

# A Study on the Psychological Mechanisms and Effects of Gamified Interventions on Energy-Saving Behaviours Among Office Building Employees

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## Abstract

In the office building, the energy-saving behavior of our employees is very important for sustainable development, but it is not enough to let everyone know that it is necessary to save energy. We must really take action. This study uses Octalysis framework, SDT and HEXAD player types to see how energy-saving awareness affects people's willingness to save energy by satisfying their psychological needs. We also studied the differences between different types of players in this respect. We made two rounds of online surveys: in the first round, we asked everyone about their energy-saving awareness, HEXAD types and basic willingness to save energy; In the second round, we put it in a gamification scene, and measured everyone's psychological satisfaction, internal motivation, interest in intervention activities, and willingness to save energy after participating in activities. After considering everyone's initial wishes and some basic information, we used special statistical software and PROCESS macro to analyze the data through mediation and adjustment model. The results show that energy-saving awareness can greatly enhance the willingness to save energy by meeting everyone's psychological needs. Different types of players have different reactions to the attraction and participation of the game mechanism. This study reveals the key 'consciousness-demand-will' chain and emphasizes the important role of player types in the gamification intervention effect, which provides practical basis for formulating targeted energy-saving strategies in office buildings.

**Keywords:** Staff participation in office buildings; gamification intervention; awareness of energy saving; satisfaction of psychological needs; willingness to save energy; and types of HEXAD players

## 1. Introduction

Modern buildings account for a large part of global energy consumption, especially office buildings. Although building automation systems can save energy, the electricity consumption of air conditioning, lighting and computers still depends largely on our usage habits. Employees often forget to turn off the equipment when they rest or leave their seats, which causes a lot of waste. The energy consumption caused by this behavior is difficult for an automation system to completely eliminate<sup>[1]</sup>. It is found that our bad energy use habits are one of the main reasons that affect energy consumption, and it is difficult for employees to keep energy-saving behavior by traditional energy-saving methods<sup>[2]</sup>. In order to effectively improve energy efficiency, gamification, an innovative energy-saving method, takes the elements in the game to places that are not games to encourage us to actively participate in energy conservation. It is now regarded as a very effective strategy, which can help us change our behavior and form a good habit of saving energy<sup>[3]</sup>. By adding elements such as points (points), badges (badges), leaderboards (leaderboards) and challenges, gamification wants to make those boring energy-saving tasks fun and interesting, so that we will be more willing to participate and more motivated to do it<sup>[4]</sup>. In the field of office energy saving, the existing research has confirmed that the gamification method is very effective.

However, the current research mainly focuses on whether the gamification method has short-term effect, how it works on the psychology behind it, and why different people have different effects. These aspects are not studied enough. In particular, we still don't know how the consciousness of saving energy has become a practical idea of saving energy psychologically. In addition, the gamification design of "everyone is the same" often ignores each user's own favorite points, which may lead some users not to participate, or even a little disgusted. Therefore, our research is to solve these problems and answer two core questions:

Can gamification make employees more willing to do energy-saving behavior by satisfying some psychological needs (such as autonomy, ability and belonging)?

In the gamification mechanism, different employees like different types of players, which will affect the effect of the method, thus changing their willingness to do energy-saving behavior?

In order to answer these questions, our research uses Octalysis's eight power cores, Self-Determination Theory (SDT) and HEXAD player types as the theoretical framework. Octalysis tells us how to make gamification design, SDT helps us understand the source of people's inner motivation, and HEXAD model is like a classification tool to help us analyze users' personalized preferences for different game elements. Through practical research, we want to find out how the gamification method affects everyone's energy saving in the office building and also want to see if different people have different reactions. In this way, we can design a better and more suitable building energy-saving method for everyone.

The research process is shown in Figure 1.

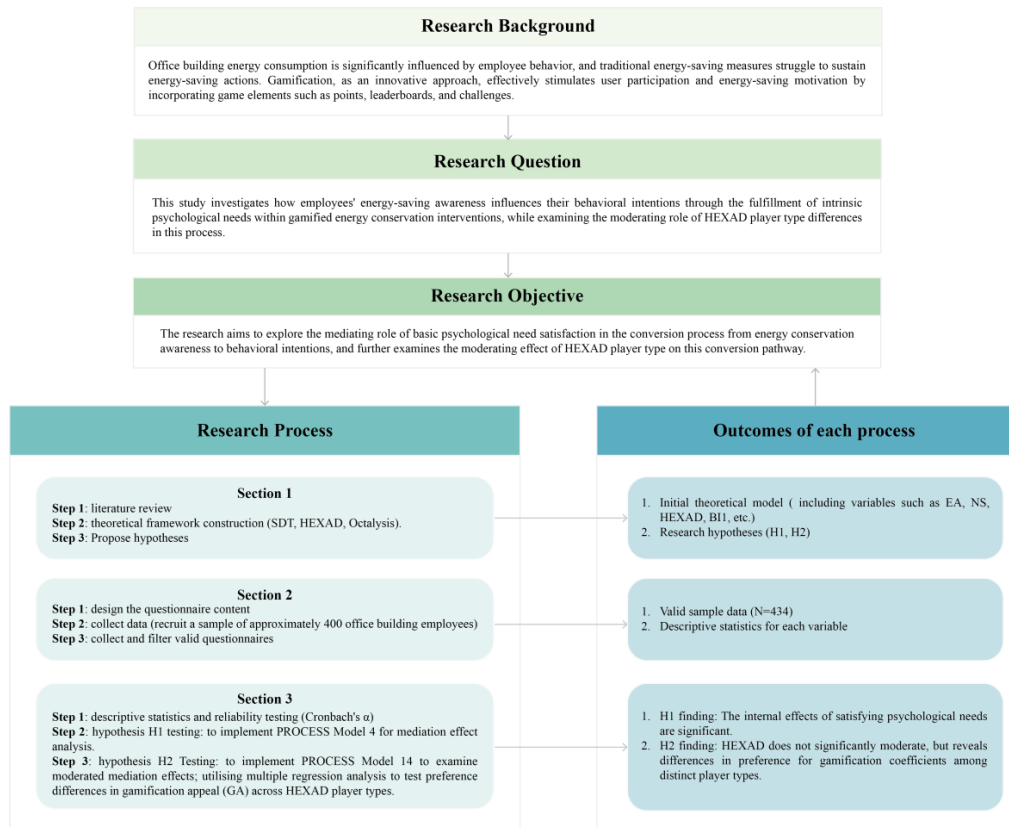


Figure 1. Research flowchart.

## 2. Literature Review

### 2.1 Gamification as an Office Energy -Saving Strategy

Gamification involves the application or adoption of game design elements in non-game settings [5]. In recent years, it has been widely regarded as an innovative approach to promoting energy-saving behaviors. Unlike merely adding fun, it stimulates psychological motivation by creating interactivity and a sense of challenge, thereby encouraging users to form energy-saving habits [6]. Existing research confirms the efficacy of gamification approaches. For instance, Iria's team [7] piloted a mobile gamification platform within an office building environment. By integrating real-time energy consumption data with game tasks through mechanisms such as points, leaderboards, and achievement badges, it incentivized users to voluntarily implement energy-saving actions. This achieved approximately 20% electricity savings. Effective gamification solutions typically involve key elements such as feedback mechanisms, reward systems, and

social interaction, while fully considering users' individual characteristics and preferences and aligning with their psychological motivations.

The Octalysis framework proposed by Yu-kai Chou<sup>[8]</sup> provides methodological support for this approach. This framework emphasizes human-centered design, balancing intrinsic motivations (such as meaning, social influence, creativity) with extrinsic motivations (such as points rewards, competitive rankings) to enhance user behavioral engagement<sup>[9]</sup>. However, what each player likes are so different. It is difficult to make everyone feel fun and motivated by using only one method to design games. Therefore, if we can divide users into different types and then design according to their respective preferences, we can help everyone develop a good habit of saving electricity more accurately, and this good habit can last longer.

## 2.2 Psychological Mechanisms: Self-Determination Theory (SDT)

In order to better understand why gamification can change our behavior, scientists began to study the theory in motivational psychology. One of the most famous theories is called Self-Determination Theory (SDT). This theory tells us that there are two kinds of motivation: one is extrinsic motivation, and the other is to reward something. SDT also said that if people want to be motivated from the heart, they need to meet three basic psychological needs: Competence (feeling capable), Autonomy (making their own decisions) and Relatedness (being connected with others). Only when these three needs are met can a person's internal motivation and his own initiative to do things be stimulated to the greatest extent<sup>[10]</sup>. The research shows that the operation mechanism of SDT is really effective in gamification energy-saving activities. For example, a gamification experiment on office energy conservation found that when many elements, such as personal challenges, team competitions and reward feedback, were added to the game design, which well met the needs of employees to be their own masters, gain a sense of accomplishment and interact with colleagues, their internal motivation to participate in energy conservation became particularly strong, and their energy-saving behavior persisted for a longer time<sup>[7]</sup>. On the other hand, if gamification design pays too much attention to external rewards but forgets to support our autonomy, it will not only be difficult to be effective for a long time, but also rebound because of the decline of internal motivation after the reward is cancelled<sup>[11]</sup>. Therefore, applying the viewpoint of self-determination theory to gamification design can help us understand why gamification can change everyone's behavior. Understanding this truth, we can optimize those intervention programs, which can not only achieve the goal of energy saving, but also meet the psychological needs of users.

## 2.3 User Individual Differences and Personalized Gamification: The HEXAD Player Types

Despite gamification generally exerts a positive influence on group behavior, merely introducing game elements without considering the needs of different user groups will hardly genuinely engage and motivate users. This is also one reason for the failure of gamification projects<sup>[12]</sup>. Therefore, user individuality is also a critical factor for successful gamification interventions<sup>[3]</sup>. Researchers have proposed segmentation and customization based on player motivation types, namely the HEXAD player typology model. The HEXAD model categorizes users into six types according to motivational preferences: Philanthropist, Socializer, Free Spirit, Achiever, Player, and Disruptor<sup>[13]</sup>. Each type values distinct elements within games. For instance, Philanthropists favor public good and collaboration, Achievers pursue challenges and progression, while Players respond most strongly to point-based rewards<sup>[11]</sup>. Furthermore, research by Eggert's team<sup>[3]</sup> indicates that employing differentiated combinations of game elements tailored to distinct HEXAD types can more effectively stimulate engagement. For instance, cumulative challenges and leaderboards can motivate competitive Achievers, while offering exploratory tasks and creative freedom proves more effective for Free Spirits. Empirical research further demonstrates that personalized gamification holds advantages over universal, one-size-fits-all approaches. Mechanisms tailored to individual differences significantly enhance intrinsic motivation and task completion rates, while also fostering sustained long-term engagement<sup>[14]</sup>. Thus, customization and adaptive adjustments considering user variability effectively elevate participation levels and prolong the intervention's lasting impact.

Although existing research has demonstrated the short-term efficacy of gamified interventions in building energy conservation, certain research gaps remain. There is a lack of empirical validation regarding how the satisfaction of basic psychological needs influences the transformation from energy-saving awareness to behavioral intent, and the moderating mechanisms of player types within this process. Moreover, variations across building contexts and user groups are frequently overlooked, rendering standardized solutions inadequate for explaining individual motivational differences. Based on this, the present study focuses on office building employees, examining daily electricity consumption, lighting, and air conditioning behaviors, and proposes two hypotheses:

H1: Satisfaction with basic psychological needs strengthens the effect of energy-saving awareness on behavioral intention.

H2: Player types not only influence intervention preferences but also mediate the path of need satisfaction, leading to differing mechanisms of motivational enhancement.

### 3. Method

#### 3.1 Research Design and Measurement Items

This study was designed as a two-round questionnaire survey, incorporating scenario simulation methods to test the proposed hypotheses. The research population consisted of employees working in office buildings. Participants were recruited through online questionnaires distributed on social media platforms, targeting office workers across various industries in China. To ensure representativeness of the sample, recruitment did not restrict specific occupations or company backgrounds, though participants were required to be currently employed in an office environment.

#### 3.2 Measures in Round 1

The first questionnaire primarily collected baseline data. Energy-saving awareness (EA) was assessed with several items measuring environmental consciousness and responsibility for energy use (e.g., “I am aware that air conditioning, lighting, and computers constitute the primary electricity loads in offices”; “I consider conserving company energy to be my duty”). Items were rated on a 5-point Likert scale<sup>[15]</sup>. In addition, participants completed the 24-item HEXAD gamer typology questionnaire<sup>[13]</sup> and reported their baseline energy-saving behavioral intention (BI0) following established measurement approaches<sup>[16]</sup>.

#### 3.3 Gamified Scenario

Before the second questionnaire commenced, participants were presented with a gamified energy-saving scenario titled ‘Energy-Saver’. This scenario was designed based on the Octalysis framework, integrating multiple gamification elements. A narrative context provided epic meaning; points and leaderboards reflected achievement; employees could autonomously choose energy-saving tasks to foster empowerment; an energy account highlighted ownership; and team competitions and sharing functions enhanced social influence. Time-limited challenges represented scarcity and urgency, random events fostered unpredictability and curiosity, and the avoidance of energy waste losses triggered avoidance motivation. Participants were reminded to carefully read the scenario and imagine themselves actively participating in the ‘Energy-Saver’ program.

The specific scenario prompt read as follows: “Imagine you are participating in this program. Your company has recently launched a new energy-saving challenge. Completing daily energy-saving tasks, such as switching off lights and monitors, earns instant points. These can be redeemed for gifts like green plants or eco-friendly cups, while also propelling you up individual and team leaderboards. The “Energy-Saver” platform displays real-time ~~high~~ electricity consumption and cumulative emissions reduction data. Watching the numerical indicators and the green progress bar advance is particularly rewarding. Additionally, the platform releases weekly team tasks alongside four-weekly milestones and six-monthly targets. Achieving these unlocks virtual badges and point boosts. Colleagues enthusiastically exchange energy-saving tips and point-earning strategies, transforming conservation into an engaging, competitive collective endeavor.”

For clarity of phrasing, the scenario also included guiding text such as: “Imagine you are participating in the company’s Energy-Saving Assistant online challenge. During the project, you might…”

#### 3.4 Measures in Round 2

The second questionnaire primarily measured the Work-Based Needs Scale (W-BNS) in its abbreviated form, comprising three items per need for a total of nine questions<sup>[17]</sup>. For intrinsic motivation towards participating in the energy-saving challenge, the ‘Interest/Enjoyment’ subscale from the Intrinsic Motivation Inventory (IMI)<sup>[18]</sup> was ~~used~~ comprising seven items. Following presentation of the intervention scenario, participants again completed the same set of seven items on energy-saving behavioral intention (BI1) that had been used at baseline (BI0), allowing for the evaluation of changes in intention following scenario activation. As well as the gamification intervention appeal (GA) comprising five items, consisting of five statements measuring participants’ interest or attraction to different game

mechanics: points, leaderboards, badges, team tasks, and story missions. Sample items included: ‘The points redemption mechanism appeals to me,’ ‘The leaderboard mechanism appeals to me,’ and ‘The badge honor mechanism appeals to me.’ These items collectively reflect the intervention’s intuitive appeal and acceptability to employees.

The study was conducted through an anonymous online questionnaire, with quality control questions incorporated to ensure response validity. Following exclusion of invalid data, 434 valid questionnaires were retrieved. All participants who completed the questionnaire received a small voucher as remuneration.

### 3.5 Data Analysis

Data were analyzed using SPSS and the PROCESS v4.2 macro developed by Andrew F. Hayes. Descriptive statistics (mean, standard deviation) were first conducted for each variable, and internal consistency reliability was examined using Cronbach’s  $\alpha$  coefficients.

To test Hypothesis H1, mediation analysis was used, to examine the mediating role of psychological need satisfaction (NS). This study employed Model 4 within the PROCESS macro [19]. The model was specified as follows: the independent variable (X) was energy-saving awareness (EA), the mediating variable (M) was psychological need satisfaction (NS), and the dependent variable (Y) was post-intervention energy-saving behavioral intention (BII). Pre-intervention behavioral intention (BIO) and key demographic variables (age, gender, etc.) were incorporated as covariates to control baseline levels and potential confounders. A bias-corrected percentile bootstrap method was employed with 5,000 repeated samples, utilizing HC3 robust standard errors to address potential heteroscedasticity. Effects were deemed significant if the 95% confidence intervals (CI) for total, direct, and indirect effects excluded zero.

To test Hypothesis H2, which proposed the moderating role of HEXAD player types, a two-stage approach was adopted. First, using the six HEXAD dimension scores as moderator variables (W), Model 14 in the PROCESS macro tested the interaction term between psychological need satisfaction and HEXAD player type ( $M \times W$ ) on energy-saving behavioral intention (Y). A significant moderating effect was indicated if the 95% CI for the interaction coefficient did not span zero. Second, to provide a more intuitive demonstration of “mechanism preference,” participants were grouped according to their highest-scoring HEXAD dimension into distinct dominant player type cohorts. One-way ANOVA was then used to compare whether significant differences existed in the means of key variables, including gamified intervention appeal (GA) and psychological need satisfaction (NS) across these groups.

## 4. Results

### 4.1 Descriptive Statistics

As shown in Table 1, the mean values, standard deviations, and reliability coefficients (Cronbach’s  $\alpha$ ) for each variable yielded satisfactory results. Although the reliability of a few variables was marginally below 0.70, this remains within an acceptable range ( $\alpha \geq 0.60$ ) given the limited number of items and the instrument’s focus on overall assessment. Nevertheless, the reliability of most variables fell within the good range ( $\alpha \geq 0.70$ ), indicating strong internal consistency.

Table 1. Descriptive statistics and reliability tests for each variable

Construct	Mean	SD	CA
Energy Awareness (EA)	25.06	3.37	0.77
HEXAD Player Types-Philanthropist (HEXAD-Ph)	24.06	2.78	0.74
HEXAD Player Types-Socializer (HEXAD-S)	23.62	3.14	0.79
HEXAD Player Types-Free Spirit (HEXAD-FS)	24.11	5.89	0.63
HEXAD Player Types-Achiever (HEXAD-A)	24.46	2.52	0.70
HEXAD Player Types-Player (HEXAD-P)	24.27	2.46	0.66
HEXAD Player Types-Disruptor (HEXAD-D)	22.27	4.52	0.89
Baseline of Energy Conservation Behavior Intention (BL0)	30.82	2.97	0.71

Work-related Basic Need Satisfaction (W-BNS)	54.05	4.55	0.75
Intrinsic Motivation Inventory (IMI)	42.06	4.20	0.77
current Energy Conservation Behavior Intention (BL1)	31.06	2.47	0.66

SD=standard deviation; CA=Cronbach’s alpha;

**4.2 Hypothesis 1: mediating effect analysis**

In testing Hypothesis H1, this study uses PROCESS macro-Model 4 for mediating effect analysis, controlling pre-intervention behavioral intention (BI0) and key demographic variables within the model. meanwhile, the analysis employs a bias-corrected percentile bootstrap method with 5000 repeated samples, utilizing HC3 robust standard errors to enhance result reliability.

The analysis results Table 2 demonstrate that Path a exhibits a significantly positive coefficient, with Energy-Saving Awareness (EA) significantly and positively predicting psychological Need Satisfaction (NS) ( $\beta = 0.3692, t = 5.999, p < 0.001$ ). Furthermore, controlling for EA, path b demonstrated that NS significantly predicted post-intervention energy-saving behavioral intention (BI1) ( $\beta=0.1513, t=2.245, p=0.025$ ). In contrast, the total effect of EA on BI1 (Path c) failed to reach statistical significance ( $\beta = -0.0421, t = -1.398, p = 0.163, 95\% CI [-0.1012, 0.0171]$ ). Moreover, after introducing the mediating variable, the direct effect of EA on BI1 (Path c') became significantly negative ( $\beta = -0.0979, t = -2.283, p = 0.023, 95\% CI [-0.1822, -0.0136]$ ).

Further examination of indirect effects in Table 3 reveals that the indirect effect of Energy-Saving Awareness (EA) on Behavioral Intention (BI1) via Need Satisfaction (NS) is 0.0559, with a Bootstrap 95% confidence interval [0.0142, 0.0944] that does not include zero. This indicates that the mediating path is statistically significant.

Overall, the most core finding is that gamification interventions do not directly influence employees' energy-saving intentions but instead play a crucial mediating role through psychological need satisfaction. This discovery supports the notion that psychological need satisfaction serves as a vital internal mechanism linking energy-saving awareness to behavioral intentions. It also constitutes a significant revision to the traditional “information-behavior” model. As it reveals that energy conservation awareness has a significant negative direct effect on energy conservation willingness, while its indirect effect through psychological needs fulfillment is significantly positive. Ultimately, these two effects cancel each other out, resulting in a non-significant overall effect. This indicates that merely increasing employees' energy conservation awareness (e.g., through poster campaigns, email reminders, or data dashboards) is insufficient and may even trigger counterproductive attitudes or responsibility fatigue, leading to negative direct effects. Only when this external “awareness” is transformed through gamification into employees' internalized autonomy, competence, and relatedness—making them perceive their actions as self-chosen, achievement-oriented, and supported by the group—can their energy-saving willingness be genuinely enhanced. This finding strongly supports the central role of SDT in gamification design, providing empirical evidence for the “awareness-needs-willingness” psychological pathway.

Table 2. Path Coefficient Test

Path	Path Coefficients ( $\beta$ )	Standard Error (HC3)	t Value	p Value	95% CI
a	0.3692	0.0615	5.9989	<.001	[0.2482, 0.4901]
b	0.1513	0.0674	2.2449	0.0253	[0.0188, 0.2838]
c	-0.0421	0.0301	-1.3979	0.1629	[-0.1012, 0.0171]
c'	-0.0979	0.0429	-2.2831	0.0229	[-0.1822, -0.0136]

Path a: EA -> NS;

Path b: NS -> BL1;

Path c: EA -> BL1 (total effect)

Path c': EA -> BL1 (direct effect)

Table 3. Indirect Effect Test

Path	Path Coefficients (β)	Boot SE	BootLLCI	BootULCI
EA- >NS- >BI1	0.0559	0.0207	0.0142	0.0944

LLCI / ULCI=Lower/Upper-Level Confidence Interval

### 4.3 Hypothesis 2: Analysis of Moderating Effects and Between-Group Differences

To examine the mechanism mediation and preference differences in H2, the study first used each of the HEXAD dimensions as moderator variables (W). PROCESS Model 14 was employed to test the interaction effect between psychological need satisfaction (NS) and W on post-test behavioral intention (BI1), while also examining the mediation indices and their 95% confidence intervals. Second, to reveal preference, the study conducted multiple regression analyses on gamification attraction (GA-1 to GA-5) to examine the predictive roles of each HEXAD dimension.

The results of the analysis in Table 4 indicate that in the process of moderating the influence of psychological need satisfaction on energy-saving behavioral intention through intervention, the highest-order interactions for the six distinct player types were not significant, with p-values all exceeding 0.05. Furthermore, the confidence intervals for the moderated mediation indices all included zero, suggesting that the HEXAD dimensions did not significantly alter the mediation strength of the “EA - NS - BI1” pathway. In other words, none of the HEXAD player type dimensions significantly moderate the relationship between psychological need satisfaction and energy-saving behavioral intention.

Table 4. Moderation Effect Tests for HEXAD Dimensions

Moderator (W)	M × W Interaction p-value	Index of Moderated Mediation	95% CI for Index
HEXAD_Philanthropist	0.9086	-0.0017	[-0.0290, 0.0224]
HEXAD_Socialiser	0.1441	0.0143	[-0.0037, 0.0343]
HEXAD_Free Spirit	0.2706	-0.0132	[-0.0389, 0.0092]
HEXAD_Achiever	0.5497	-0.0076	[-0.0258, 0.0158]
HEXAD_Player	0.4282	-0.0136	[-0.0496, 0.0040]
HEXAD_Disruptor	0.2896	0.0058	[-0.0045, 0.0164]

With regard to preference differences, the regression analysis results revealed that employees' HEXAD player types exert a significant differentiated predictive effect on the attractiveness of different gamification interventions. As shown in Table 5 (significant predictive variables are highlighted in bold)

Table 5. Regression Analysis of HEXAD Player Types on Gamification Mechanism Appeal

Dependent Variable	Predictor	Unstandardized Coefficient (B)	Standardized Coefficient (Beta)	t Value	p Value
GA-1	HEXAD_Philanthropist	0.089	0.102	1.766	0.078
	HEXAD_Socialiser	-0.002	-0.003	-0.051	0.959
	HEXAD_Free Spirit	0.024	0.024	0.401	0.688
	HEXAD_Achiever	-0.019	-0.02	-0.43	0.667
	HEXAD_Player	0.317	0.321	6.531	<.001
	HEXAD_Disruptor	-0.018	-0.033	-0.57	0.569
GA-2	HEXAD_Philanthropist	0.003	0.003	0.045	0.964
	HEXAD_Socialiser	0.157	0.152	2.474	0.014

	HEXAD_Free Spirit	0.135	0.101	1.722	0.086
	HEXAD_Achiever	0.009	0.007	0.159	0.874
	HEXAD_Player	0.146	0.111	2.317	0.021
	HEXAD_Disruptor	0.131	0.183	3.272	0.001
	HEXAD_Philanthropist	-0.002	-0.002	-0.028	0.977
	HEXAD_Socialiser	0.127	0.125	2.017	0.044
GA-3	HEXAD_Free Spirit	0.061	0.046	0.783	0.434
	HEXAD_Achiever	-0.054	-0.043	-0.959	0.338
	HEXAD_Player	0.214	0.165	3.427	<.001
	HEXAD_Disruptor	0.144	0.205	3.638	<.001
	HEXAD_Philanthropist	0.175	0.147	2.715	0.007
	HEXAD_Socialiser	0.243	0.229	3.877	<.001
GA-4	HEXAD_Free Spirit	-0.002	-0.001	-0.023	0.982
	HEXAD_Achiever	-0.018	-0.014	-0.319	0.75
	HEXAD_Player	0.012	0.009	0.188	0.851
	HEXAD_Disruptor	0.157	0.212	3.948	<.001
	HEXAD_Philanthropist	0.066	0.057	1.021	0.308
	HEXAD_Socialiser	0.08	0.078	1.266	0.206
GA-5	HEXAD_Free Spirit	0.09	0.068	1.155	0.249
	HEXAD_Achiever	0.007	0.006	0.128	0.898
	HEXAD_Player	0.029	0.022	0.464	0.643
	HEXAD_Disruptor	0.208	0.292	5.239	<.001

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GA-1 =Points Redemption System; GA-2=Leaderboard System; GA-3=Badge Honor System;  
GA-4=Team Mission System; GA-5=Story/Mission Setting

Dependent Variable	Predictor	Unstandardized Coefficient (B)	Standardized Coefficient (Beta)	t Value	p Value
GA-1	HEXAD_Philanthropist	0.089	0.102	1.766	0.078
	HEXAD_Socialiser	-0.002	-0.003	-0.051	0.959
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	HEXAD_Achiever	-0.019	-0.02	-0.43	0.667
	<b>HEXAD_Player</b>	<b>0.317</b>	<b>0.321</b>	<b>6.531</b>	<b>&lt;.001</b>
	HEXAD_Disruptor	-0.018	-0.033	-0.57	0.569
GA-2	HEXAD_Philanthropist	0.003	0.003	0.045	0.964
	HEXAD_Socialiser	0.157	0.152	2.474	0.014
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	HEXAD_Socialiser	0.127	0.125	2.017	0.044
	HEXAD_Free Spirit	0.061	0.046	0.783	0.434
	HEXAD_Achiever	-0.054	-0.043	-0.959	0.338
	<b>HEXAD_Player</b>	<b>0.214</b>	<b>0.165</b>	<b>3.427</b>	<b>&lt;.001</b>
	<b>HEXAD_Disruptor</b>	<b>0.144</b>	<b>0.205</b>	<b>3.638</b>	<b>&lt;.001</b>
GA-4	<b>HEXAD_Philanthropist</b>	<b>0.175</b>	<b>0.147</b>	<b>2.715</b>	<b>0.007</b>
	<b>HEXAD_Socialiser</b>	<b>0.243</b>	<b>0.229</b>	<b>3.877</b>	<b>&lt;.001</b>
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GA-1 =Points Redemption System; GA-2=Leaderboard System; GA-3=Badge Honor System;

GA-4=Team Mission System; GA-5=Story/Mission Setting

The HEXAD\_Player exhibited significant positive predictive effects on GA-1 (Point Redemption), GA-2 (Leaderboards), and GA-3 (Badge Honors). The HEXAD\_Socialiser demonstrated significant positive predictive effects on GA-2, GA-3, and GA-4 (Team Missions). was a significant positive predictor for GA-2, GA-3, GA-4, and GA-5 (Story/Mission Context), whereas the HEXAD\_Philanthropist showed significant effects only for GA-4. In contrast, the HEXAD\_Achiever and HEXAD\_Free Spirit did not display significant predictive effects in any of the five models. These findings reveal systematic differences in player preference for gamification elements across player types, with the preferences of HEXAD\_Player, HEXAD\_Socialiser and HEXAD\_Disruptor particularly pronounced. This strongly supports the notion that distinct player types exhibit significant variations in their mechanism preferences.

Overall, Hypothesis 2 (H2) received only partial support. The results of the above data analysis supported the component of H2 suggesting that HEXAD player types differ significantly in their gamification appeal, but failed to support the hypothesis that these types of influence energy-saving behavior intentions through the process of need satisfaction, thereby leading to differences in motivation enhancement pathways and preference mechanisms.

## 5. Conclusion

This study systematically examined how gamification interventions influence employees' intention to adopt energy-saving behaviors within office building contexts through specific intrinsic psychological mechanisms, while also testing the role of individual differences. The findings confirm that psychological need satisfaction mediates the transformation of “energy-saving awareness” into “energy-saving intention”, providing strong support for the applicability of Self-Determination Theory (SDT) in environmental behavior research. Moreover, the results reveal that the effectiveness of gamification interventions arises not merely from enjoyment or extrinsic rewards, but from the deeper impact of specific design elements. In particular, choice fosters autonomy, challenges and real-time feedback enhance competence, and social interaction strengthens relatedness. When employees perceive their energy-saving actions as self-chosen, feel competent and tangibly see the effects of their efforts, and simultaneously gain positive social connections through the process, their intrinsic motivation is effectively stimulated. This intrinsic drive makes them more likely to translate general awareness of energy saving into concrete, actionable intentions. These findings also help to explain why traditional, awareness-only energy saving campaigns often yield limited results, as they fail to engage and activate deeper psychological motivations. Thus, successful gamification interventions must shift focus from mere external stimuli to satisfying employees' intrinsic drivers.

Although psychological needs serve as universal motivators, this study's examination of player types—a significant individual variation—yielded dual findings. When testing the relationship between need satisfaction and energy-saving intentions with the six HEXAD player dimensions as moderating variables, the interaction effect failed to reach statistical significance. However, multiple regression analysis revealed that different player types exhibited markedly divergent levels of attraction towards intervention systems centered on competition and rewards. This finding indicates that while player types may influence employees' preferences for different gamification elements (a predictive role), they do not significantly alter the core mediating position of psychological need satisfaction in the conversion from awareness to intention.

Consequently, future gamification interventions should adopt a tiered strategy. At the core level, interventions must universally satisfy employees' needs for autonomy, competence, and relatedness to ensure the fundamental conversion mechanism. At the adaptive level, interventions should incorporate modular and optional elements tailored to player type, thereby maximizing engagement across diverse groups. For example, Disruptors could be offered greater autonomy or more challenging tasks, whereas Socializers may benefit from the design of robust team-based collaboration mechanisms.

Finally, this study also presents certain limitations. Firstly, the dependent variable focuses on behavioral intention rather than actual energy consumption behavior. Although intention serves as a potent predictor of behavior, an “intention-behavior gap” persists between the two. Future research should integrate monitoring of actual energy consumption data and conduct long-term tracking to validate the effectiveness and sustainability of interventions in eliciting genuine, enduring behavioral change. Secondly, this study employed scenario-based simulations rather than field interventions within real systems, potentially affecting the external validity of the findings. Future research should prioritize the development and deployment of practical, gamified energy-saving applications and evaluate their effects through field experiments conducted in authentic office environments. Finally, the sample exhibited a single cultural background, meaning the generalizability of the conclusions requires further examination through cross-cultural studies.

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