Gamified Learning of Project Business Skills

https://doi.org/10.3991/ijac.v15i1.26689

Matti Koivisto(✉)
South Eastern Finland University of Applied Sciences, Mikkeli, Finland
matti.koivisto@xamk.fi

Abstract—During the recent years, scholars have paid a lot of attention to game-based and gamified learning. Although recent studies have offered some mixed results, most scholars believe that gamification increases the student engagement, collaboration, and communication. In our study, we applied gamification to learn skills required to manage a large project portfolio with many simultaneous project and project opportunities. In the empirical part of the study, we investigate post-graduate students' feedback on the project portfolio management (PPM) workshop using both content and sentiment analysis. The complexity of the human nature makes studies on learning extremely challenging and vulnerable to human errors and biases. To increase the accuracy of our study, we applied a machine learning assisted approach and used machine learning both to validate the conceptual framework of our study and to verify the correctness of the manual feedback categorization. The results of the experiment indicate that students' sentiment towards the PPM workshop was positive, and gamification supports learning project business skills. The more detailed analysis revealed that the PPM workshop is a suitable tool for learning two central areas of project business management: the creation of the management system for a company and implementation of the various portfolio management. On the other hand, the workshop is unlikely the best way to learn the management of the customer and subcontracting networks or anticipative financial management.

Keywords—gamification of education, project business, machine learning

1 Introduction

In many organizations, projects are considered as a primary value creation method. Companies use projects constantly to create innovations and new products or services. With the ever-increasing number of simultaneous and more complex projects, demand for project management skills has never been higher. Managing many projects concurrently is not an easy function because it involves many challenging decision-making tasks, including but not limited to resource allocation, scheduling, risk and financial management, and project prioritization.

New project environment with large project portfolios and the increased importance of the project business requires new skills and learning methods. The main aim of the study is to develop a new and engaging method of gaining expertise needed in the project business. More precisely, we focus on gamified learning and analyze the

suitability of gamification to learn project business skills. Our analysis is based on the findings and feedback from a workshop designed and organized at a Finnish university of applied sciences. The prime purpose of gathering students' feedback is to assess and improve the quality of the workshop.

Our secondary objective relates to the methodology used in the study. Because our research methods are prone to human error, we decided to use machine learning (ML) to reduce the researcher bias and number of unintended errors in two different ways. We use ML to verify our theoretical framework and to validate our manual sentiment analysis or opinion mining results. It is important to notice that our approach does not try to replace human judgement but make it more accurate.

Our paper is organized as follows. Section 2 is the literature review. In Section 3, we present the study design. First, we describe the structure of the study and create a theoretical framework to analyze different aspects of the gamified project business workshop. Then, we report the design and contents of the workshop, followed by descriptions of the data collection and analysis methods. The student feedback on the workshop is analyzed using both content and sentiment analysis to find out the suitability of the gamification to gain expertise needed in project business. The results of the study are reported and discussed on Section 4. Finally, in Section 5, we draw the final conclusions.

2 Literature review

In this section, we provide the short reviews of the main elements of the study, which are ML, games and gamification in education, and project business. All these topics are so wide that we cannot cover them fully, but we focus only on the most essential aspects to our study.

2.1 Humans in machine learning

ML is a branch of artificial intelligence which can be broadly defined as computational methods using experience to improve performance or to make accurate predictions [1]. Most of today's ML applications do not learn by themselves, but they work together with humans and rely on intensive human feedback. The co-operation between a man and a machine can take different forms and can be called as supervised learning, mutual learning, or human in the loop learning (HITL). HITL has been defined as follows: "a bidirectional process involving reciprocal exchange, dependence, action or influence within human and machine collaboration, which results in creating new meaning or concept, enriching the existing ones or improving skills and abilities in association with each group of learners" [2].

The definition above identifies two groups of learners (human and machine as a learner) and HITL can be used to solve one or more of the following [3]:

- Making Machine Learning more accurate
- Getting Machine Learning to the desired accuracy faster
- Making humans more accurate
- Making humans more efficient

The application of ML has led to significant benefits in many fields (e.g., astronomy, medicine, government, industry, and the military) and applications such as self-driving cars and drones [4]. However, we cannot deny that the wide use of artificial intelligence and ML has also exposed several problems associated with data and context. More details on artificial intelligence failures can be found for example in [5] and [6].

2.2 Games and gamification in education

In recent years, games and game-like elements have been introduced to several domains, including entertainment, business, and education. In education, practitioners have applied two different approaches: game-based learning (GBL) and gamification. In GBL, the game is the starting point, and at a simple level, GBL has been defined as "learning that is facilitated by the use of a game" [7]. Usually, we assume that the game is a digital one, but this is not always the case. All learning or serious games seem to share a three-step structure of challenge, response, and feedback, and the game continues when the feedback creates a new challenge to the player [8].

Gamification instead has been defined as "the use of game design elements in non-game contexts" [9] and "the process of making activities more game-like" [10]. Both definitions emphasize that, in gamification, the focus is not on the game but on the learning process. Thus, gamification is not a product similarly like an educational or serious game is in GBL. Instead, in gamified learning an existing learning process is altered to create a revised version of this process that users experience as game-like [11]. Gamification of education typically aims to improve students' motivation, engagement [12], participation and learning outcomes [13], and it combines play-like simulation, functional proficiency, and social interaction with learning [14]. Many scholars have reported the positive effects of gamification on learning outcomes at different education levels and subjects [15]. Naturally some critical views have been reported [16, 17], but most of the empirical studies on gamification in higher education have provided positive outcomes [18]. Table 1 provides additional information on differences between gamification and GBL from three different perspectives: challenge, content, and cost.

Table 1. Comparing gamification and game-based learning (modified from [19])

Area of Comparison	Gamification	Game-Based Learning
Challenge	A new way to approach challenges	Challenges are part of the game
Content	Features are added to the LMS* or any other system.	Usually morphed to fit the story of the game
Cost	Cheaper	Expensive, especially if existing game is not used

Note: * Learning Management System.

Researchers have modeled gamification of learning in different context (e.g., in MOOCs [20] and in eLearning [21]). For our purpose, a model for virtual team collaborative learning (LIC) based on gamification of education, collaborative learning, virtual teams, and technology [22] is especially interesting. The model is shown in Figure 1, and it consists of the following three parts: a learner as a player, an instructor as a coach, and a classroom as an arena. According to this model, the learners work

together in the learning space. The physical and virtual classroom offers a place to compete, receive feedback and gain status. The role of the instructor is to create the context or the story and set the rules and the goals of the learning session.

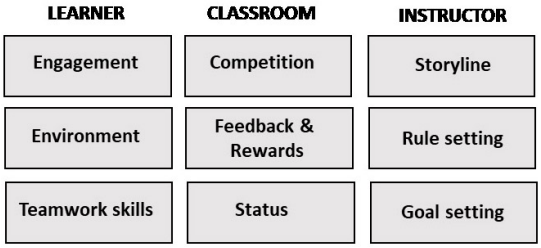

Fig. 1. The model for virtual team collaborative learning (modified from [22])

2.3 Scope and skills of project management and project business

Project management is the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements and to complete a project [23]. Project management competencies can be divided, for example, in the following three categories: technical, behavioral, and contextual competencies [24]. Another often applied classification is based on hard and soft skills. Hard skills refer to technical expertise and are used in implementing common project management tasks, embodied in standards and handbooks, such as the PMBOK [23]. Soft skills are instead related to people and relationships. Earlier studies have indicated that project managers need both hard and soft skills [25] and predicted that the emerging work environment will place greater importance on soft skills [26].

Project business, on the other hand, goes beyond a single project and it is defined as "the part of business that relates directly or indirectly to projects, with a purpose to achieve the objectives of a firm or several firms" [27]. In project business, many projects are managed simultaneously with the aim to fulfill the organization's strategic business objectives. Managing a diverse project portfolio is not an easy job because project portfolio management (PPM) involves many challenging decision-making tasks including resource allocation, the scheduling of the individual tasks, risk management and project prioritization. To solve these problems, organizations have created different kinds of PPM tools for increasing efficiency and productivity.

Researchers have defined two project related success concepts. Project success refers to achieving the overall goals of the project or a successful completion of change, while project management success means delivering a project on schedule, within budget according to the project specifications [28]. Therefore, the project success concentrates on the outcome, while the success of the project management focuses more to the process leading to that outcome. Earlier findings indicate that successful project management [24] and good actions of the project manager [29] are essential to the project success.

Although scholars have analyzed project business from many related perspectives like trust [30], outsourcing [31], and project selection in the project portfolio [32], the success factors of project business management have received far less interest. One of the few attempts to do so is presented in [33]. The model (see Figure 2) has the following four elements: a management system, financial management, PPM, and managing customer and supplier networks. All of them are connected to the strategy of the organization, and they affect individual projects through resourcing, financing, goal setting, and management of the project lifecycle.

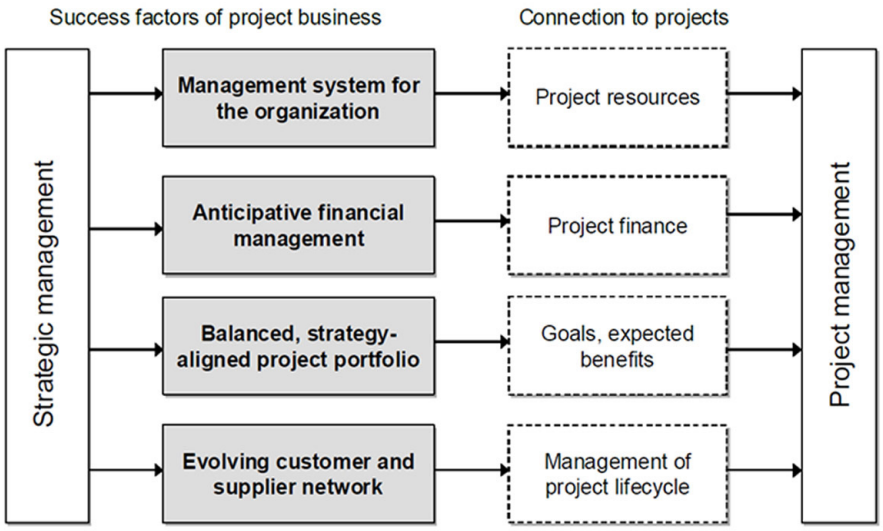

Fig. 2. Project business management success factors [33]

3 Study design

To be able to analyze the suitability of the gamification in the project business context, we first created a conceptual framework and then conducted an empirical study at the South Easter Finland University of Applied Sciences. The model sets the foundation for analyzing the data collected in a project business workshop. More details on the conceptual framework, workshop design and data collection are described below.

3.1 Conceptual framework

In Section 2, we presented some theoretical models for gamified learning and introduced the key success factors of the project business. Based on these discussions, we created a theoretical framework for gamified project business education, and the model is presented in Figure 3. The model has two parts. The gamification side of the model has three elements: a learner, learning environment, and an instructor.

Here the learner is seen both as an individual student and as a member of a team because learning takes place in collaboration with other students and project business, and portfolio management contains decision making both alone and with others. Learning environment refers to all activities of the exercise and environment contains both physical and virtual learning spaces. Finally, the instructor's role contains all the teaching and supporting functions, as well as materials provided before, during and after the learning session. On the right side of the model, instead, are the four key success factors of the project business—namely, the organization's management system, financial management, portfolio management, and customer and supplier management.

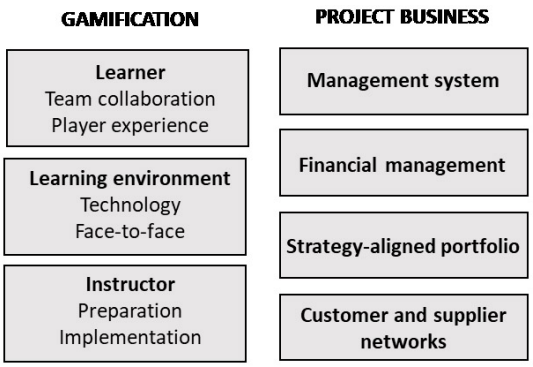

Fig. 3. The conceptual framework for the gamified learning of the business project skills

3.2 Project business workshop design

The following five questions presented in [34] guided us during the design of our learning workshop:

- What is the focus of the exercise?
- Why is gamification used?
- Who is the target or learner of the gamified exercise?
- How is the gamified exercise shown and presented to the learners?
- How does the gamified exercise work (steps of the game)?

Justification for the first two questions can be found in Section 2. The focus of the exercise is learning various skills needed in project business management. Gamification was selected as a learning method because earlier studies have indicated that it improves students' motivation, engagement, participation and learning outcomes. The workshop was targeted to the post-graduate engineering students with at least two years of work experience after gaining their bachelor's degree.

Earlier studies suggest that, in meaningful gamification, designers must focus on the aspects of the underlying activity to understand where an integration of game elements makes sense [35]. To do that, we applied Marczewski's general game element principles [36] in our planning. The narrative of the workshop was that participants

worked for an international project business company, and they had to carry out typical project business management tasks. At the beginning of the workshop, the instructor demonstrated the use of the PPM software and provided students with tutorials and learning videos. During the workshop, the instructor gave the tasks and instructions to the participants. The students got feedback during the task from the software and after each phase from the instructor. Each team had to create their own teamwork strategies and decision-making methods. Because the projects of the company used shared resources, the decisions related to one project affected others and wrong decisions could have negative outcomes like lost bonuses. The workshop tried to simulate typical project business environment with unknown events, time pressure, shortage of resources, etc. Students spent six hours in this exercise; therefore, it was essential that there was a good balance between the skills of the students and the challenges of the tasks. Figure 4. summarizes the correspondence between general game elements and their implementation in our workshop.

GENERAL GAME ELEMENTS	IMPLEMENTATION HERE
Narrative/Story	You are a member of the management team
Theme	You must run the project business of the company
On-boaring/tutorials	Short demo by the instructor and learning videos
Signposting	Instructions for the next task
Progress/feedback	From instructor after completing of each task From software during the tasks
Curiosity	Unknown events in each task
Strategy	Decisions about the team rules and working methods
Time pressure	Limited time and feel of hurry
Scarcity	Limited resources to complete the projects
Consequences	Decisions in one project affects others
Loss aversion	Wrong resource allocation leads to lost bonuses
Investment	Students spent the whole Saturday in the workshop
Flow	Balance of skills and challenges

Fig. 4. Implementation of the general game elements in the workshop

After designing the content of the workshop, the execution of the exercise was planned. We created the following four-phase structure. At the starting phase, the instructor will provide students with necessary information about the narrative, goals, and tools. In the second phase, all participants will work individually and add their own projects to the project portfolio. At this phase, they will also make optimal resource allocation to their own project. Each member of the team will have a unique project, but there will be no differences between the portfolios of the teams. This way the results of the teams can be compared against each other. Next in phase three, students will shift their perspective from a single project to the project portfolio of their team. The scarcity of resources will force them to prioritize projects, reschedule tasks and reallocate resources, as well as react to the new orders from the company headquarters. This step will be the most essential part of the exercise, and it will involve a lot of co-operation, negotiations, and decisions on team rules and working methods under time pressure. After each phase, all competing teams will meet in a short feedback

meeting. These meetings will also provide guidance to the next tasks. Finally, at the end of the workshop the instructions for homework or phase 4 will be given.

3.3 Data collection and analysis methods

To collect some empirical data, we conducted the workshop in a Finnish university of applied sciences. In the workshop, 42 post-graduate engineering students worked in teams of four or five students. All participants were adult learners with full-time jobs and at least some work experience in the project organizations. After a six-hour exercise, students gave written feedback about the learning session. The total number of the feedback sentences was 358. The student feedback was analyzed both with the content and sentiment analysis.

Content analysis is an established empirical method of studying recorded human communications [37], and it has been used both in quantitative and qualitative studies. Research using qualitative content analysis focuses on the characteristics of communication and pay special attention to the content or contextual meaning of the communication [38]. This can be implemented by determining the presence of certain words, word groups, or concepts in text, speech, or some other form of qualitative data. The current applications of content analysis use three different approaches: conventional, directed, or summative. All of them are used to interpret meaning of communication, and the major differences between them are in coding schemes and the origins of the coding categories [39]. In this study, a directed content analysis (DCA) was used. DCA is a structured process guided by existing theory, and its goal is either to validate or extend a theoretical framework or theory [39]. In DCA, researchers use the key concepts of the theory as coding categories. In our case, seven elements of the model described earlier created the framework for categorization.

We applied the content analysis for two different purposes. First, it was used to validate our framework introduced earlier. Like always, the model represents the conceptual world, and therefore, it is a simplified version of the real world. The aim of model validation was to find out if the suggested model is useful, addresses the right problems, and provides accurate information about the system being modeled [40]. The main consideration, in this case, was how well the new model encapsulates the key elements of the gamified learning of the project business. To find this out, we used a simple n-gram-based content analysis for the student feedback. The analysis was done with Microsoft Azure Machine Learning Studio, and the workflow contained the typical data processing steps including data selection, cleaning, and pre-processing before extracting the n-grams as shown in Figure 5. The outcome of the process was a dictionary of the most often used concepts in student feedback, and they were then compared against our model.

Second, we carried out a manual content analysis. In this task, we assigned all feedback sentences to corresponding categories. If a comment contained opinions related both to the subject of study (project business) and the learning method (gamification), it was classified to both categories. The categorization results indicated how much each dimension of the gamified learning received attention from the students.

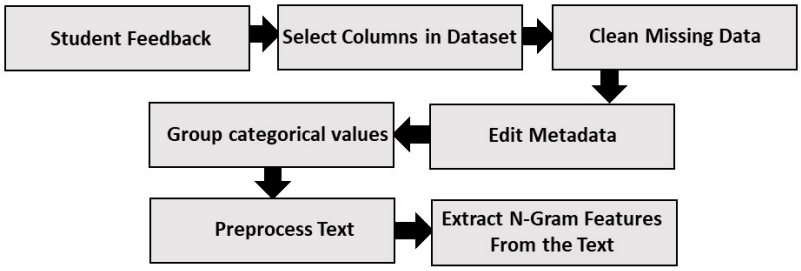

Fig. 5. Workflow to extract n-grams from the feedback data

Our second method, sentiment analysis, aims to identify opinions and determine attitudes towards a particular topic. It studies the subjective elements of the text or "the linguistic expressions of private states in context" [41]. These elements are usually single words, phrases, or sentences. Sentiment analysis has been applied for many purposes. In education, it has been mainly used to analyze student feedback in different contexts and learning environments. In sentiment analysis, the classification of the opinion can be done different ways using binary, ternary, or ordinal classification. In this study, binary classification (positive or negative) was used. The sentiment analysis was first done manually. Due to the human nature of the manual classification, the method is prone to errors and to the researcher bias. To avoid any unintended errors in the research process, we used ML to verify the correctness of the sentence classification. Therefore, our aim was not to develop an efficient ML algorithm for the classification but to increase the accuracy of human classification.

4 Results

In this section, the results of both content and sentiment analysis are reported. Because our study design and analysis methods do not provide data that can be compared meaningfully using statistical tests, we apply a qualitative approach in our reporting.

4.1 Findings of the content analysis

Our simple ML algorithm created a dictionary of 50 key words or word groups from the student feedback. Ten most often appeared n-grams and their frequency scores (DF) were: project (54), portfolio (34), train (29), software (22), strategy (19), economy (18), accordance (14), company (13), accordance strategy (13), and project manager (12). Next, we categorized all 50 n-grams in seven categories of our model to find out how well the model and the content of the feedback matched. The results are shown in Table 2. From 50 n-grams, 28 were related to project business and 17 to gamification sides of the model. Five n-grams were not associated to the framework.

Our approach did not provide data that can be compared meaningfully using statistical tests. Therefore, we report here only the relative shares of the supporting and non-supporting codes as suggested in [39], and they are 90% and 10%, respectively. Bearing in mind that "all models are wrong, but some are useful" [42], the results

suggest that the framework contains the key elements of the phenomenon, and it can be used for analyzing the gamification of the project business.

Table 2. N-grams and their associations to the elements of the model

Model Element	N	N-grams
Management system of the company	10	manager, project_manager, decision, problem, leader, operate, realization, advantage, company, operation
Financial management	3	budget, anticipate_control, anticipate_control_economy
Portfolio management	11	accordance_strategy, portfolio, resource, work, creation_ portfolio, strategy_company, different_project, progress, view, point_view, point
Customer and supplier management	4	network_subcontract, customer_network_ subcontract, network_subcontract_network, customer_network_subcontract_network
Learner	8	group, deal, opinion, like, easily, succeed, understand, able
Learning environment	6	time, place, open, think, program, software
Instructor	3	support, facilitate, follow
Not mapped	5	surely, level, really, accord, , possible

Next, we carried out a manual content analysis and categorized all feedback sentences to corresponding categories. As mentioned earlier, we used DCA and our framework for classification. If a comment contained opinions in more than one category, it would be classified to all of them. Portfolio management and the learning environment were the most often commented areas, with 80 and 71 mentions, respectively. Instructor together with customer and support networks received least feedback from the students. Table 3 shows the number of the statements in each category.

Table 3. Feedback sentences in each category

Element of the Model	Number of Statements
Management system of the organization	51
Financial management	40
Portfolio management	80
Customer and supplier management	26
Learner	59
Learning environment	71
Instructor	15

4.2 Findings of the sentiment analysis

We used sentiment analysis to identify students' opinions and attitudes towards our workshop and suitability of gamification to learn skills needed in project business management. Manual classification gave the following results: 232 positive, 79 negative

sentences. Forty-seven comments did not have a clear positive or negative attitude, and they were therefore removed from the further study.

As mentioned earlier, manual classification is an error-prone method. Therefore, a dictionary-based ML approach was used to improve the quality of the manual classification process. The simplified ML workflow is shown in Figure 6. First, we had to preprocess the data to get it in correct format. We then divided the data into two parts—first for model creation and second for using it. In model creation, we used supervised learning with a neural network algorithm to create a binary classifier, which divided the sentences either into positive or negative categories. Our neural network algorithm used one hidden layer with 100 nodes and maximum 100 learning iterations. After running our model, we compared the outcomes of manual and ML classifications, and the accuracy of the ML model was 0.78. In other words, the algorithm classified 68 sentences out of 311 differently than we had done manually. Because our aim was not to develop a more accurate ML model but to increase the accuracy of human classification, we compared the outcomes of the human and machine-made classification. After reviewing all differently classified cases, we found three clear errors in our original manual classification and we corrected them.

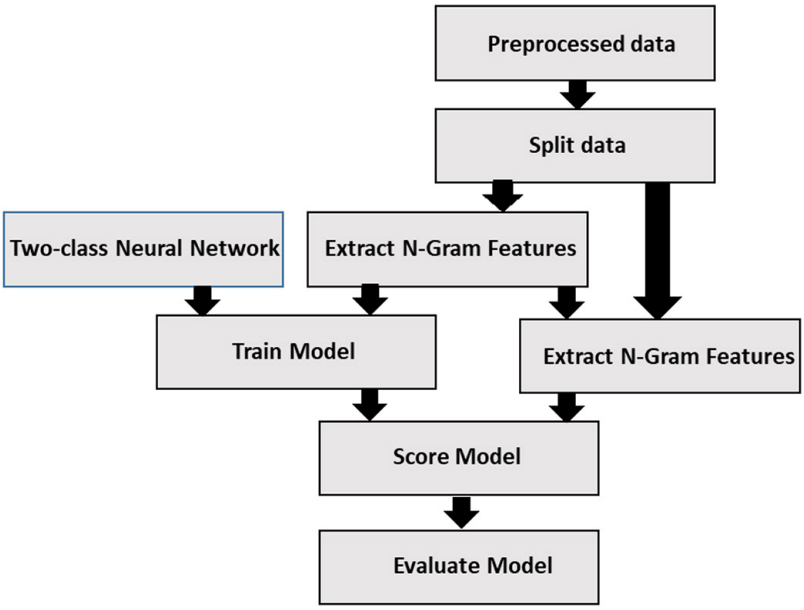

Fig. 6. Simplified machine learning based sentiment analysis workflow

Finally, we combined the classification and sentiment results to find out the students' sentiment towards different elements of the model. The results are summarized in Table 4, and it contains the number of both positive and negative statements in each element of the model and the sentiment score. The sentiment score range is from –1 to +1 and is calculated according to Eq. 1.

$$Sentiment\ score = \frac{n_{Positive\ statements} - n_{Negative\ statements}}{n_{Positive\ statements} + n_{Negative\ statements}} \quad (1)$$

Because we applied here a qualitative rather than quantitative approach, Table 4 also contains the qualitative sentiment assessment based on the logic presented in [43]. According to the results, students expressed strong positive sentiment towards the following three elements of the model: management system, portfolio management and learner. The only dimension receiving more negative than positive comments and, thus, a moderate negative sentiment was customer and supplier management.

Table 4. Results of the sentiment analysis

Element of the Model	Positive Comments	Negative Comments	Score*	Qualitative Sentiment
Management system	48	3	0.88	strong positive
Financial management	36	14	0.30	weak positive
Portfolio management	75	5	0.88	strong positive
Customer & supplier	8	18	–0.38	moderate neg.
Learner	56	3	0.90	strong positive
Learning environment	41	30	0.15	weak positive
Instructor	9	6	0.20	weak positive
TOTAL	263	79	0.54	moderate pos.

Note: * Sentiment score = (Positive statements – Negative statements) / (Positive statements + Negative statements).

5 Conclusions

Our study provides valuable information on the gamified learning of project business skills. First, the results of the sentiment analysis clearly point out that students' attitude towards gamification was positive. Second, the more detailed analysis indicated that a gamified PPM exercise is a good and motivating method of learning the creation of the management system for a company and implementation of the various portfolio management tasks (e.g., resource allocation, scheduling, and prioritization). The results also indicated that this kind of workshop seems to be a less suitable way to study financial management and especially the customer and supplier network management.

There can be many reasons behind these findings. However, an obvious explanation can be the role of the PPM software in the general information system architecture of a company. The PPM software serves as production information system for a project-oriented company and provides support for managerial decision-making. Organizations have typically dedicated customer and supplier management systems, as well as finance and accounting applications; therefore, these areas cannot be covered fully in an exercise utilizing PPM software. Further studies are naturally needed to find more detailed information.

Although sentiment towards learning was strongly positive, the student feedback also provided some suggestions for how the current learning session and instructions could be further developed. The main sources of criticism were related to the timing. Many students reported that their team had to hurry in some parts of the exercise, which limited their possibility to compare different alternatives. Some students also pointed out that they would like to get familiar with the PPM software before the exercise. Based on these comments, the exercise will be, in the future, divided into three separate parts before, during, and after the exercise. In the new version of the workshop, students will use video tutorials to get familiar with the software before the learning session. This allows students to concentrate on decision-making and teamwork during the workshop. Finally, most of the reporting will be carried out after the learning session offering students more time to reflect their experiences.

Although the focus of the study was to analyze the suitability of gamification to learn project business skills, we also reported simple but successful ways to use ML during the research process. Our approach did not try to replace the human judgment but, rather, to make it more accurate by reducing the researcher bias and number of unintended errors. Thus, we joined the ever-increasing trend where the traditional confrontation between a man and a machine is evolving to co-operation between man and the machine against the problem. We see many possibilities in this area, but a large number of further studies are needed to clarify this subject.

6 Acknowledgment

This work was supported by Master Talent program of Thinking Portfolio Oy, Finland.

7 References

[1] Mohri, M., Rostamizadeh, A., Talwalkar, A. (2018). Foundations of Machine Learning. 2nd Edition. The MIT Press.

[2] Ansari, F., Erol, S., Sihn, W. (2018). Rethinking Human-Machine Learning in Industry 4.0: How Does the Paradigm Shift Treat the Role of Human Learning? 8th Conference of Learning Factories. April 12–13. Patras, Greece. pp. 117–122. https://doi.org/10.1016/j.promfg.2018.04.003

[3] Monarch, R. (2021). Human-in-the-Loop Machine Learning Active learning and annotation for human-centered AI. Manning Publications. Shelter Island, NY.

[4] Lawless, W., Mittu, R., Sofge D. (2020). Introduction: Artificial Intelligence(AI), Autonomous Machines, and Constructing Context: User Interventions, Social Awareness, and Interdependence. In Human-Machine Shared Context. Academic Press. https://doi.org/10.1016/B978-0-12-820543-3.00001-8

[5] Oakden-Rayner, L., Dunnmon, J., Carneiro, G., Ré, C. (2020). Hidden Stratification Causes Clinically Meaningful Failures in Machine Learning for Medical Imaging. In ACM Conference on Health, Inference, and Learning (ACM CHIL '20), April 2–4, 2020, Toronto, ON, Canada. https://doi.org/10.1145/3368555.3384468

[6] Yampolskiy, R. (2019). Predicting Future AI Failures From Historic Examples. Foresight, 21(1), 138–152.
[7] Whitton, N.: Games-Based Learning. In Encyclopedia of the Sciences of Learning, 1337–1340 Springer, Boston, MA (2013). https://doi.org/10.1007/978-1-4419-1428-6_437
[8] Plass, J., Homer, B., Kinzer, C. (2015). Foundations of Game-Based Learning. Educational Psychologist, 50(4), 258–283. https://doi.org/10.1080/00461520.2015.1122533
[9] Deterding, S., Dixon, D., Khaled, R., Nacke, L.: From Game Design Elements to Gamefulness: Defining Gamification. In 15th International Academic MindTrek Conference: Envisioning Future Media Environments, pp. 9–15 New York (2011). https://doi.org/10.1145/2181037.2181040
[10] Werbach, K.: (Re) Defining Gamification: A Process Approach, Persuasive Technology. Lecture Notes in Computer Science, 8462, 266–272 (2014). https://doi.org/10.1007/978-3-319-07127-5_23
[11] Landers, R. N., Auer, E. M., Collmus, A. B., Armstrong, M. B. (2018). Gamification Science, Its History and Future: Definitions and a Research Agenda. Simulation & Gaming, 49(3), 315–337. https://doi.org/10.1177/1046878118774385
[12] Dichev, C., Dicheva, D.: Gamifying Education: What Is Known, What Is Believed and What Remains Uncertain: A Critical Review. International Journal of Educational Technology in Higher Education. 14(9), 1–36 (2017). https://doi.org/10.1186/s41239-017-0042-5
[13] Buckley, P., Doyle, E.: Gamification and student motivation. Interactive Learning Environments 24(6), 1162–1175 (2016). https://doi.org/10.1080/10494820.2014.964263
[14] Sousa, M. J., Rocha, A.: Leadership styles and skills developed through game-based learning. Journal of Business Research 94, 360–366 (2019). https://doi.org/10.1016/j.jbusres.2018.01.057
[15] Legaki, N.-Z., Xi, N, Halmari, J., Karpouzis, K., Assimakopoulos, V.: The Effect of Challengebased Gamification on Learning: An Experiment in the Context of Statistics Education. International Journal of Human-Computer Studies 144 (2020). https://doi.org/10.1016/j.ijhcs.2020.102496
[16] Bogost, I.: Why Gamification is Bullshit. In S. P. Walz & S. Deterding (Eds.), The gameful world, 65–80 The MIT Press, Cambridge, MA (2015).
[17] Morozov, E.: To Save Everything, Click Here: The Folly of Technological Solutionism. PublicAffairs, New York, NY (2013).
[18] Hung, A.C.Y.: A Critique and Defense of Gamification. Journal of Interactive Online Learning. 15. 57–72 (2017).
[19] Al-Azawi, R., Al-Faliti, F., Al-Blushi, M. (2016). Educational Gamification Vs. Game Based Learning: Comparative Study, International Journal of Innovation, Management and Technology, 7(4), 132–136. https://doi.org/10.18178/ijimt.2016.7.4.659
[20] Saputro, R.E., Salam, S., Zakaria, M., Anwar, T.: A Gamification Framework to Enhance Students' Intrinsic Motivation on MOOC. Telkomnika Telecommunication Computing Electronics and Control, 17, 170–178. (2019). https://doi.org/10.12928/telkomnika.v17i1.10090
[21] Rutkauskiene, D., Gudoniene, D., Maskeliunas, R., Blazauskas, T.: The Gamification Model for E-Learning Participants Engagement. Smart Education and e-Learning. Springer International Publishing, Switzerland (2016). https://doi.org/10.1007/978-3-319-39690-3_26
[22] Srisomboon, P., Jeerungsuwan, N.: Gamification Model for Virtual Team Collaborative Learning via Cloud Technology. In: The 12th International Conference on eLearning for Knowledge-Based Society (2015).
[23] Project Management Institute: A Guide to the Project Management Body of Knowledge (PMBOK Guide). 5th ed. Newtown Square, Pennsylvania (2013).

[24] International Project Management Association. (2015). Individual Competence Baseline Vol. 4.0; International Project Management Association: Zurich, Switzerland.
[25] Mateo, J., Navamuel, D., & Villa, M. (2020). Are Project Managers Ready for the 21th Challenges? A Review of Problem Structuring Methods for Decision Support, International Journal of Information Systems and Project Management, 5(2), 43–56.
[26] Ozguler, I. (2020). Project Management After Covid-19, PM World Journal, 9(5), no. V, May, 2020.
[27] Artto, K., Wikström, K.: What is project business? International Journal of Project Management, 23(5), 343–353 (2005). https://doi.org/10.1016/j.ijproman.2005.03.005
[28] Radujkovića, M., Sjekavicab, M. (2017). Project Management Success Factors. Creative Construction Conference, 19–22 June 2017, Primosten, Croatia. https://doi.org/10.1016/j.proeng.2017.08.048
[29] Ling, F., Ning, Y., Chang, Y., & Zhang, Z. (2018). Human Resource Management Practices to Improve Project Managers' Job Satisfaction. Engineering, Construction and Architectural Management, 25, 654–669. https://doi.org/10.1108/ECAM-02-2017-0030
[30] Smyth, H., Gustafsson, M., Ganskau, E.: The Value of Trust in Project Business. International Journal of Project Management. 28(2), 117–129 (2010). https://doi.org/10.1016/j.ijproman.2009.11.007
[31] Sandhu, M.A., Shamsuzzoha, A. and Helo, P. "Does Outsourcing Always Work? A Critical Evaluation for Project Business Success", Benchmarking: An International Journal, 25(7), 2198–2215 (2018). https://doi.org/10.1108/BIJ-06-2017-0146
[32] Costantion, F., Di Gravio, G., Nonino, F.: Project Selection in Project Portfolio Management: An Artificial Neural Network Model Based on Critical Success Factors. International Journal of Project Management. 33. 1744–1754 (2015). https://doi.org/10.1016/j.ijproman.2015.07.003
[33] Artto K., Martinsuo M., Kujala J.: Project Business. Helsinki, Finland (2011). https://doi.org/10.1093/oxfordhb/9780199563142.003.0006
[34] Hallifax, S., Marty, J-C., Serna, A., Lavoué, E.: A Design Space For Meaningful Structural Gamification. Extended Abstracts of the 2018 CHI Conference on Human Factors in Computing. (2018). https://doi.org/10.1145/3170427.3188442
[35] Nicholson, S.: A User-Centered Theoretical Framework for Meaningful Gamification. Games+Learning+Society 8.0, Madison, WI. (2012).
[36] Marczewski, A.: User Types. In Even Ninja Monkeys Like to Play: Gamification, Game Thinking and Motivational Design (1st ed., pp. 65–80). CreateSpace Independent Publishing. (2015).
[37] Babbie, E. (2001). The Practice of Social Research (9th ed.). Belmont: Wadsworth.
[38] Tesch, R. (1990). Qualitative Research: Analysis Types and Software Tools. Bristol, PA: Falmer
[39] Hsieh, H.-F., Shannon, S.: Three Approaches to Qualitative Content Analysis. Qualitative health research. 15. 1277–88. (2005). https://doi.org/10.1177/1049732305276687
[40] Macal C.: Model Verification and Validation Workshop on "Threat Anticipation: Social Science Methods and Models" The University of Chicago and Argonne National Laboratory April 7–9 Chicago, IL (2005).
[41] Wiebe, J., Wilson, T., Bruce, R., Bell, M., Martin, M. (2004). Learning subjective language. Computational Linguistics, 30:277–308. https://doi.org/10.1162/0891201041850885
[42] Box, G., Draper, N. (1987), Empirical Model-Building and Response Surfaces, John Wiley & Sons.
[43] Dancey C.P., Reidy, J.: Statistics without Maths for Psychology. Pearson Education. (2007).

8 Author

Matti Koivisto is the Principal Lecturer at South-Eastern Finland University of Applied Sciences, Patteristonkatu 3, FI-50100 Mikkeli, Finland. He received his Ph.D. from the Helsinki University of Technology, and his areas of interest include the application of new methods and technologies in adult education and project management.

This is a revised and extended version of a presentation given at The Learning Ideas Conference 2021, held online June 14-18, 2021. Article submitted 2021-9-3. Resubmitted 2021-12-3. Final acceptance 2021-12-7. Final version published as submitted by the authors.