

The Impact of University Challenges on Academic Value Added Perception and Job Opportunities

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Abstract: Teaching has always been one of the foundational elements in the growth and education of children. Over time, the introduction of different teaching methodologies in university classrooms has become increasingly widespread to enrich the courses offered, and many evidences have shown how this can actually enhance and improve the learning experience. Collaborative teaching methods, learning factories, and as study learning are widespread. In this study, our aim is to investigate how submitting optional university challenges during Engineering & Management courses of study can lead to correlations on a better academic path and offer better job opportunities. The results have important implications for the orientation of university teaching methodologies and also for the definition of occupational profiles in the field of industrial engineering that can be integrated into business assessments.

Keywords: *Human Factor; Attitudes; Education; Teaching; Challenge; University*

I. INTRODUCTION

Game-based education has been successfully used to enhance the learning experience of students and increase their motivation. This is particularly relevant in the field of creating a connection between theoretical knowledge, practical knowledge, and the development of soft skills (Burghardt et al., 2021).

The use of Serious Game (SG) within university courses is a very useful tool for the improvement of students in project management and also has the additional result of increasing interest in the subjects taught and improving academic performance. This aspect, also wrapped up in a survey of online project management students (Yang, 2020) showed how engagement can influence academic performance, with the support of students' personal motivation. Such personal motivation is a critical factor in the promotion of

learning, as demonstrated in Brouwer and Koster's (2019) study, which uses tools to analyse student perceptions and assess the quality of the student learning experience in a course.

Institutions are increasingly adopting innovative teaching methods to equip students with practical skills and real-world experience that can prepare them for successful careers. To this end, various educational approaches have emerged that prioritise hands-on learning and the development of essential competencies.

One such approach is project-based learning, in which students work on real-world projects to gain practical skills while mastering theoretical concepts. Another strategy is experiential learning, where students learn by doing through activities such as internships, cooperative education, and volunteer work. Some institutions are also turning to technology-enabled learning, such as simulations and serious games, to create engaging and interactive learning experiences. Others are

focussing on collaborative learning and teamwork to help students develop social and leadership skills.

These innovative approaches have been shown to have positive effects on student learning and career success.

In summary, institutions are embracing a variety of innovative teaching methods to provide students with practical skills and real-world experience that can prepare them for successful careers. These approaches are based on a variety of SGs, from project-based learning to experiential learning, technology-enabled learning and collaborative learning, and have been shown to have positive impacts on student learning and career readiness.

Taking into account the defining characteristics of Serious Games and an extensive review of the relevant literature, the present study seeks to explore the potential outcomes of this type of game-based learning. To this end, the authors pose the following research questions:

- RQ1: Does participating in university challenges provide added value for students?
- RQ2: Can participation in challenges serve as a useful tool during the hiring process?

The remainder of this paper is structured as follows. The following section provides background information on the teaching method and highlights some of the most significant contributions from the literature. The design study is then described in detail, including the methodological and experimental approach, as well as the administration of surveys and personality tests. Subsequently, the results of the study are presented and discussed in detail. Finally, the paper concludes with suggestions for future research and avenues for continued progress.

II. SERIOUS GAME OVERVIEW

Several studies have investigated the impact of serious games and challenges on student learning in higher education. Esposito et al. (2022) conducted a study on the use of serious games in operations management and found a positive correlation between students' game performance and final evaluation. Similarly, Ameerbakhsha et al. (2019) compared two methods of using a serious game for teaching marine ecology in a university setting and found that the game-based approach improved students' learning outcomes.

In addition to serious games, challenges have also been used to enhance the learning experience. For example, Lau (2015) used a modified beer game as an action learning approach to teach supply chain management and found that the game-based

approach helped students better understand the complexities of supply chain management. Similarly, Pekkanen et al. (2020) used a challenge-based approach to build integration skills in supply chain and operations management study programmes.

The use of serious games and challenges in higher education has also been shown to improve student motivation and engagement. Jääskä et al. (2022) found that game-based learning methods improved student motivation in project management education. Furthermore, Jääskä et al. (2022) demonstrated that serious games could trigger a transformation in project management education. Similarly, Ud Din and Gibson Jr. (2019) showed that serious games could enhance learning and engagement in prevention through design concepts.

However, the implementation of serious games and challenges in higher education also poses some challenges. Akçayır and Akçayır (2018) reviewed the advantages and challenges of the flipped classroom, a popular approach that combines online learning and in-class activities. The study found that the flipped classroom approach could improve student performance and engagement, but it also required significant effort from instructors to design and implement.

Moreover, in addition to their impact on learning outcomes and motivation, serious games and challenges can also provide opportunities for interdisciplinary education. Berta et al. (2015) used a tangible serious game approach to science, technology, engineering and mathematics (STEM) education, which facilitated interdisciplinary learning and provided a unique learning experience for students.

Another important aspect of the use of serious games and challenges in higher education is their potential to improve problem-solving and critical thinking skills. A study by Iten and Petko (2016) investigated the relationship between the fun factor of serious games and students' learning success. They found that while enjoyment of the game did not directly predict learning success, the fun factor was positively correlated with students' problem-solving abilities. In addition to improving problem-solving skills, serious games and challenges can also provide opportunities for experiential learning. Johnson (2021) explored teaching excellence in the context of business and management education and found that experiential learning approaches, such as serious games and simulations, were effective in improving student learning outcomes.

Furthermore, serious games and challenges can be used to promote collaborative learning and teamwork. Jääskä et al. (2022) found that game-

based learning methods improved students' collaboration skills in project management education. Furthermore, Bonnier et al. (2022) explored the use of serious games in project management education and found that the games encouraged team building and collaboration among students.

Despite the potential benefits of serious games and challenges in higher education, their implementation requires careful consideration of the learning objectives and the target audience. A study by Jones et al. (2022) explored the use of an online survey tool to measure the motivational climate in an online course, which helped instructors make data-driven decisions to improve student learning outcomes.

In conclusion, the use of serious games, challenges, and other gamification techniques in higher education has the potential to enhance the learning experience, improve student engagement and motivation, and facilitate better learning outcomes. However, its implementation requires careful planning and effort from instructors. More research is needed to better understand the impact of serious games and challenges on student learning and the best practises for their implementation in higher education.

III. METHODOLOGY OF WORK

In this research article, we will discuss the university challenges hosted by Tor Vergata University of Rome, Italy, which engaged students in various topics presented by prominent multinational corporations. The themes revolved around key areas including Supply Chain Management, Operations Management, Logistics, and Distribution Management. The participating students primarily belonged to Management Engineering courses such as Industrial Plants, Production Management, and Operations Management, considering the subject matter covered.

The challenges considered in the present work covered a time frame from 2017 to 2022. Although they exhibited slight variations in themes and structures, they can all be summarised into five consecutive phases, which are briefly outlined below.

1. **Problem Presentation:** the organizers introduce one or more company-specific problems to the students. Subsequently, the challenge rules and the deadline for group submissions are defined.

2. **Solution Development:** participating student teams form groups and work on developing solutions for the challenges presented by the companies. They may request a limited amount of additional information from company representatives or involved professors.
3. **Evaluation Phase:** once the submission deadline for solutions has passed, the finalists are determined based on criteria such as the effectiveness of the solution, the cost-effectiveness of its development, and the level of innovation demonstrated.
4. **Deeper Problem Understanding:** In this phase, the finalists often have the opportunity to visit the company's facilities related to the problem of interest and gather additional information to refine and enhance their solutions. It is possible that Human Resources (HR) conduct interviews during this phase to assess students' suitability for future employment within the company.
5. **Winner Announcement:** Finally, the winning student team is announced, and they may be offered opportunities such as internships at the company, visits to other facilities, and more.

A. *Description of the questionnaires*

In order to address the research questions, two questionnaires were developed and administered to both participating and non-participating students in the challenges. The first questionnaire aimed to capture student characteristics related to soft skills, attitudes, and personality traits. It consisted of 249 items derived from the International Personality Item Pool (IPIP) (Battistoni & Fronzetti Colladon, 2014; Johnson, 2014). Additionally, profiles characterising the Operations and Supply Chain Management sector were examined in the O*NET (2022) database to identify the most significant characteristics for the roles in these sectors.

On the other hand, the second questionnaire aimed to assess the academic career of the students and evaluate whether there were significant performance or satisfaction differences in the participation of the challenges, and if these differences influenced or determined variations among the different professional paths.

Both questionnaires utilized a 5-point Likert scale for response options, as outlined below:

1. Strongly Disagree

2. Partially Disagree
3. Neither Agree nor Disagree
4. Partially Agree
5. Strongly Agree

The dimensions traced through the first of the questionnaires can fall within the classification proposed by Fantozzi et al. (2022) and are characterised by soft aspects of the human sphere. There are a total of seventeen of them, which are briefly described in the Table I below.

TABLE I. DESCRIPTION OF THE ASSESSED ASPECTS OF THE HUMAN SPHERE

N.	Attitudinal trait	Description
1	Achievement/ Effort	Setting ambitious goals and dedicating substantial effort to mastering tasks.
2	Adaptability/ Flexibility	Demonstrating a receptive attitude towards change, both positive and negative, and displaying adaptability.
3	Analytical Thinking	Conducting thorough analyses of information and employing logical reasoning to address work-related issues.
4	Attention to Detail	Exercising diligence and meticulousness in task completion, ensuring comprehensive execution.
5	Concern for Others	Exhibiting empathy, understanding, and helpfulness towards the needs and emotions of colleagues in the workplace.
6	Cooperation	Cultivating a friendly and collaborative demeanor with coworkers, fostering a cooperative atmosphere.
7	Dependability	Assuming responsibility, dependability, and trustworthiness, consistently fulfilling job obligations.
8	Independence	Cultivating an autonomous approach to tasks, demonstrating initiative even with minimal supervision.
9	Initiative	Displaying proactive eagerness to embrace challenges and assume additional responsibilities.
10	Innovation	Utilizing creative and innovative thinking to conceive ideas and develop problem-solving solutions.
11	Integrity	Upholding honesty and ethical conduct in all job-related activities.
12	Leadership	Willingness to take the lead, assume charge, express opinions, and provide guidance.
13	Neuroticism	Displaying a tendency towards worry, self-doubt, and feelings of insecurity, coupled with increased sensitivity to criticism.
14	Persistence	Exhibit perseverance and persistence in the face of obstacles.
15	Self-Control	Exercise of emotional control and avoid aggressive behaviour during challenging situations.
16	Social Orientation	Prefers collaborative work over solitude and forging robust interpersonal connections.
17	Stress Tolerance	Gracefully accepting criticism and effectively managing high-stress situations.

In the second questionnaire that was submitted, information was drawn about aspects of the university challenge experience and how this, in the opinion of those involved, had influenced the respondents' growth path.

This made it possible to determine both the self-assessment of the experience and also the degree to which they were satisfied with it several years later. The dimensions that were tracked to assess satisfaction with the university course and the impact the challenges had are summarised in Table II below.

TABLE II. UNIVERSITY ASSESSMENT DIMENSIONS

N.	Occupational trait	Description
1	Path satisfaction	Assessment of how much the chosen academic path has positively contributed to the professional journey.
2	Added value of the challenge	Evaluation of the extent to which participating in university challenges can provide added value during interviews/recruiting processes.
3	Development Soft Skills	Assessment of how much the pursued study program has facilitated the development of essential soft skills for future professional endeavors.
4	Hard Skills development	Evaluation of how much the participation in the academic journey has enabled the acquisition of significant hard skills for future professional development.
5	Evaluation of regret for not participating in the challenge	Perception of the potential regret associated with not having participated in the proposed challenges.
6	Added value in the assessment phase	Evaluation of how important it was to have participated in a human resources interview challenge
7	Value added in the recruitment	Evaluation of the importance of participating in a challenge to be hired by a company.

IV. EVALUATION AND ANALYSIS OF RESULTS

The students involved in this study, as mentioned in Section II, attended the Engineering and Management courses at Tor Vergata University of Rome, Italy. The total respondent sample consisted of 86 individuals; however, the distribution between those who participated in the challenges and those who did not was not homogeneous. Specifically, a majority of the 64 respondents (74%) had participated in the challenges, while the remaining 22 (26%) had not. This resulted in a somewhat heterogeneous sample.

With the aforementioned number of respondents, the dimensions described in the previous Table I were measured in relation to the mappings provided in Table II, aiming to calculate an average value between the two groups.

A. Analysis of results

To answer the research questions, several questions were asked to respondents about their professional career and how much, in their opinion, participation in challenges had contributed to their career path and the development of different dimensions such as soft and hard skills. The hypotheses shown in

Table III were then performed and evaluated using a Pearson correlation analysis.

TABLE III. EXPECT HYPOTHESIS UNDER EVALUATION

Hypothesis
H1. Participating in challenges represents added value in recruitment
H2. Those who do not participate in challenges find it not particularly useful
H3. Participation in challenges enables the development of soft skills

In order to test the hypotheses, the two respondent groups were divided according to their participation or non-participation in the challenges and the dimensions shown in Table II were evaluated. The results of the correlations are shown in Table IV and Table V, respectively.

TABLE IV. PEARSON’S CORRELATION MATRIX FOR NON PARTECIPATING STUDENTS

	Path satisfaction	Value added Challenge	Soft skills development	Hard skills development
Value added	-0,318			
Soft skills development	0,219	0,405*		
Hard skills development	0,614**	-0,089	0,068	
Regret evaluation	-0,349	0,769**	0,271*	-0,015

* p < 0.05
** p < 0.01

TABLE IV. PEARSON’S CORRELATION MATRIX FOR PARTICIPATING STUDENTS

	Path satisfaction	Added value in the assessment phase	Value added in recruitment	Soft Skills Development
Added value in the assessment phase	0,565**			
Value added in recruitment	0,584**	0,567**		
Soft Skills Development	0,604**	0,578**	0,442**	
Hard Skills Development	0,417**	0,382**	0,374**	0,377**

** p < 0.01

The results show that for the group who did not participate in university challenges, they believe that they chose a university pathway that enabled them to develop important hard skills. However, it is particularly significant to highlight two other aspects that emerge in the correlation analysis, in

fact, for the group of non-participants in the university challenges, this experience is an element of strong importance for the development of soft skills and, furthermore, not having taken part in them represents an important regret factor linked to the added value that they believe these experiences can give. While the last significant element may be the correlation between regret and the development of soft skills, this is less than the other two.

Analysing, however, what is shown in Table IV, it is immediately evident that all the parameters are characterised by particularly significant correlation values. This type of response reinforces what could already be appreciated in the responses of the group of non-participants. In fact, if it were possible to imagine that participants associated their participation in the challenge with an added value in the HR assessment phase and subsequent employment in the company, it was not foreseeable that those who did not participate would do the same. Additionally, participation in the challenge was also positively related to the development of both hard and soft characteristics.

It also appears that for the group of challenge participants, this type of experience was an advantage for them to be employed in their respective companies, and this factor therefore also supports the perception of the nonrespondents, who similarly consider this experience to be a potential advantage in their CVs in order for them to be employed.

In the light of this type of result, hypothesis H2 is disproved, since despite their non-participation, the non-participating students believe that this opportunity actually represents a useful experience for all.

On the other hand, hypotheses H1 and H3 both turn out to be true, as they are corroborated not only by the group of those who took part in the challenges, but also by the analysis of the other group's answers, it can be deduced that participation in opportunities such as those analysed represents an added value for the students' professional opportunities and also an excellent tool for the development of their soft skills.

V. DISCUSSION AND CONCLUSIONS

The purpose of this study was to assess the impact of university challenges on student development, both as an added value on their path and as superior possibilities in recruitment. In order to answer the two research questions (RQ1-2), a double questionnaire was structured, one for psycho-aptitude assessment and one for gathering information on employment status and evaluation of the challenge experience.

The questionnaires were administered to two groups of students, participants, and non-participants in the challenge, all from the Engineering and Management course at Tor Vergata University of Rome, Italy.

Although only two relevant aspects from a psychopoint of view could be detected, relating to analytical thinking and the degree of innovativeness, the response of the groups regarding the importance of university challenge experiences was particularly significant in improving the quality of the university course, in the development of soft skills, and in greater possibilities of subsequent employment.

This type of research can certainly be useful in the definition and introduction of this type of opportunity within university courses in a more structured and continuous manner, to enhance the educational offer and also the degree of appreciation of the students with respect to the didactic offer proposed by the universities.

Despite a positive response with respect to the research questions, it is necessary to emphasise certain limitations in the presented work.

The first important factor is the unequal distribution of the sample examined, which can certainly influence the analysis of the answers.

Secondly, there is the numerosity of the sample which gathered only a limited number of total respondents and a larger sample would be needed to wrap up the answers provided. And finally, the research was limited to students from the faculty of engineering, and therefore in order to conduct a more robust experiment, it would be useful to extend these analyses to include other faculties.

The limitations outlined above are possibilities for further research to wrap up the results obtained, and further future possibilities could investigate the relationship between participation in these challenges and overall student performance.

As a final consideration, we can state, even if only preliminarily, that there is a significant impact on participation in university challenges and the overall quality that can be obtained from this experience, these types of results can also be used to encourage more and more young people to take part in these experiences and further studies could consider evaluating participant feedback to make these types of opportunities even better for the user experience.

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