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University Students' Usage Evaluation and Value Perception of Online Study Rooms: A Mixed-Methods Investigation

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ABSTRACT

Online study rooms have proliferated amid educational digitalization, yet face functional homogenization and experiential deficits. Based on 544 survey responses from Chinese university students, this study combines quantitative and qualitative data to examine usage evaluations and perceived value. K-means clustering identifies three distinct user segments: high-value immersed (28.5%), low-experience detached (40.1%), and pragmatic but alienated(31.4%). Value perception fully mediates the experience–loyalty relationship, with a serial mediation path (learning efficacy → emotional support → social value → loyalty) significantly operating. Design flaws exhibit a negative "overdesign" effect that weakens loyalty. These findings inform both platform optimization and students' reflective usage strategies.

KEYWORDS: *online study rooms; university students; value perception; user loyalty; serial mediation; user clustering.*

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INTRODUCTION

Under China's 15th Five-Year Plan for educational digitization, online learning has become routine for university students. Intense competition in postgraduate and civil-service entrance examinations has accelerated the adoption of online study rooms, which now reach a penetration rate of 68.2%. However, rapid expansion has also induced feature redundancy, inconsistent user experiences, and poor retention, threatening sustainable industry growth.

Existing scholarship has largely approached this phenomenon through qualitative descriptions or single-factor motivational analyses[1], with limited systematic quantification of how usage behavior, experiential perception, and loyalty formation are interconnected. While some studies have introduced interaction ritual theory[2] and flow theory[3] to explain co-learning dynamics, empirical work has mostly focused on usage motives[4] or social presence effects[5], leaving the integrated experience–perception–loyalty pathway underexamined-particularly regarding heterogeneous demands among student subgroups[6].

[1] Li, J. Y. (2020). A perspective on live-study broadcasts based on interaction ritual chain theory. Youth Journalist, (14), 79–80. Lu, J. H. (2021). Identity construction of cloud-study groups from the perspective of ritual communication [Master's thesis]. Inner Mongolia Normal University. Wu, M. H., & Zhang, Y. (2021). Behavioral logic and reflections on online live-study among Generation Z. Contemporary Youth Research, (6), 45–50. Sun, W. Z. (2022). "Being together alone": Digital management and companionship in the video era—A case study of adolescent live-study. Journalism and Writing, (11), 71–80.

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To address this gap, we propose an integrative framework linking user experience, value perception, and loyalty. We test three hypotheses:

- H1:User experience dimensions exert significant direct effects on behavioral outcomes (continued use, recommendation, and alienation).
- H2:Value perception mediates the relationship between user experience and loyalty.
- H3:A serial mediation chain exists among value-perception dimensions, following learning efficacy → emotional support → social value → loyalty.

Method

A. Survey design and measures

The questionnaire comprised five sections: demographics, usage behavior, experiential evaluation (7-point Likert), value perception, and behavioral outcomes. Experience was measured across five dimensions-system usability, social presence, rule rationality, environmental/functional design, and perceived design flaws/cognitive load-adapted from validated platform-experience scales[7]. Value perception covered three dimensions: learning efficacy and self-management, emotional support and psychological value, and social/community value, drawing on multidimensional value frameworks[8]. Behavioral outcomes included continued-use intention, recommendation intention, and behavioral alienation induced by mechanistic design features. All items were adapted from established instruments to ensure content validity.

B. Sampling and participants

A multi-stage probability-proportionate-to-size (PPS) procedure, combined with stratified and simple random sampling, was employed to enhance representativeness. Three cities (Guangzhou, Beijing, Chengdu) were selected as primary sampling units based on official enrollment data; within each city, four institutions stratified by type and tier were chosen, yielding 12 universities. Quota sampling by major and grade was then implemented, with questionnaires distributed via random campus intercepts. Of 639 distributed, 544 valid responses were retained (effective rate 85.1%) after excluding straight-lining or excessively short completion times. The sample comprised 73.2% female, 67.7% undergraduates, 34.0% STEM majors, and 29.6% economics/management majors; 70.4% were active users.

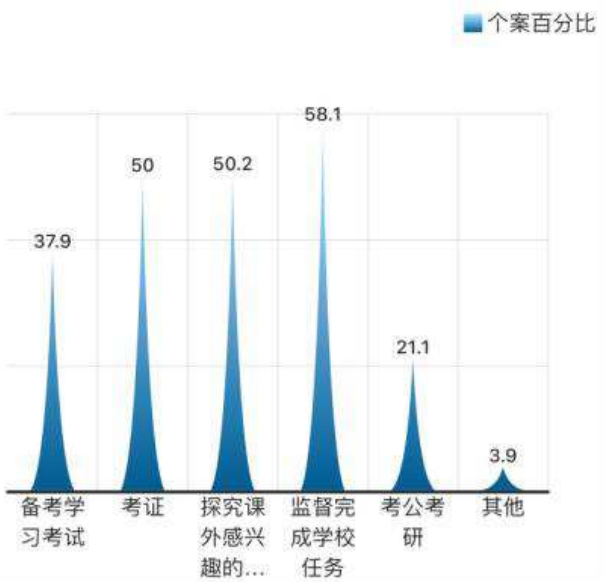
C. Reliability and validity

The KMO measure was 0.964, and Bartlett's sphericity test yielded $\chi^2 = 18{,}066.77$ ($p<0.001$), indicating strong factor-analytic suitability. Cronbach's αcoefficients for core dimensions ranged from 0.705 to 0.876, all exceeding the 0.7 threshold, confirming satisfactory internal consistency.

Results

A. Descriptive usage patterns and correlations

Among active users, weekly frequency concentrated at 3–5 times (41.2%) and 1–2 times (37.3%); session duration clustered around 1–2 hours (50.5%) and 2–4 hours (37.5%), matching typical exam-preparation blocks. Preferred platforms were specialized focus apps (Costudy, Todo; 81.4%), followed by video-conference-based rooms (46.5%) and social-platform live streams (41.7%). Primary purposes included supervising coursework (58.1%), exploring extracurricular interests (50%), certification preparation (50%), and exam preparation (60%). Among non-users, the main barriers were preference for offline environments (50.0%), unclear utility (36.5%), distraction concerns (36.5%), and habitual independent learning (32.7%).



Correlation analyses showed that continued-use and recommendation intentions correlated most strongly with social/community value $r = 0.78$, emotional support $r = 0.72$, and learning efficacy = 0.58, all $p<0.001$. Perceived design flaws exhibited significant negative correlations with all positive experience dimensions ($r=-0.41$ to -0.52), indicating systematic detrimental effects. Open-ended responses frequently mentioned "ads," "simplicity," "lag," and "rewards," corroborating these quantitative patterns.

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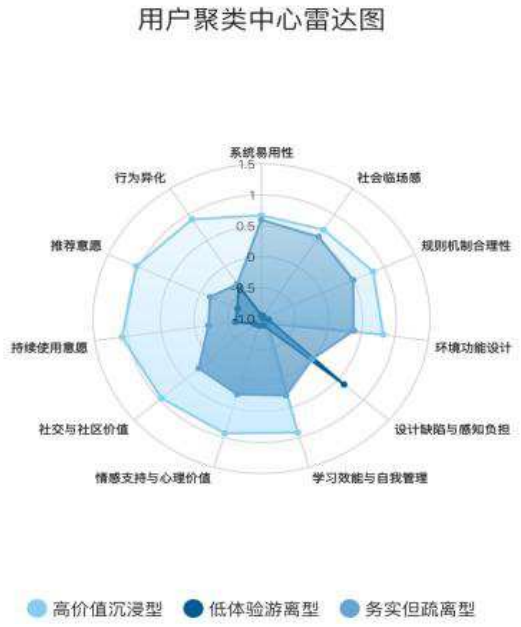
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B. Differential analyses

Independent-samples t-tests revealed gender differences in rule rationality p=0.009 and perceived design flaws p=0.002, with males rating rule design more poorly and reporting heavier burdens; system usability approached marginal significance p=0.057. One-way ANOVA showed educational-level differences in perceived design flaws p= 0.001, with higher attainment associated with lighter burden perceptions; system usability also differed significantly across education groups p=0.049. Across majors, only rule rationality varied significantly p= 0.015, with post-hoc tests indicating higher ratings from humanities/social sciences and economics/management students than from STEM students.

C. User clustering

Using standardized scores across the 11 core experiential dimensions, we applied K-means clustering. The elbow method determined an optimal cluster number of k= 3, yielding three balanced groups: 155 (28.5%), 218 (40.1%), and 171 (31.4%). ANOVA confirmed that mean differences across all 11 dimensions were highly significant (p< 0.001), validating cluster differentiation.



- High-value immersed (28.5%):scored above average on all positive dimensions and exhibited the strongest loyalty; paradoxically, they perceived design flaws most acutely yet remained undeterred, suggesting positive experience compensates for localized negatives.
- Low-experience detached (40.1%):scored below average on all positive dimensions, displayed the lowest loyalty, and faced the highest churn risk-this largest segment warrants priority intervention.
- Pragmatic but alienated (31.4%):affirmed instrumental qualities (usability, rules) but reported weak emotional and social value, with loyalty below expectations; they are prone to anxiety from leaderboards and time-tracking, marking them as high-risk for behavioral alienation.

D. Regression and mediation analyses

1. Direct effects (H1). Hierarchical regression, controlling for demographics, tested direct effects on continued use, recommendation, and alienation. For continued use, environmental/functional design showed a significant positive effect $\beta = -0.298$, $p < 0.001$, while design flaws exerted a significant negative effect ($\beta = -0.277$,$p< 0.001$; model $R^2 = 0.372$); rule rationality and social presence were non-significant. For recommendation intention, rule rationality $\beta = 0.268$, $P<0.001$ and environmental design $\beta = -0.163$, $p = 0.005$ were positive predictors, while design flaws were negative ($\beta=-0.242$,$p< 0.001$; $R^2 = 0.370$). For behavioral alienation, reward mechanisms significantly increased alienation $\beta = 0.174$, $p=0.001$, and design flaws had the strongest negative effect ($\beta= -0.439$, $p<0.001$; $R^2 = 0.269$); social presence was non-significant across all outcomes. Thus, H1 is partially supported.
2. Mediation effects (H2).We employed bootstrapping with 5,000 resamples for mediation testing. Parallel mediation models revealed that the direct effects of system usability, rule rationality, and environmental design on loyalty were all non-significant; however, each exerted full mediation through the three value-perception pathways (learning efficacy, emotional support, and social/community value). Among these, the social-value pathway yielded the largest indirect effect (e.g., for system usability: standardized indirect = 0.2451, total indirect = 0.4987). For design flaws, the direct effect on loyalty remained significant ($\beta = -0.1429$,$p< 0.001$), alongside significant indirect effects via all three mediators-indicating partial mediation. H2 is supported.
3. Serial mediation (H3).We further constructed a serial mediation model with learning efficacy as the antecedent, emotional support and social value as sequential mediators, and loyalty as the outcome. All three indirect paths were significant. Crucially, the full serial path (learning efficacy → emotional support → social value → loyalty) yielded a standardized indirect effect of 0.1448 (95% CI [0.0962, 0.2088]), with a total indirect effect of 0.4875. This confirms that enhanced learning efficacy first strengthens emotional support, which in turn boosts social-value perception, ultimately elevating loyalty. H3 is supported.

Subgroup mediation analyses across the three clusters revealed mechanistic heterogeneity: for the high-value immersed group, the emotional-support pathway was

strongest (indirect = 0.2350), with system usability fully channeled through emotional support and social value. In contrast, no mediation paths reached significance for the low-experience detached and pragmatic but alienated groups, suggesting that loyalty among these segments may be driven by other factors or that psychological experience is decoupled from loyalty formation.

Discussion

Our findings carry multiple theoretical implications. First, the five experiential dimensions we identified align broadly with prior online-learning platform research[9], yet we refine context-specific elements such as rule mechanisms and design flaws. The consistent negative correlations between design flaws and all positive dimensions extend earlier conclusions regarding perceived interactivity and continuance intention[10], underscoring that negative-experience suppression deserves dedicated attention alongside positive feature enhancement.

Second, the full mediation by value perception clarifies the intrinsic function→ perception → value pathway. Among the three psychological routes, social/community value exerts the strongest effect, suggesting that online study rooms' core appeal lies not merely in instrumental efficiency but equally in social companionship and community belonging[11]. The serial mediation model further reveals a hierarchical progression from instrumental value (learning efficacy) to emotional value (emotional support) to social value-a finding that moves beyond single-mediator or parallel-mediator paradigms. It provides fresh empirical support for applying flow theory[12] and emotional attachment perspectives[13] to online learning contexts, showing that cognitive gains alone do not sustain loyalty unless they are emotionally and socially internalized.

Third, the three K-means-derived user profiles enrich the segmentation literature on online learners. The low-experience detached group, constituting 40.1% of our sample, exhibits complete mediation failure-a finding resonant with the industry's high penetration yet fragmented retention, signaling an urgent need for tailored activation and conversion strategies. The pragmatic but alienated group's "use but dislike" ambivalence offers a novel lens for understanding loyalty formation among instrumental users, who treat the platform as a pure tool and remain immune to community-building efforts[14].

Finally, the "overdesign" phenomenon associated with design flaws yields a counterintuitive theoretical insight: greater functional complexity paradoxically diminishes psychological experience and erodes loyalty. This challenges the conventional assumption that feature richness positively predicts satisfaction, yet aligns with research on formalized features triggering behavioral alienation[15]. Our results suggest a threshold effect of functional complexity in high-cognitive-load learning environments, offering empirical justification for a "minimalist design" philosophy in online study platforms.

Conclusion and recommendations

Conclusions.Three main conclusions emerge. (1) Online study rooms have become normalized auxiliary tools, especially for high-stakes exam preparation, delivering core value in concentration enhancement, belonging, peer monitoring, and temporal flexibility. (2) Users clearly recognize benefits in time management and emotional regulation, yet persistent problems-functional homogenization, weak personalization, cluttered interfaces, and unstable connectivity-remain widespread. (3) Usage is markedly goal- and phase-driven; online rooms complement rather than substitute offline physical spaces.

Practical recommendations.For platform operators: (a) refocus on core learning modules (focus timers, study analytics, white-noise) and introduce minimalist modes that eliminate pop-ups and social feeds; (b) create goal-specific virtual spaces (postgraduate/civil-service/final-review) with customizable interfaces and supervision intensity; (c) anchor incentive systems in real learning behaviors-prioritizing weekly/monthly reports and lightweight honor systems over rankings that induce comparison anxiety; (d) improve audio-video stability

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and deploy real-time moderator patrols. For student users: set task-oriented goals to avoid inefficient time-accumulation; maintain a balanced perspective, integrating platforms with offline venues (libraries, classrooms); and consciously cultivate autonomous learning skills while leveraging the platform's monitoring functions.

Limitations and future directions.The sample, drawn from 12 universities across three cities, may not fully represent the national population; data are self-reported without objective behavioral logs. Future research should expand sampling scope, incorporate platform-generated behavioral data and controlled experiments, and explore emerging modalities such as AI-driven tutoring and metaverse-based study rooms.

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