Game Theory of Contextual Information Acceptance in Mobile Libraries and Its Optimized Postprint

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Abstract

[Purpose/Significance] While a seamless experience represents the pursued objective for contextualized information acceptance in mobile library scenarios, discrepancies exist between mobile library developers and libraries in their understanding of users' information needs, alongside conflicts of interest between both parties. Therefore, how the two parties can seek an equilibrium point for a seamless information acceptance experience has become a central focus. [Method/Process] Grounded in game theory and based on users' expectations for information acceptance, this study constructs a game mechanism model for contextualized information acceptance in mobile libraries from three dimensions: cognitive game, scenario game, and information acceptance game, aiming to achieve seamless experiences in information acceptance gaming. [Result/Conclusion] From the three perspectives of information acceptance cognition, information acceptance scenario, and information acceptance experience, this paper analyzes the gaming relationship between mobile library developers and libraries, identifies the value orientation of information acceptance gaming, and proposes game optimization strategies to enhance users' pleasure in information acceptance experiences.

Full Text

Preamble

Mobile Library Scenario-Based Information Acceptance Game and Its Optimization

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Abstract

[**Purpose/Significance**] While seamless experience represents the desired direction for scenario-based information acceptance in mobile libraries, gaps in understanding user information needs between mobile library developers and libraries, coupled with conflicting interests, make finding a balance point for smooth information acceptance experiences a critical focus. [**Method/Process**] Grounded in game theory and based on user information acceptance expectations, this study constructs a game mechanism model for mobile library scenario-based information acceptance across three dimensions: cognitive game, scenario game, and information acceptance game, aiming to achieve an optimal flow experience in information acceptance. [**Result/Conclusion**] The paper analyzes the game between mobile library developers and libraries from three perspectives—information acceptance cognition, information acceptance scenarios, and information acceptance experience—and identifies the value orientation and optimization strategies for information acceptance games to enhance user satisfaction and pleasure in information acceptance experiences.

Keywords: mobile library; scenario-based information acceptance; scenario-based services; information acceptance game
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1. Introduction

In 1975, M. Csikszentmihalyi proposed Flow Theory [1]. Applying flow theory to mobile library scenario-based information acceptance helps reveal the degree to which user information acceptance expectations are met. Flow theory suggests that during information acceptance, users become immersed in the application as if all irrelevant perceptions and thoughts are filtered out, with clear feedback on scenario-based information acceptance. Since scenario elements have been gradually embedded in mobile libraries, "no scenario, no experience" has become the benchmark for innovation in mobile user information acceptance, with users valuing both service content and delivery methods. In recent years, user abandonment and uninstallation of mobile libraries have occurred frequently. Macroscopically, this stems from poor usefulness of resource contexts, poor usability of technical contexts, and poor availability of service contexts. Microscopically, it reflects the coarse granularity of contextual configuration across different dimensions of mobile libraries. Although scenario elements such as big data, mobile devices, social media, positioning systems, and sensors have gradually emerged in mobile libraries, they have not been effectively integrated or embedded. The root cause lies in differing perceptions among mobile library developers, suppliers, and libraries, leading to varied willingness to pay [2].

To enable users to form exclusive, personalized experiences during information acceptance, libraries must engage in games with mobile library develop-

ers and suppliers, specifically manifested as cognitive games, scenario games, and acceptance games. A review of existing literature reveals scarce research on scenario-based information acceptance games in mobile libraries, which this study addresses as its entry point. In today's environment where scenarios have become touchpoints for user information acceptance and contextual configuration has become a pain point, the essence of mobile library information acceptance games is the three-dimensional "context-user-scenario" adaptation based on user information demand expectations, search habits, and acceptance preferences. Drawing on existing theoretical research, this study defines mobile library scenario-based information acceptance game as the process by which mobile libraries can perceive users' scenario-based information acceptance expectations, search habits, and acceptance preferences upon application access, and through gaming across three dimensions—user information acceptance expectations, information acceptance context configuration, and scenario-based information acceptance—maximally satisfy users' smooth experience in information acceptance [3].

To better study mobile library scenario-based information acceptance games, we divide them into three dimensions: cognitive game, scenario game, and information acceptance game. Integrating these three aspects pairwise yields three components: scenario segmentation, information acceptance cognition, and scenario-based information acceptance. These games are realized through competition and cooperation between libraries and mobile library suppliers across these three aspects. The mobile library scenario-based information acceptance game model is shown in [Figure 1: see original paper].

As shown in [Figure 1: see original paper], mobile library scenario-based information acceptance games manifest in three aspects: First, cognitive game (OA dimension, where OA values represent the game outcome between libraries and mobile library developers regarding user information demand cognition). Due to inaccurate understanding of user information needs by libraries and developers, gaps exist between perceived and actual user information acceptance expectations, resulting in either redundant or insufficient information acceptance context configuration [4]. As scenario elements gradually embed in mobile libraries, libraries have not given them sufficient attention, leaving scenario elements disconnected from contexts and causing frequent mismatches in the "context-user-scenario" alignment. Second, scenario game (OB dimension, where OB values represent the game outcome regarding scenario functionality). Although mobile library platform development considers users' actual scenario-based information demand expectations, scenarios fail to accurately capture real information needs, and mobile libraries do not configure contexts specifically for user scenarios [5]. The game outcome between mobile libraries and library developers regarding interests confines "context-user-scenario" adaptation within certain thresholds [6]. Third, acceptance game (OC dimension, where OC values represent the game outcome regarding user information acceptance capabilities). In the mobile scenario era, various scenario elements permeate mobile library applications, making existing contextual configurations unable to satisfy users'

information acceptance habits altered by new media applications [7]. Therefore, it is necessary to seek ideal game outcomes for mobile library scenario-based information acceptance from the perspectives of information acceptance cognitive game, information acceptance scenario refinement game, and information acceptance reconciliation game [8][9].

2. Game Mechanism for Mobile Library Scenario-Based Information Acceptance

2.1 Cognitive Game in Mobile Library Scenario-Based Information Acceptance

The cognitive game emphasizes the dynamic optimization of configuration based on information acceptance expectations among information acceptors, acceptance scenarios, and acceptance contexts [10]. Mobile library scenario-based information acceptance games meet the prerequisites for game theory application, specifically in three aspects: First, bounded rationality in cognition. Mobile library scenario-based information acceptance games must first grasp the evolutionary mechanism of information acceptance—why people choose imitative learning for information acceptance rather than conducting optimization analysis to maximize effects [11]. As user information acceptance levels continuously evolve, dynamic adaptation schemes in chain, domain, and field patterns have been proposed. Second, cognitive evolution and mutation. Whenever the information environment of mobile libraries changes, it inevitably affects information acceptance contexts and their configuration [12], leading to mutations in mobile library information acceptance. Two different learning methods coexist among information acceptors: “introspective” and “trial-and-error.” For mobile library scenario-based information acceptance, a key concern is how to use game theory to reveal changes in internal/external environments and system transitions. Therefore, domain-based and field-based games are proposed on the foundation of chain games. Third, cognitive 磨合调和. Mobile library scenario-based information acceptance is a random combination game, where the configuration between information acceptance contexts and scenario elements based on user information acceptance expectations gradually reconciles through 磨合 during gaming [13].

2.2 Scenario Game in Mobile Library Scenario-Based Information Acceptance

Mobile library scenario-based information acceptance games arise from conflicts of interest between mobile library developers and libraries [14]. Mobile library developers bear enormous product development risks and costs, pursuing economies of scale and long-term benefits [15], thus requiring market expansion, strengthening, and sustainability. In contrast, libraries only bear sales costs with lower risks, pursuing product personalization, specialization, and localization. Therefore, the scenario game occurs across several dimensions

that collectively form the game outcome: First, selective combination game. Scenario-based information acceptance elements include feasible strategy sets for scenario-based information acceptance completed through competition and cooperation between mobile library developers and libraries based on user contexts (such as selective integration of context sets, user sets, and scenario sets) or corresponding benefits (such as smooth experience in information acceptance and improved information literacy). Second, functional construction game. Mobile library scenario-based information acceptance is a dynamic process, and the degree of dynamic satisfaction of library functions for user information acceptance represents the outcome of dynamic gaming between libraries and developers. In actual gaming, scenario functional construction is realized based on varying degrees of understanding of user information needs by developers and libraries [17]. As shown in [Figure 1: see original paper], the combination of cognitive game and scenario game promotes user cognition of scenarios, facilitating scenario segmentation construction; the combination of cognitive game and acceptance game promotes user cognition of information acceptance, including information demand cognition, search cognition, and acceptance cognition. Third, inertia reconciliation game. Based on the historical game value orientation of mobile library developers and libraries, inertia-based gaming achieves evolutionary stability of interests starting from existing user information demand expectations, search habits, and acceptance preferences. D. Fudenberg [18] broadly defined the basic rationality assumptions of evolutionary games, suggesting that information acceptance group behaviors exhibit certain inertia while higher-benefit strategies gradually replace lower-benefit ones.

2.3 Information Acceptance Game in Mobile Libraries

Based on the characteristics of mobile library scenario-based services, the information acceptance game represents seamless connection across several stages: First, game chain formation. In the long-term development of mobile library information acceptance, three parties—mobile library developers, libraries, and users—have recognized the necessity and importance of cooperation. Driven by user information demands and library development innovation [19], mobile library developer products form interconnected information acceptance nodes integrating information acceptance contexts, scenario elements, and user information acceptance expectations, with all three elements dynamically changing, thus forming chain games from game nodes. Second, game domain formation. As mobile library developers continuously enrich scenario elements, various elements in the mobile library information acceptance chain increasingly tend toward integration and collaborative development. With growing user recognition, libraries are willing to pay more for collaborative development among context elements, scenario elements, and user elements [20], promoting the formation of relatively stable, mutually beneficial game domain relationships. Third, game field formation. When mobile library developers and libraries enter a period of completely free competition in information acceptance, with synchronous development of information flow, relationship flow, and context flow, the domain

game structure of information acceptance gradually matures, progressively forming a field-based information acceptance game model. The field game should enable rapid reconstruction of game structures according to changes in external environments, user information demands, and system context reforms. Once user demands disappear, it will disintegrate [21]; when new demands emerge, it will dynamically organize new chain, domain, and field structures, repeating this cycle.

Accordingly, this study constructs a game mechanism model for mobile library information acceptance, as shown in [Figure 2: see original paper].

In [Figure 2: see original paper], A represents the cognitive game in mobile library information acceptance, primarily the competition and conflict game between mobile library developers and libraries regarding user information demand expectations, search habits, and acceptance preferences. B represents the selective game process of mobile library scenarios on information acceptance contexts. Whether cognitive game, scenario game, or acceptance game, the ultimate result is progressive scenario segmentation and richer, more powerful mobile library information acceptance contexts, enabling "context-user-scenario" adaptation based on user information acceptance expectations. The value evolution orientation of chain, domain, and field game results [22] is shown in [Figure 3: see original paper].

As shown in [Figure 3: see original paper], the game evolution of mobile library information acceptance is an integrated evolution process combining context elements, scenario elements, and user contexts across multiple dimensions. Starting from initial state nodes forming single-chain evolution games, with contextual changes, continuous enrichment of scenario elements, and changing user information acceptance expectations, information acceptance games evolve from chains to branches, tree structures, and network structures.

3. Orientation of Mobile Library Scenario-Based Information Acceptance Games

3.1 Cognitive Evolution Game Orientation

In the scenario era, most mobile libraries game with developers through government procurement [23], providing targeted services to meet user information demand expectations, align with search habits, cater to acceptance preferences, enhance smooth experiences, and maximize economic and social benefits for the stakeholder community. However, adapting information acceptance contexts with scenario elements increases development costs and sales prices for developers, reducing libraries' purchase desire and preventing refined adaptation. From another perspective, low satisfaction of user information demands reduces user stickiness and willingness to continue using mobile libraries, leading to low usage efficiency and potential user exit to alternative products—an undesirable outcome for both libraries and users [24]. This situation arises from inconsistent

interest cognition between libraries and developers, forcing libraries to abandon usage. For example, on March 30, 2016, Peking University Library issued a notice on its website about potential service interruption from CNKI due to excessive price increases, representing a phenomenon in the game between digital library developers and libraries. In recent years, Superstar Company has continuously improved its market share by expanding from digital library services (Superstar Digital Library) to retrieval tools (Duxiu Academic Search and BaiLian Cloud) and discovery systems (Superstar Discovery), along with mobile applications like thesis management systems, similarity detection systems, smart classrooms, and Superstar Learning App. This development process exemplifies the evolution from node games to chain games and field games, enhancing user stickiness and product added value, serving as a successful case of cognitive evolution gaming.

3.2 Scenario Game Orientation

In mobile library scenario-based information acceptance, the goals of developers and libraries involve both cooperation and continuous conflict. Sometimes developers dominate, sometimes libraries dominate, but either form must orient toward scenario refinement to improve user smooth experiences. In reality, scenario refinement does not evolve with equal probability from complete competition (0,0) to complete cooperation (1,1). Gaming between different elements produces outcomes shown in [Figure 4: see original paper].

In [Figure 4: see original paper], M represents the outcome point of scenario refinement gaming between developers and libraries, O represents complete non-cooperation, B represents complete cooperation, and OB indicates the degree of cooperation throughout the gaming process. The left side of [Figure 4: see original paper] shows stronger cooperation willingness and trends between suppliers and libraries regarding scenario refinement, with advantageous user perception and experience effects. For example, Superstar Learning App has added mini-programs, creation tools, and interactive tools to enhance user experience, demonstrating game evolution between developers and libraries. Although scenario element embedding remains insufficient (e.g., positioning functions), its overall evolution reflects the scenario refinement process. The right side shows weaker cooperation willingness, where mobile library functions remain dominant, as seen in BoKan Mobile Library, HuiWen Palm Library, ShuSheng Mobile Library, and Superstar Mobile Library, which have incorporated scenario elements but failed to truly embed them or leverage their utility. While developers and suppliers show weak willingness to invest in improvements, as users' cognition of scenario-based information acceptance improves, future willingness to embed scenario elements will gradually strengthen to enhance product stickiness and user loyalty.

3.3 Information Acceptance Game Orientation

Mobile library scenario-based information acceptance involves not only cognitive and scenario refinement games between developers and libraries but also "scenario-user-context" reconciliation games [25] that form the foundation of user experience. In practice, smooth experience gaming should focus on: First, balancing additional benefits. Adapting information acceptance contexts with scenario elements based on user demand expectations, preferences, and habits provides exclusive VIP services, generating smooth experiences. Once users experience smooth information acceptance, their willingness to continue using strengthens, creating substantial additional benefits. For example, Superstar Learning App has added interactive tools (sign-ins, voting, video conferencing, live streaming) and mini-programs (knowledge challenges, Sudoku, assessments, reading reports, leave requests, check-ins, form collection, paper detection), with contextual configurations across different scenarios encouraging continued use. Second, reducing payment costs. While future scenario-based functional attributes will become more prominent, the premise is minimizing selected costs. Future cost minimization should emphasize not only profit maximization but also maximizing user pleasure in information acceptance, reflecting social benefits over economic benefits [26]. All mobile libraries strive to avoid shortcomings like single functionality, poor iteration, and poor application experience. Third, enhancing utility ratios. When the ratio of cooperative benefits to costs between information acceptance contexts and scenario elements or between developers and libraries increases, mobile library information acceptance achieves sustainable development. For example, Superstar Learning App's utility ratio gradually increases through continuous context enrichment and scenario refinement [27]. Years of gaming practice between Superstar Mobile Library and various libraries demonstrate that establishing trusting cooperative relationships and fair benefit distribution mechanisms facilitates continuous evolution toward user-desired smooth experiences.

4. Optimization of Mobile Library Scenario-Based Information Acceptance Games

4.1 Game Experiment for Mobile Library Information Acceptance

Currently, widely used mobile libraries include Superstar Learning App, Superstar Mobile Library, Global Academic Express, ShuSheng Mobile Library, and HuiWen Palm Library. Their scenario-based information acceptance performance reflects comprehensive gaming outcomes across cognitive, scenario refinement, and information acceptance dimensions. To empirically evaluate these libraries, we conducted scenario-based experiments testing users from Jilin, Henan, and Inner Mongolia on information demand expectations, search habits, and acceptance preferences. If cognitive, scenario, and acceptance games achieve basic balance, this indicates basic adaptation; if one aspect is prominent, it indicates biased adaptation; if one aspect is constrained, it indicates restricted

adaptation. In , B1, B2, and B3 represent navigation browsing, information retrieval, and download reading behaviors; S1-S5 represent dormitory morning pre-class, morning classroom, midday dining, afternoon classroom, and evening dormitory rest scenarios; C1-C6 represent resource, technical, service, mobile, social, and terminal contexts; A1-A5 represent Superstar Learning App, Superstar Mobile Library, Global Academic Express, ShuSheng Mobile Library, and HuiWen Palm Library.

shows adaptation levels across five mobile library types for three demand categories across five scenarios and six contexts, where ++ indicates basic adaptation, + indicates biased adaptation, and - indicates restricted adaptation. Currently, Superstar Learning App demonstrates better adaptation, offering an optimization model for other mobile libraries. Optimization requires user scenario profiling [28] to inform context configuration improvements.

4.2 Game Portrait for Mobile Library Information Acceptance

Based on experiments with Superstar Learning App users across five scenarios (dormitory morning pre-class, morning classroom/self-study, midday dining, afternoon classroom/self-study, evening dormitory rest), this study comprehensively analyzed user information acceptance attributes through questionnaires, user logs, think-aloud protocols, and sentiment analysis to create scenario-based information acceptance tag clouds [29], as shown in .

presents scenario-based context configuration schemes for five scenes, demonstrating how different combinations of resource, technical, service, mobile, social, and terminal contexts are configured for specific scenarios.

4.3 Game Application for Mobile Library Information Acceptance

Mobile library scenario-based information acceptance is a selective adaptation process between information acceptance contexts and scenario elements based on user demand expectations, search habits, and acceptance preferences [30]. As discussed, mobile library information acceptance games exist within cognitive, scenario, and acceptance games. For example, the gaming process for university students using Superstar Learning App before evening dormitory rest can be described as: “After a full day of study, students finally have time for campus communication before rest. The mobile library uses its built-in clock and sensors to capture body posture, configuring scenario-based information acceptance contexts to provide entertainment content (TV shows, variety programs, cultural programs, short videos) while enabling campus communication through social functions.” This context configuration based on cognitive, scenario, and acceptance games provides targeted contextual settings to enhance information acceptance pleasure, forming the strategy: (Resource, Technical, Service, Mobile, Social, Terminal) = (TV shows, variety programs, cultural programs, short videos, campus communication, reading mode, body posture, precise matching, context capture, content adaptation).

[Figure 5: see original paper] shows the first- and second-level factor framework for university students' evening dormitory information acceptance gaming using Superstar Learning App. Elliptical frames represent unused dimension elements, while filled boxes represent activated information acceptance elements across dimensions. The framework demonstrates that mobile library information acceptance gaming involves "matrix + overlay" context configuration, where successful gaming in a dimension closes the switch (value = 1) and failure opens it (value = 0). This optimization enhances user experience and creates value.

Only through cognitive, scenario, and acceptance games based on user demand expectations, search habits, and acceptance preferences can "scenario-user-context" adaptation be achieved, enabling ecological evolution toward smooth experiences. This paper proposes an optimization strategy model for mobile library scenario-based information acceptance games, analyzing gaming across five application scenarios and identifying an innovation direction of "overlay + matrix" context configuration.

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Author Contributions:
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Information Acceptance Game and Optimization of Mobile Library Scenario-Based Services

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Abstract: [Purpose/significance] Although smooth experience is the direction pursued by scenario-based information acceptance in mobile libraries, due to the gap between mobile library developers and libraries in understanding user information needs and conflicts of interest between the two parties, how to seek a balance point for smooth information acceptance experience has become the focus. [Method/process] Based on game theory and user information acceptance expectations, this paper constructs a game mechanism model of scenario-based information acceptance in mobile libraries from three dimensions: cognitive game, scenario game, and information acceptance game, in order to seek a smooth experience in information acceptance games. [Result/conclusion] This paper analyzes the game between mobile library developers and libraries from three perspectives of information acceptance cognition, information acceptance scenario, and information acceptance experience, and points out the value orientation and game optimization strategy of information acceptance games to enhance the pleasure of user information acceptance experience.

Keywords: mobile library; scenario-based information acceptance; scenario-based services; information acceptance game

Note: Figure translations are in progress. See original paper for figures.