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A Randomized Controlled Field Trial: A Gamified Training Course on Workplace Health and Safety Prevention for Middle School Students – "Let's Play 81!"

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INTRODUCTION

Injury prevention and the promotion of health in the workplace are priority objectives starting from school age. Early and effective training can help develop a safety culture in future workers. However, traditional methods often fail to engage students. Gamification, the integration of game elements into educational contexts, has emerged as a promising strategy to increase engagement, improve learning, and enhance working memory [1-5].

OBJECTIVES

To evaluate the effectiveness of the gamified training course "Let's Play 81!" ("Giochiamo a 81!") in promoting and improving knowledge of workplace health and safety, in reference to the contents of Italian Legislative Decree 81/2008 [6], among middle school students.

METHODS

A teaching kit was created, consisting of a box (30×20×10 cm) containing an operational manual and the materials necessary for three different types of games: a role-playing game ("81 si gira!"), a board game ("Riduci il premio") and a card game ("Mettici la mano") [7]. The games were designed to reinforce the key concepts of Legislative Decree 81/2008, with particular attention to the duties and responsibilities of key figures in prevention (company owner, safety executive, operator in charge, Prevention and Protection Service Manager, security officer, inspector, occupational health physician, workers' safety representative and a simple worker).

The study was conducted following CONSORT guidelines [8]. The study was set in third-year classes from three middle schools of Rome. A 15-question quiz was administered to both the intervention group (IG) and the control group (CG) at the beginning (T0) and at the end of the training day (T1). "Score81" was calculated (range 0–15), based on the number of correct answers of the quiz. The quiz, validated in a previous study with an adult population (Cronbach's $\alpha > 0.70$), required one correct answer among four alternatives, including the "don't know" option.

The intervention included a 1-hour lecture, with materials (slides and theoretical content) available in the manual included in the kit, followed by 2.5 hours of playful-formative activities with the three games. Students were divided into groups of 7–9 participants, with about 40 minutes dedicated to each game. The activities were led by graduates in Prevention Techniques, specializing in Occupational Medicine, competent doctors, and university professors.

The project received ethical approval from the Universitas Mercatorum Ethics Committee on March 13, 2025.

Qualitative variables were described using absolute frequencies and percentages, while quantitative ones were described using means and standard deviation (SD). The comparison between IG and CG was performed using chi-square test for qualitative variables and independent t-test or Mann-Whitney test in the case of non-normality. The pre-

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post Score81 change was analyzed with paired t-tests or the equivalent non-parametric test. Normality was checked using skewness and kurtosis coefficients and the Kolmogorov-Smirnov test. The level of statistical significance was set at p<0.05.

RESULTS

Ten classes (n = 226 students) were invited to participate (100% response rate). On the day of the intervention, 36 students were absent, resulting in 190 students participating (mean age 13.08 ± 0.36 years; 49.5% female), evenly distributed between the intervention (IG: n = 97) and the control groups (CG: n = 93). Three students from the CG were excluded from the analysis due to missing the T1 questionnaire. The groups were comparable for age, gender, and school of origin (p > 0.05).

Based on the sample size obtained of both groups, it was possible to define the hypothesis of being able to observe a mean difference in the Score81 between CG and IG at time T1 of at least 3.96, with 80% power and a 95% level of significance, assuming SD=2.

At the start of the study (T0), there were no significant differences in the Score81 between the groups (IG: 4.87 ± 2.41; CG: 4.69 ± 2.14; p=0.597). By the end (T1), the IG showed a significant increase in the mean score (9.30 ± 2.89), while the CG maintained values similar to T0 (4.60 ± 2.41) (Table1). The difference within groups was highly significant (p<0.001) only in the IG.

When analyzing the change (Δ=post-pre) within the groups, the IG showed an average increase of Δ=+4.43 points (SD=2.98; p<0.001), whereas the CG showed no significant change (Δ=+0.09 points; SD=1.68; p=0.617).

CONCLUSIONS

The gamified training course "Let's Play 81!" proved effective in significantly improving knowledge of workplace health and safety among middle school students. Students in the intervention group achieved a significant average increase in Score81 of more than 4 points, while no changes were observed in the control group.

The teaching kit "Let's Play 81!" was found to be easy to manage and use by trainers. The manual allows for the independent delivery of the theoretical lesson by teachers and trainers. The integration of theoretical content and gamified activities represents a replicable and sustainable strategy to promote a prevention culture among young people.

Despite encouraging results, the study has limitations. Group assignment at the class level may have introduced selection bias, and the sample was limited to Roman schools, affecting generalizability. The absence of long-term follow-up prevented assessment of knowledge retention over time.

The project is currently being extended to high school students to evaluate effectiveness in older age groups and broader educational contexts.

Table1. Analysis of Score81: comparison between the IG and CG (T0 and T1), and within the two groups pre-post

Group	Score 81 Mean ± SD		P
	T0	T1	(T0 vs T1)a
GC (n=90)	4.69 ± 2.14	4.60 ± 2.41	0.617
GI (n=97)	4.87 ± 2.41	9.30 ± 2.89	<0.001
P (GC vs GI) b	0.597	<0.001	-

Legend:
T0 = pre-intervention time;
T1 = post-intervention time;
a: p-value of the paired t-test;
b: p-value of the independent t-test.

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