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ENHANCING PSYCHOLOGICAL CAPITAL IN INFRASTRUCTURE TEAMS THROUGH GAMIFIED HR TRAINING MODULES

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ABSTRACT
This research assesses the effectiveness of gamified HR training modules on improving psychological capital (PsyCap) within infrastructure teams. Psychological capital—considered as hope, efficacy, resilience, and optimism— functions as an psychological asset for teh teams in acute stress and heavy workload environments. An experimental cross design was used with a control group and an experimental group that underwent gamified training. An increase in scores of PsyCap, Training Engagement Score TES, as well as a positive change in the PsyCap Retention Index PRI was noted in the gamified group. The results demonstrate that gamification of training not only accelerates psychological development but also promotes long-term engagement and retention. The impact of gamification underscores the need to strengthen psychological capital in infrastructure-based organizations.

KEYWORDS: psychological capital, gamification, HR training, infrastructure teams, employee engagement, resilience, training retention

INTRODUCTION

Project execution relies heavily on team performance and resilience in the fast-paced infrastructure sector. In most cases, employees' mental health and development is overlooked due to the rigid structure of traditional HR training [4]. Psychological capital (PsyCap), which incorporates self-efficacy, optimism, hope, and resilience, has proven to positively influence job satisfaction and engagement and has emerged as a vital construct. In the infrastructure team context, benefitting from the psychosocial constructs of PsyCap shall lead to enhanced collaboration, adaptability, and motivation for meeting demanding operational challenges [5]. In this regard, many organizations are seeking new strategies for training employees outside traditional methods.

One such promising approach is the use of gamificationin human resource training programs. Gamification, as the use of game mechanics in a non-game setting, is known to enhance learning engagement, motivation, and retention of knowledge [1]. When effective, gamified training is capable of fostering emotionally and psychologically developmental bonds in the trained team due to peak engagement and participation [2][3][7-8]. In professional training seminars or meetings held in relation to infrastructure projects where the team s mental, collaborative, and strategic stamina is almost always overworked due to challenges in time, budget and coordination, the utilization of gamified training enables the development of mental resilience and team cohesion [9].

This research examines the potential of strategically constructing and applying gamified HR training modules to foster psychological capital within teams in infrastructures. Such modules can elevate crucial psychological capitals in a systematic, efficient, and enjoyable manner when training content is coupled with gaming elements and applied psychological theories. This research seeks to advance the integration of behavioral science with HR practices to strengthen and improve the productivity, resilience, and adaptability of the workforces in infrastructures.

KEY CONTRIBUTIONS:

1. Created and integrated a game-based HR training framework aimed at boosting psychological capital within infrastructure teams, leading to significant advancements in important psychological areas.
2. Designed and sustained training impact along with psychological capital sustainability by introducing two distinct evaluation metrics: Training Engagement Score (TES) and PsyCap Retention Index (PRI).

This paper consists of five fundamental parts. The first part is the introduction part where the importance of psychological capital within the context of infrastructure projects is explained alongside gamification presented as a possible approach to intervene. Following this is the survey of the literature, which synthesizes the prior research done on psychological capital development focusing on the effectiveness of learning strategies that utilize gamification. In the Methodology section, the design of the training modules is described alongside the implementation of the gamified training, the participant group structure, and the described quantitative assessment methodology that used two custom equations. The results and discussion section includes the intervention outcomes and describes the results alongside data comparisons and interpretive insights. The last part is the conclusion and future work section which states the contributions of the study alongside providing recommendations on how to further refine and extend the practical and longitudinal research work.

LITERATURE SURVEY

Hope, efficacy, resilience, and optimism make up the Psychological capital (PsyCap) of an individual and has been noted as an important factor in improving their professional productivity , emotional health, and commitment towards the organization [10]. Studies indicate that individuals with elevated levels of PsyCap demonstrate greater motivation and better coping skills in addition to enhanced job satisfaction [6]. In the infrastructure sector, the development of PsyCap is of utmost importance because of the demanding nature of the work, the compressed timeframes, and the need for effective collaboration during challenging conditions [11].

Conventional human resource training practices, although useful for developing skills, do not adequately foster emotional engagement to build personal resources like PsyCap [12]. More recently, some scholars have pointed out the promise of experiential and interactive learning for skills training [13]. One of the most powerful of these approaches is gamified training [14]. Research indicates that gamification of training effectively moves the training from the 'boring' to the 'engaging' and emotionally rich continuum, stimulating participation, intrinsic motivation, and behavioral change [15].

Gamified modules use engaging features like point scoring, instant feedback, stories, and challenging activities. They foster psychological engagement and motivation. These features support the growth of different PsyCap components. For instance, goal-setting and progression systems enhance hope and efficacy, while failure-with-recovery strengthens resilience. Also, optimism and engagement are positively served by game design and reinforced by recovery constructs.

Studies from different fields like education, healthcare, and even corporate training affirm the effectiveness of gamification in promoting psychological development. …specific use cases within the infrastructure teams, however, are still relatively unexplored, which creates an opportunity for more focused applied efforts and research.

METHODOLOGY

Design and Development of Gamified HR Training Modules

The infrastructure teams received HR training through specialized gamified modules which underwent creation, implementation, and evaluation using design-based research (DBR) methodology. The modules incorporated the fundamental components of psychological capital - "hope, efficacy, resilience, and optimism. The instructional design integrated immersive learning experiences using core game mechanics which included point-based rewards, narrative missions, real-time feedback, and challenge tasks. The content included real life infrastructure problems like risk management, crisis management, resource management, and teamwork under time constraints."

Participants and Implementation

A sample of 120 professionals from infrastructure organizations was selected and split evenly into a control group receiving traditional HR training and an experimental group receiving the training gamified. During the four-week duration of each training module, pre and post-assessment surveys measuring psychological capital were conducted in both groups.

Measurement of Psychological Capital

Psychological capital was measured utilizing a standardized PsyCap questionnaire, which employed a Likert-scale format. The composite PsyCap score for each participant was computed using the equation below:

$$\text{PsyCap Score(PCS)} = \frac{\text{H} + \text{E} + \text{R} + \text{O}}{4} \qquad \text{Eq (1)}$$

In Eq (1), we have, Hope score (H) represents the ability of a person to carve out meaningful goals and pursue them through different methods; E is the Efficacy score which indicates confidence in one's ability to deal with difficult goals and execute them; H gives us the Resilience score which captures the ability of an individual to bounce back and stay calm in difficult situations; and O is the Optimism score which indicates the tendency to expect good things to happen in given situations in the present and in the future. These four psychological dimensions were evaluated with a given tool and integrated to calculate each participant's Psychological Capital Score.

To evaluate how effective the gamified intervention was, the percentage change in psychological capital was calculated using Eq (2):

$$\text{Improvement}(\%) = \left(\frac{\text{PCS}_{\text{post}} - \text{PCS}_{\text{pre}}}{\text{PCS}_{\text{pre}}}\right) \times 100 \qquad \text{Eq}(2)$$

Data Analysis

Descriptive statistics along with paired t-tests were performed to assess within-group and between-group differences on the pre and post training scores. More specifically, the analysis aimed to confirm notable changes in psychological capital in the gamified training group relative to the control group in order to confirm the effectiveness of the framework.

RESULT AND DISCUSSION

The outcomes from the application of gamified HR training modules show a considerable increase in the psychological capital of the infrastructure team. Participants in the experimental group who received gamified training not only surpassed the control group in HR training's conventional training PsyCap metrics but also demonstrated considerable improvement in PsyCap scores. Motivation and psychological capital in the workforce were better fostered through the gamified experience featuring real-time feedback, reward systems, and mission-driven challenges.

To assess the intensity of the training participation, the formula below was used to compute a Training Engagement Score (TES) for each participant:

$$\text{TES} = \frac{\text{A} + \text{F} + \text{S}}{3} \qquad \text{Eq (3)}$$

In this Eq (3), A refers to the Achievement Completion Rate, F indicates the Feedback Engagement Rate, and P denotes the In-Game Tasks Performance. Members of the gamified cohort achieved markedly higher values of TES, signifying higher levels of engagement and interaction with the training materials.

A PsyCap Retention Index (PRI) was introduced to measure the retention of PsyCap enhancements which is shown in Eq (4):

$$\text{PRI} = \left(\frac{\text{PCS}_{\text{post2}} - \text{PCS}_{\text{post}}}{\text{PCS}_{\text{post}}}\right) \times 100 \qquad \text{Eq}(4)$$

The index pointed out that psychological benefits obtained via gamification were mostly held on to even two weeks after the training had been completed. As indicated in Table 1, the gamified group's PRI was -0.5%. That indicates a very slight drop, and in comparison to the PRI of the control group, which had a greater drop, that is minimal.

Table 1: Comparative Analysis of Psychological Capital and Engagement Metrics Between Control and Gamified Training Groups

Metric	Control Group (Mean)	Gamified Group (Mean)
Pre-Training PsyCap Score	61.3	62.1
Post-Training PsyCap Score	64.0	73.5
TES (%)	48.7	87.2
PRI (%)	-2.1	-0.5

The results presented in Table 1 show that the gamified training not only enhanced the immediate psychological capital but also supported the enduring engagement and retention of psychological benefits. This confirms the efficacy of gamification as an intentional approach to improving psychological and resilience preparedness in an infrastructure team.

CONCLUSION AND FUTURE WORK

This research shows that psychological capital in infrastructure teams can be improved considerably with gamified HR training modules. The application of game components—training goals, prompt feedback, and rewards—within the training frameworks led to significant improvements in psychological constructs of hope, efficacy, resilience, and optimism. The effects demonstrated not only the immediate impact of psychological capital, but also a longitudinal effect, as the participants maintained high engagement in training and showed minimal decline in the PsyCap Retention Index. The engagement and psychological growth achieved during training was markedly higher with the use of gamified techniques than with traditional training. The research demonstrates the use of gamification as a purposeful HR strategy to strengthen team adaptability, motivation, and mental sharpness in intricate infrastructure settings.

The current study concentrated on immediate impacts and those occurring two weeks post-training, but it would be beneficial to investigate how long psychological benefits last over the course of several months. Moreover, looking at onsite engineers, project managers, and office personnel expands the study for more nuanced training customization insights. The creation of adaptive gamified modules that use AI to tailor training to the distinct performance level of each trainee would improve motivational and retention levels. Assessing the relationship

between improved PsyCap and observable project outcomes like meeting deadlines or safety requirements would deepen the project's practical usefulness.

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