education.

Based on the SPSS analysis matrix, the following results were obtained, which will be presented, interpreted, and commented on in the following sections.

The study included 103 participants, who provided their responses to the survey questions. Of these participants, 49 were women, and 54 were men. The data revealed that the largest proportion of respondents were individuals aged 20 to 29 years, making up 56.3% of the total sample. Following them, the second largest group consisted of individuals aged 40 to 49 years, representing exactly 18.4% of the total sample. The remaining demographic parameters related to the participants and their characteristics are presented in Table 1 and can be further analyzed.

This data provides valuable insights into the demographics of the study population and forms the foundation for the next steps in analyzing the relationship between these demographic factors and the responses to the research questions. This analysis will also help in determining the effectiveness and relevance

of project-based e-learning in different age groups and professional backgrounds, as well as understanding potential barriers and motivators for different segments of the population.

Table 1: Demographic characteristics of respondents

Characteristics		Frequency	Percent
Gender	Female	49	47,6
	Male	54	52,4
	Total	103	100,0
Age	18-20	9	8,7
	20-29	58	56,3
	30-39	12	11,7
	40-49	19	18,4
	50-59	4	3,9
	60+	1	1,0
	Total	103	100,0
Level of education	High school	30	29,1
	Vocational school	11	10,7
	Undergraduate studies	42	40,8
	Master studies	18	17,5
	PhD studies	2	1,9
	Total	103	100,0
Field of work	Education	10	9,7
	Tourism	33	32,0
	Sales	5	4,9
	IT	13	12,6
	Commerce	6	5,8
	Sport	2	1,9
	Finance	15	14,6
	Construction	5	4,9
	Cosmetics	1	1,0
	Media	6	5,8
	Engineering	5	4,9
	Military	1	1,0
	Healthcare	1	1,0
	Total	103	100,0
Work experience (years)	1-3	34	33,0
	3-5	15	14,6
	5-10	28	27,2
	10+	26	25,2
	Total	103	100,0

The diversity of professions and positions within the aforementioned industries provides a varied representation of attitudes, experiences, and satisfaction with project-based e-learning from multiple perspectives. In other words, it offers a broader picture of project-based e-learning in the general population, rather than focusing on a specific segment.

The industry with the highest number of respondents is, without a doubt, hospitality and

tourism. As for the years of experience in the industry, the highest number of responses came from individuals with one to three years of experience, followed closely by those with five to ten years of experience. However, it can be noted that the distribution of responses is relatively even when considering years of experience, indicating a fairly balanced representation across different experience levels. This variation in both industry sectors and years of experience allows for a comprehensive analysis of how project-based e-learning is perceived and implemented across various professional backgrounds, as well as the possible challenges and benefits identified by individuals at different stages of their careers.

Table 2: Mean values per answer

Questions	Mean value	SD deviation
Have you ever participated in project-based learning at your workplace?	1.86	.919
Have you ever participated in a competition such as a hackathon or internal company competitions?	1.58	.835
How long have you been experiencing project-based learning?	1.94	1.219
Competitions – significant experience?	3.72	1.317
Does management encourage project-based learning?	3.68	1.222
Overall assessment of experience with project-based learning?	4.02	1.048
To what extent does material compensation motivate you in project-based learning?	4.06	1.211
To what extent does the opportunity for advancement motivate you?	4.29	1.090
To what extent does a certain type of recognition motivate you?	4.04	1.111
To what extent do additional days off motivate you?	4.24	1.098
To what extent does knowledge enrichment motivate you?	4.36	.969
To what extent does a more engaging and interactive approach to work tasks motivate you?	4.23	.962
To what extent do interdisciplinarity and skill enhancement motivate you?	4.05	1.079
To what extent does the improvement of “soft skills” motivate you?	4.12	1.105
Are the goals in project-based learning clear and achievable?	4.04	1.047
Does project-based learning increase learning engagement?	4.09	1.030
Does project-based learning help with a better understanding of business processes?	4.13	1.054
Does project-based learning develop leadership?	4.10	1.034
Does project-based learning increase team cohesion?	4.16	.926
Does project-based learning improve communication among team members?	4.10	.995
Does project-based learning help develop creativity?	4.31	.940
Is project-based learning difficult to integrate into existing work processes?	3.63	1.306
Does project-based learning require too much preparation time?	3.50	1.220
To what extent has project-based learning improved your professional skills?	4.00	1.029
I would gladly participate in project-based learning.	3.96	1.102
I would recommend this type of learning.	4.21	.936

The results from Table 2. show that the majority of respondents have encountered project-based e-learning in the form of group projects, with the least exposure being in the form of internal company competitions. Given that most respondents agreed that participation in project-based e-learning competitions was a significant experience, this could serve as a direction for companies to incorporate this as an option in the workplace.

Regarding the barriers to project-based e-learning, a lack of time, with 61.2% of respondents, was identified as the most significant challenge. Further investigation is needed to determine which specific factors take

up the most time, so that potential solutions can be implemented to alleviate this barrier and make the learning process more efficient.

The advantages of project-based e-learning offered for selection by the respondents include increased engagement, development of critical thinking, flexibility, better understanding of business processes, improved teamwork, and all of the above. The option "all of the above" was the most selected, with 30.1% of respondents choosing it, while the other options were fairly evenly selected.

As for motivational factors, extrinsic motivation factors are slightly more prominent. 53.4% of respondents indicated that material rewards motivate them in project-based learning, 63.1% mentioned the opportunity for advancement, 48.5% cited certain forms of recognition, and 60.2% mentioned additional days off as motivating factors.

Regarding intrinsic motivational factors, 64.1% of respondents are motivated by the enrichment of knowledge, 53% by a more interactive approach to learning, 49% by additional education, and 51.5% are motivated by the improvement of so-called "soft skills".

These results provide valuable insight into both the advantages and challenges associated with project-based e-learning, as well as the factors that motivate learners. This data can guide future educational strategies, particularly in professional settings, and offer a clearer understanding of how to best integrate project-based e-learning to maximize engagement and effectiveness.

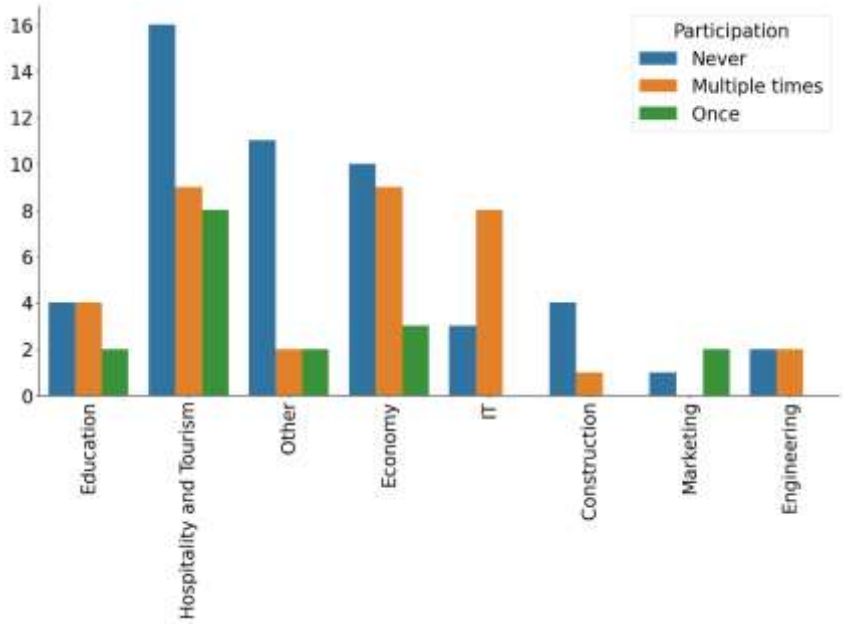

Figure 1: Participation in project-based learning at the workplace classified by industry of employment

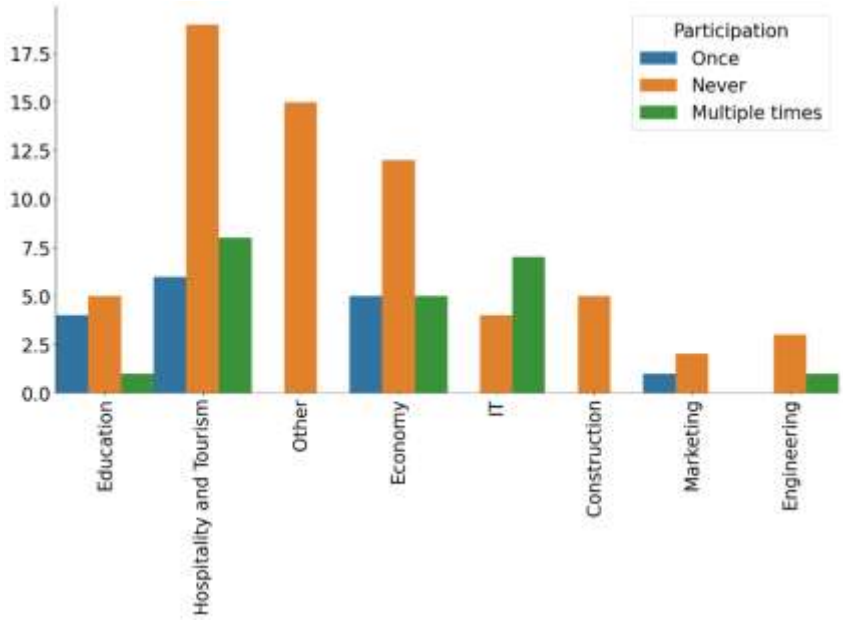

Figure 2: Participation in competitions such as hackathons or internal company competitions classified by the industry of employment

Therefore, the results of the survey on participation in competitions such as hackathons or internal company competitions shown in Figure 2, as well as participation in project-based e-learning at the workplace shoen in Figure 1, provide interesting data. At the top, with the most positive responses, is the hospitality and tourism industry, followed by the IT and financial industries, while no significant results were achieved in the other sectors.

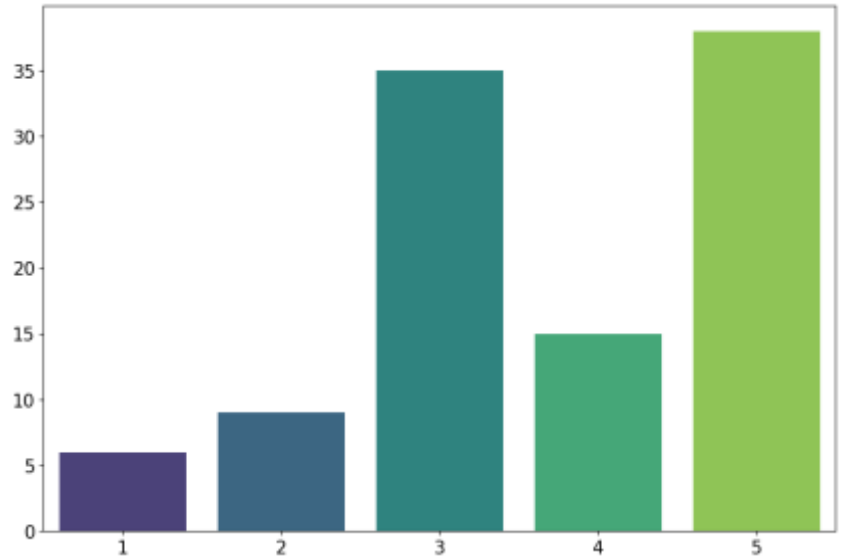

Figure 3: Encouragement of management for project-based learning across different industries

Positive responses regarding the management and promotion of project-based learning in the workplace are most frequently seen by employees in the hospitality and tourism industries and IT as presented in Figure 3. It can be assumed that this is due to these two industries being the most subject to changes, innovations, and the dynamic nature of the job, requiring modernization and staying up to date with trends, new knowledge, and opportunities. Respondents who answered affirmatively to the question “Have you ever participated in project-based e-learning at your workplace?” tended to have higher levels of education as presented in Figure 4.

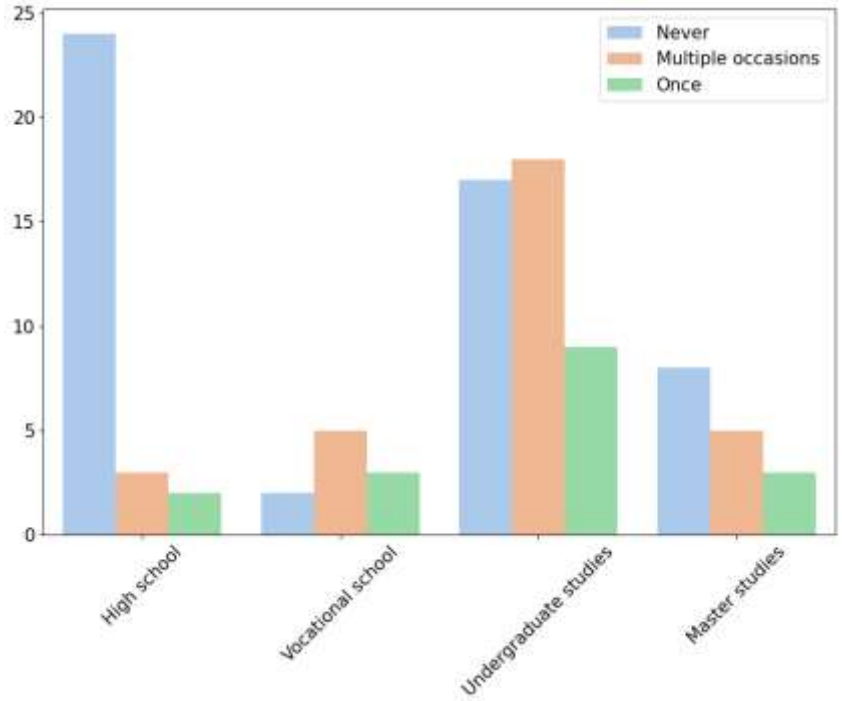

Figure 4: Distribution of experience with project-based learning according to education level

With positive responses to the question "Have you ever participated in competitions such as hackathons or internal company competitions," a trend can be observed on Figure 5 that respondents with higher levels of education have more experience with hackathons and internal company competitions. Given that the popularity of this type of competition has recently increased, it is expected that younger respondents had more opportunities to encounter this type of competition. This data, along with the previous one, confirms that interest in this form of learning is growing.

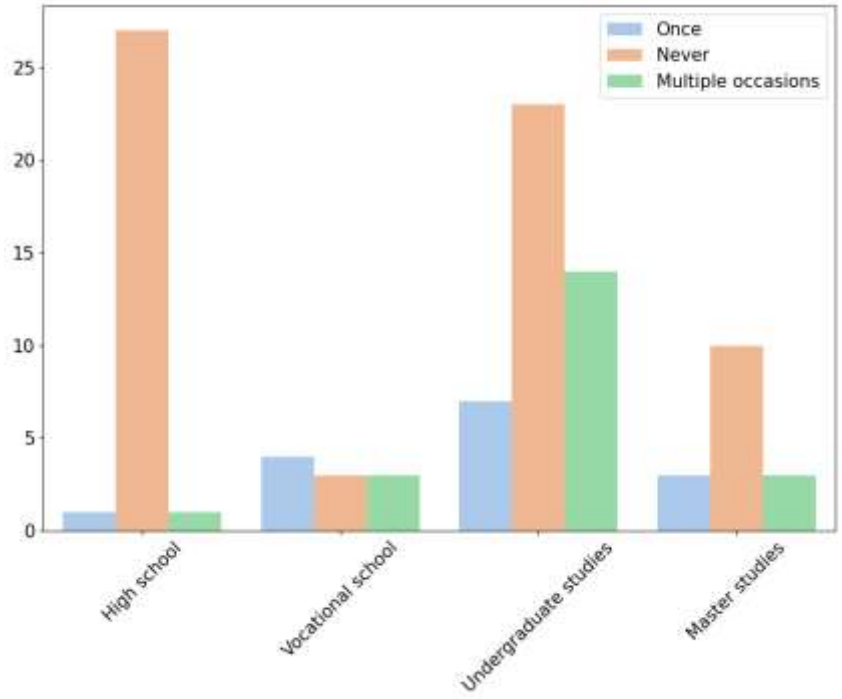

Figure 5: Distribution of participation in hackathons/internal company competitions according to education level

An interesting finding is that respondents who marked competitions such as hackathons or internal company competitions as extremely significant more often state that management encourages project-based e-learning. For companies, this can be an important piece of data, indicating the importance of encouraging internal company competitions by management, which helps in valuing this type of learning among employees.

Through correlation analysis presented in Figure 6, several conclusions can be drawn: The overall experience rating with project-based e-learning correlates with high ratings on the questions "I would gladly participate in project-based e-learning" and "I would recommend this type of learning" (in the following text, output variables) (Spearman correlations: 0.77 and 0.68). Experiences with hackathons (Spearman correlations: 0.61 and 0.62) and acquiring new knowledge (Spearman correlations: 0.66 and 0.64) also show statistically significant correlations with the output variables.

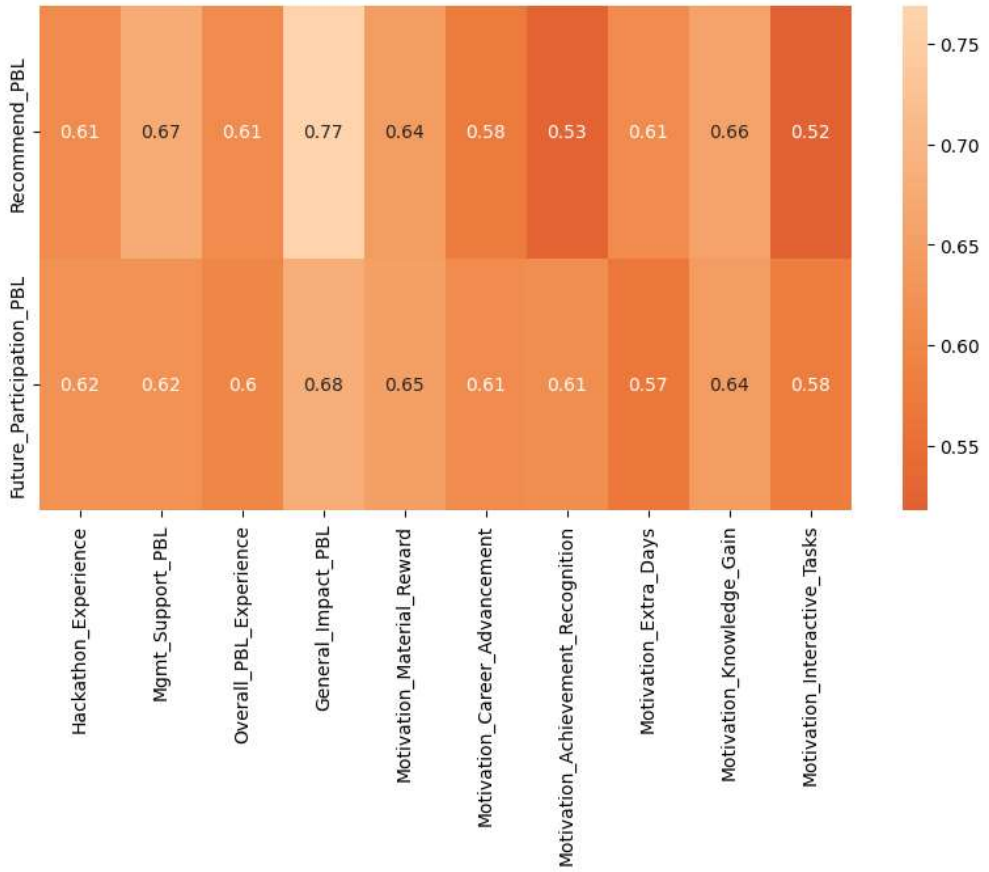

Figure 6: Correlations between dependent and independent variables (extrinsic factors)

The contribution of project-based learning to a better understanding of business processes is in a highly positive correlation with the output variables (Spearman correlations: 0.77 and 0.68). The output variables are highly correlated with clearly defined goals (Spearman correlations: 0.63 and 0.6) as well as with the development of critical thinking (Spearman correlations: 0.65 and 0.56). These characteristic correlations are described, but in general, Figure 7 shows that the dependent variables measuring experiences, opinions, and motivation for project-based learning are in a statistically significant positive correlation with the output variables.

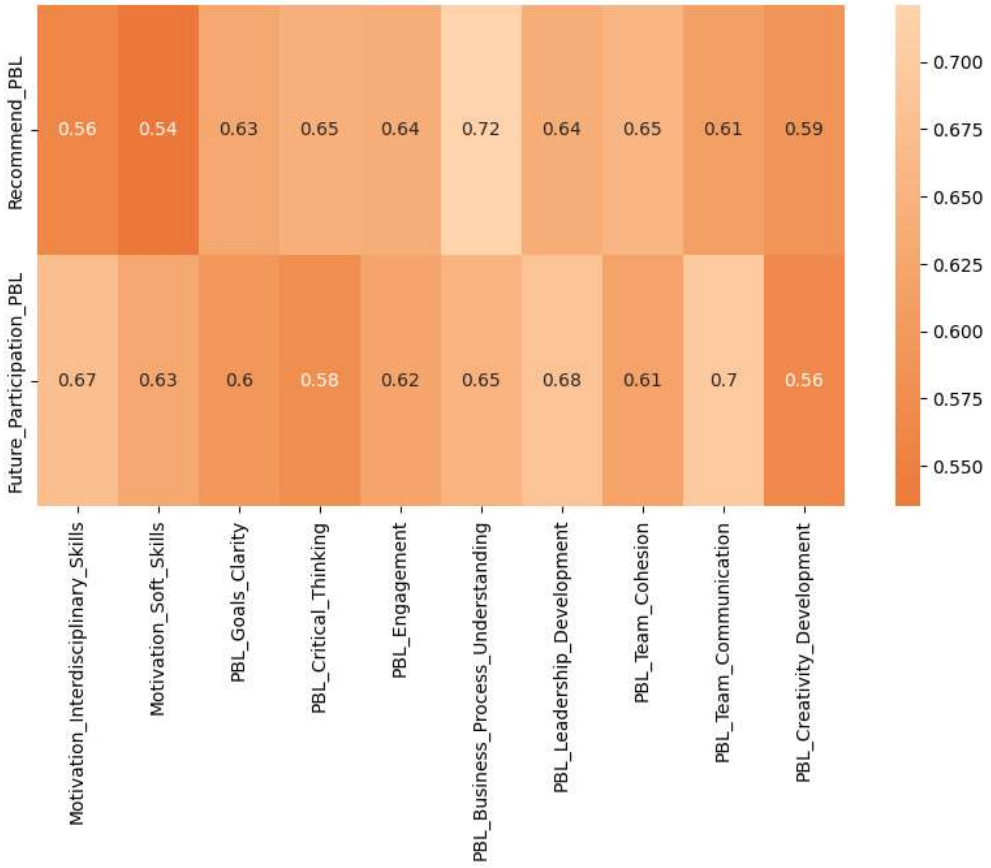

Figure 7: Correlations of dependent and independent variables (extrinsic factors)

Towards the end of the analysis of the results, it is necessary to revisit the hypotheses:

H1: The majority of respondents have encountered project-based e-learning in some form during their education or work.

The majority of respondents have encountered project-based e-learning once or more, with 60.2% in the form of group projects, 50.5% of respondents at their workplace, and 35.9% of respondents encountered project-based e-learning in the form of competitions or internal company competitions.

H2: The main motivators in project-based e-learning are predominantly intrinsic in nature.

Regarding motivational factors, extrinsic motivation factors are slightly more pronounced. 53.4% of respondents state that material rewards motivate them during project-based learning, 63.1% mention the possibility of advancement, 48.5% mention certain forms of recognition, and 60.2% mention additional days off. As for intrinsic motivational factors, 64.1% of respondents are motivated by the enrichment of knowledge, 53% by a more interactive learning approach, 49% by further education, and 51.5% by the development of so-called “soft skills”. Given the results, hypothesis number 2 is not fully proven, but the difference between these two types of motivators is not significant. Nevertheless, these results highlight the importance of providing some form of motivation during participation, i.e., clearly presenting the benefits of participating in project-based e-learning, whether in the form of a competition or group project.

H3: The most prominent advantage of project-based e-learning is the development of so-called "soft skills" and the interactivity that results in a more engaging learning process.

Respondents predominantly chose the option “All of the above”, while the other options were relatively evenly selected, without significant deviations. Given this, hypothesis number 3 is not confirmed.

H4: The most prominent barrier in project-based e-learning is the time demand of project-based e-learning.

When asked about barriers to project-based e-learning, 61.2% of respondents chose the option “Lack of time”. A recommendation for further research is to investigate the cause of time demands in project-based e-learning and ways to overcome this obstacle.

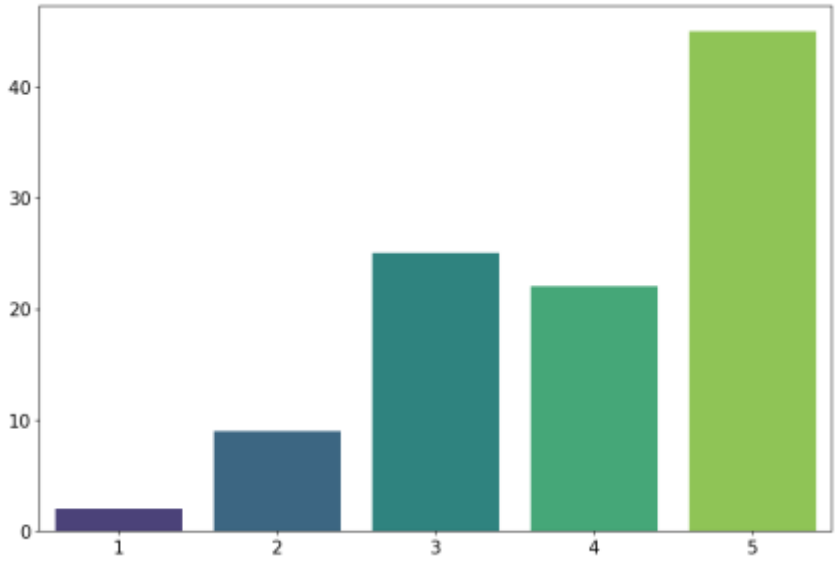

Figure 8: Number of responses per grade to the question "I would gladly participate in project-based learning"

In Figure 8, it can be observed that respondents are willing to participate in project-based e-learning and recommend it as a learning method. Overall, after analyzing the results of the research, it can be concluded that the population is generally familiar with and has encountered project-based learning and has had satisfactory experience with it. Additionally, an important finding is that motivational factors correlate with management and the encouragement of project-based e-learning in the workplace. The fact that extrinsic and intrinsic motivational factors are nearly equal in importance to respondents can be significant for employers and companies when designing projects and workshops.

5. CONCLUSION

Project-based e-learning represents a key component of modern education, providing learners with the opportunity to engage in a learning process that is relevant, engaging, and focused on solving real-world problems. This educational approach allows for the personalization of learning, enabling learners to work on projects aligned with their interests and professional goals. At the same time, it allows educational institutions to create flexible and adaptable learning environments that support various learning styles and meet the diverse needs of learners.

Research results show that project-based e-learning can significantly improve student engagement and learning effectiveness. This approach allows students to apply theoretical knowledge in practice, leading to deeper understanding and better learning outcomes. The use of technologies such as e-learning platforms and collaboration tools plays a crucial role in enabling this type of learning, providing resources necessary for successful project management and collaboration among students.

Project-based e-learning not only supports engagement and knowledge acquisition, but also directly contributes to the development of core project-management competencies. The analysis demonstrated that participants mostly engaged in project-based learning at their workplace, in forms of hackathons and internal company competitions. Such participants reported stronger development of crucial soft skills such as communication, teamwork, leadership, creativity, and understanding of business processes. These results confirm the statement that project-based learning, supported by technology, provides a practical environment in which learners develop competencies that are readily transferable to real project settings.

However, despite its numerous benefits, project-based e-learning also faces challenges. Implementing this approach requires adequate infrastructure, teacher training, and student support. Issues such as lack of resources, technical difficulties, and resistance to change may hinder the successful adoption and application of project-based e-learning.

Looking to the future, it is clear that project-based e-learning will continue to play a significant role in education, but its success will depend on the ability to address existing challenges and develop strategies that ensure its effective implementation. Trends such as the increased use of artificial intelligence, learning analytics, and the development of new technologies, as well as the growing need for continuous education, will further shape the future of this approach.

Social and economic influences also play an important role in shaping the development of project-based e-learning. While this form of learning may reduce education costs and provide access to education in remote areas, it is important to ensure equal access for all users.

The results of the research conducted in this study showed that the general population is more familiar with and has encountered some form of project-based e-learning, and that most were satisfied with this experience. Motivational factors were found to be significant in the process of this type of learning, and the importance of management in project-based e-learning in the workplace was also noted. Respondents highlighted the importance of project-based e-learning and its flexibility in developing leadership and fostering team cohesion.

Recommendations for future research include further investigation into how different technologies and methodologies can be integrated into project-based e-learning to optimize learning outcomes. Additionally, it is necessary to explore the long-term effects of this approach on professional development and adaptability across different sectors. To a lesser extent, it would also be important to investigate ways to overcome the obstacle of the time demands of project-based e-learning, which respondents most frequently identified as significant.

An AI-based language assistance tool (ChatGPT by OpenAI) was used during the preparation of this paper solely for language editing, grammar checking, and improvement of clarity and readability. The AI tool did not contribute to the research design, data analysis, or interpretation of results.

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