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GAMIFICATION-BASED HABIT TRACKER APPLICATION USING WEIGHTED SCORING ALGORITHM TO ENHANCE STUDENT PRODUCTIVITY

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ABSTRACT

Student productivity is fundamentally influenced by consistency; however, it is frequently hampered by motivational deficits and digital distractions that offer immediate gratification. Existing habit tracker applications often fail to sustain user engagement due to their passive nature, while applications that incorporate gamification tend to rely on uniform scoring models that do not encourage task prioritization. This study aims to design and develop a native Android habit tracker application that integrates a gamification engine—comprising experience points (XP), levels, and badges—with a Weighted Scoring algorithm to produce a fair and proportional reward system. The Research and Development (R&D) method was adopted as the research approach. The system was implemented using Kotlin, Jetpack Compose, the MVVM architecture, and Jetpack DataStore, with core functionality encompassing habit management (CRUD operations), XP calculation, leveling, badges, and daily resets. Black Box testing results indicated that all system functionalities operated as designed, while the User Acceptance Test (UAT) results demonstrated excellent usability and motivational impact. This study concludes that gamification integrated with the Weighted Scoring algorithm is effective as a digital intervention for enhancing student motivation and productivity.

INTRODUCTION

Students in the modern era face significant challenges in managing personal productivity. As learners who are expected to be self-directed in managing their time and tasks, students must contend with high academic demands alongside the reality of constant digital distractions such as social media, streaming platforms, and instant notifications (Putra et al., 2022). The phenomenon of continuous partial attention poses a substantial challenge for students in allocating cognitive resources toward forming and maintaining positive habits, such as structured study time management. Consequently, many students fail at the critical phase of routine formation.

The evolving technological landscape of the 21st century, characterized by the ubiquity of mobile computing devices, has fundamentally transformed the way students interact with information and manage their daily activities. Smartphones have evolved from mere communication tools into integral personal ecosystems. Nevertheless, this integration presents a productivity paradox: while it offers accessibility to learning resources, it simultaneously functions as a primary gateway to distraction.

Theoretically, the root cause of this issue lies in the neurological habit loop model popularized by Duhigg and refined by Clear (2018), which postulates that every habit operates within a three-step cycle: the cue, which serves as the signal prompting the brain to enter automatic mode; the routine, which constitutes the behavior itself; and the reward, which provides the positive feedback that teaches the brain the cycle is worth repeating. The disparity in reward immediacy is the core problem: digital distractions offer a highly efficient cycle with constant cues (notifications) and instantaneous neurochemical rewards (social validation, new content), whereas academic habits tend to involve delayed gratification such as good exam scores or graduation.

As a technological response to this problem, various habit tracker applications have been developed to function as scaffolding systems that externally engineer the habit loop—delivering notifications as cues, providing recording interfaces to facilitate routine execution, and offering progress visualizations as rewards. However, empirical observation of similar applications reveals a critical deficiency in the reward component. The majority of applications are limited to passive data recording (CRUD) functionality, where monotonous interactions such as merely checking off a to-do list—often fail to deliver sufficiently strong motivational feedback to sustain long-term user engagement, resulting in high rates of user churn.

To address this motivational deficit, gamification has emerged as a recommended approach in the field of Human-Computer Interaction (HCI). Deterding et al. (2011) define gamification as the application of game-inspired mechanics, dynamics, and aesthetics within non-game contexts to promote desired user behaviors. Rather than relying solely on intrinsic motivation, gamification systematically injects extrinsic motivators points, badges, and level progression that effectively re-engineer the habit loop by providing rewards that are immediate, measurable, and psychologically satisfying. The effectiveness of this approach has been demonstrated by Nugroho et al. (2020), who found that point and badge elements significantly increased student engagement in learning applications, a finding also supported by Sari and Hidayat (2021), who identified a positive correlation between gamification elements and user motivation.

However, the effectiveness of a gamification system depends not only on the presence of game elements, but also on the fairness and relevance of its scoring mechanism. Generic gamification systems employing a Uniform Scoring Model in which every habit yields the same number of points regardless of its complexity or importance carry a fundamental weakness: they can create perverse incentives, encouraging users to complete many trivial tasks to accumulate points rather than prioritizing high-impact activities that require greater cognitive effort. For example, completing a "Laboratory Report" inherently has a far greater impact on productivity than "Drinking a Glass of Water," yet both are treated equally under a uniform scoring model.

Therefore, a more intelligent and adaptive scoring algorithm is required. One relevant quantitative approach in decision support systems is the Weighted Scoring algorithm—a method used to evaluate a set of alternatives based on multiple criteria, each carrying a different level of importance (weight) (Kusumadewi et al., 2006). The fundamental principle is that not all criteria contribute equally to the final outcome, necessitating weighting to represent the significance of each criterion. This study adapts that principle to the habit tracker context, assigning each habit a numerical weight reflecting its level of importance, thereby making the point system more proportional and encouraging users to prioritize high-impact activities.

Several prior studies have examined related topics but demonstrated notable limitations. Putra et al. (2022) developed a habit tracker application for students that was passive, lacking any motivational mechanism; Nugroho et al. (2020) focused on gamification in e-learning systems for academic learning rather than personal productivity; Kurniawan et al. (2023) integrated self-tracking with gamification but continued to employ uniform scoring; while Sari and Hidayat (2021) surveyed the influence of gamification on user motivation without producing a functional software product. Based on this comprehensive analysis, a clear research gap was identified: the need for a habit tracker application that synergistically combines self-monitoring with a gamification engine supported by a fair and adaptive scoring algorithm.

The novelty of this research lies in the design and development of an integrated system that does not merely record habits, but actively motivates and guides students through the integration of a Weighted Scoring algorithm as the core mechanism of a gamification engine within an Android-based habit tracker application specifically designed for university students. This study aims to address three primary research questions: how to design an effective software architecture and user interface to support habit management and the integration of gamification elements; how to implement the Weighted Scoring algorithm within the gamification engine mechanism so that the system can generate proportional XP gains, level progression, and badge achievements; and how the application performs when evaluated through functional testing and a user experience survey in measuring system usability and the perceived impact on student motivation.

RESEARCH METHODS

This study employed the Research and Development (R&D) method to design, develop, and evaluate a gamification-based habit tracker application. The R&D method was selected due to its high relevance to the primary objective of this research namely, to produce a software artifact in the form of a functional mobile application, and subsequently to test or validate that product against the target users in order to measure its usability and the perceived impact it produces. The research phases consisted of four main stages: requirements analysis, system design, implementation, and testing and validation.

During the requirements analysis stage, a literature review was conducted alongside the definition of the system's functional and non-functional requirements, which served as the foundational basis for feature development. The functional requirements analysis yielded eleven core features, including habit management (CRUD operations), weight implementation, XP score calculation, mission completion, level calculation, streak calculation, automatic daily reset, statistics and profile display, achievement display, profile customization, and daily reminder notifications. In the system design stage, the results of the analysis were translated into technical designs encompassing software architecture design, database design, and user interface design. In the implementation stage, the application code was written in accordance with the previously established design, while the testing and validation stage was conducted in two phases: functional verification and user validation.

The application was developed natively for Android (API Level 30+) using Kotlin a modern, statically typed programming language that runs on the Java Virtual Machine and is officially recommended by Google as the primary language for Android development (Google Developers, 2023). Its concise and null-safe nature significantly reduces the potential for runtime errors, while its full support for coroutines enables efficient management of asynchronous operations without blocking the main thread.

Jetpack Compose was used to build the declarative user interface forming the View layer, in which composable functions reactively render views based on state changes exposed by the ViewModel. The MVVM (Model-View-ViewModel) architecture was adopted to maintain a clean separation of concerns, resulting in modular, testable, and maintainable code. The ViewModel component contains all business logic, including the Weighted Scoring algorithm calculations, while the Model layer is implemented using the Repository pattern, which functions as the single source of truth and abstracts the data source.

Jetpack DataStore was used as the local data storage medium, replacing SharedPreferences used in the traditional approach. This solution was chosen because it operates asynchronously using Kotlin Coroutines and Flow which is critical for preventing Application Not Responding (ANR) errors and provides more structured type safety. Data such as the list of habits are serialized into JSON format using the kotlinx.serialization library and stored as a single string entity within the DataStore.

The core algorithm implemented is the Weighted Scoring algorithm. Each habit is assigned a weight representing its level of importance (Light, Medium, or Heavy). The Experience Points (XP) earned upon completing a habit are calculated using the following equation:

$$XP = \Sigma (\omega_i \times \text{Base Value})$$

where ωi is the habit weight coefficient (1, 3, or 5) and the Base Value is a constant XP value set by the system at 10 XP. The complete weight configuration and base XP gains are presented in Table 1.

Table 1. Weight Configuration and XP Gains

Weight Level (ωi)	Task Criteria (Examples)	Coefficient (ωi)	Base XP
Light	Quick daily routine tasks (drinking water, stretching)	1×	10 XP
Medium	Intermediate academic tasks (reading journals, practice problems)	3×	30 XP
Heavy	Priority/difficult tasks (working on thesis, presentations, deep focus work)	5×	50 XP

As an example, completing a habit with a Heavy weight ($\omega i = 5$) yields $5 \times 10 = 50$ XP five times more than a Light-weight habit (10 XP) thereby encouraging users to prioritize high-impact tasks. Each time a user marks a habit as complete, the system retrieves the stored weight value and adds it to the user's total XP, which subsequently serves as the basis for calculating level progression and badge achievements.

Data were collected through three techniques. First, a literature review was conducted to gather secondary data from scientific journals, textbooks, and official technical documentation in order to build the theoretical foundation. Second, functional testing (Black Box Testing) was used to collect primary qualitative data by executing a series of test cases on the application prototype, where measurement was carried out on a binary basis by recording a "Pass" or "Fail" status based on the correspondence between the system's actual output and the expected output. Third, an online questionnaire (User Acceptance Test, or UAT) using Google Forms was distributed to 30 active students of Universitas Islam Sumatera Utara following a trial period of the application.

The UAT questionnaire instrument was designed to measure three main variables. The Usability and Interface Quality variable measured ease of navigation, the data input flow (both via template and manually), and the clarity of XP, level, and mission weight information. The Gamification Effectiveness variable measured extrinsic motivation derived from the level and locked-avatar system, as well as the visual aesthetics of badge and progress bar elements. The Weighted Scoring (novelty) variable measured the perceived fairness of point distribution, the encouragement to prioritize heavy-weighted tasks, and satisfaction with instant rewards. Each questionnaire item was measured using a 5-point Likert Scale (Strongly Agree = 5 through Strongly Disagree = 1).

Black Box Testing data were analyzed descriptively, with the system declared to have "Passed Verification" if and only if all test cases yielded a "Pass" status with no critical errors. Questionnaire data were analyzed using descriptive statistics (mean scores) and subsequently interpreted based on the interval ranges in Table 2 to determine the level of user acceptance.

Table 2. Likert Scale Score Interpretation Criteria

Mean Score Range	Agreement Percentage (%)	Interpretation Category
4.21 - 5.00	84.1% - 100%	Excellent / Strongly Agree
3.41 - 4.20	68.1% - 84.0%	Good / Agree
2.61 - 3.40	52.1% - 68.0%	Adequate / Neutral
1.81 - 2.60	36.1% - 52.0%	Poor / Disagree
1.00 - 1.80	0.0% - 36.0%	Very Poor / Strongly Disagree

RESULTS AND DISCUSSION

The implementation stage represented the realization of the system design, in which Kotlin application code was written based on the MVVM architecture and Jetpack Compose. Implementation was carried out within the Android Studio Giraffe/Hedgehog development environment, targeting Android 13 SDK (API 33), using Kotlin 1.9.0+ as the programming language and Jetpack DataStore as the local database.

The developed application successfully implemented all planned features. The Main Page functions as the daily engagement hub, displaying each habit within an individual Habit Card complete with an explicit XP weight indicator serving as the visual representation of the Weighted Scoring algorithm. When a user taps the checkbox, the system provides immediate visual feedback in the form of a color change on the card, simultaneously triggering score calculation based on the weight as a form of immediate reward. The application also provides full management functionality (CRUD) through contextual swipe gestures, allowing users to swipe right to edit and left to delete a daily mission, as well as a Floating Action Button to add new missions either through template selection or manual creation.

The Statistics Page is designed as a personalization dashboard displaying the user's status (avatar, name, title, and level), XP progress toward the next level, performance summaries (daily streak, total XP, number of completed missions), and an adventure history log recording all activities along with their XP gains as a form of gamification system transparency. The profile customization feature allows users to change their name, avatar, and honorary title, where certain avatars and titles (such as "Discipline Warrior") are locked and only become available as the user levels up, providing additional motivation for continued progress. The Achievements Page functions as a digital trophy case, displaying badges in three states: Locked (displayed dimly with a lock icon), In Progress (displaying a numerical indicator), and Unlocked (displayed brightly as a mark of successful achievement).

Functional testing was conducted in two iterations using the Black Box Testing method. In the first iteration, three functional failures were identified: (1) validation of an empty mission name input that caused the application to crash (force close); (2) a leveling logic error when XP exceeded the level threshold (e.g., 110/100 XP), where the level should have increased to 2 with a remainder of 10 XP, but instead remained at 1 with an overflow display; and (3) a failure in the daily reset mechanism, where the mission checkbox status remained checked despite the day having changed. Based on these findings, code corrections were made, including the addition of an if (name.isNotEmpty()) validation in the ViewModel, a fix to the XP modulus logic so that the remainder carries over to the next level, and a correction to the date synchronization function in Jetpack DataStore to ensure the daily reset runs accurately.

The second (final) testing iteration was conducted after these corrections to verify that all features ran stably. The testing results showed that all nine test scenarios encompassing manual and template-based habit management, Weighted Scoring algorithm calculations, gamification logic (leveling and streaks), daily reset logic, and profile features (editing name, selecting locked avatars and titles) were declared PASSED (100%). This validated that all core functionalities (CRUD), the daily reset logic, and the research novelty comprising the Weighted Scoring algorithm calculations (with a Base Value of 10) and interactive gamification features operated correctly and accurately in accordance with the design specifications, thereby confirming that the prototype was stable and functionally suitable for end-user testing.

The User Acceptance Test (UAT) was conducted to validate the usability and effectiveness of the motivational impact from the user's perspective. The UAT gathered perception data from 30 active students of Universitas Islam Sumatera Utara, comprising 70% final-semester students (Semesters 7 through thesis) and 30% students in Semesters 4-6, of whom 86.7% had rarely or never used a habit tracker application before. The usability analysis results are presented in Table 3.

Table 3. Usability Analysis

Usability Aspect	Representative Question	Mean Score	Category
Layout & Navigation	The application display and layout of the 3 main menus are easy to understand	4.6 (92%)	Excellent
Input Flow (Template)	The process of adding a mission and selecting a weight is easy to understand	4.7 (94%)	Excellent
Input Flow (Manual)	XP, level, and weight information is clearly communicated	4.4 (88%)	Excellent
Daily Interaction	The process of checking off missions and using the edit/delete menu runs smoothly	4.5 (90%)	Excellent

Profile Interaction	The process of changing name, avatar, and title feels intuitive	4.3 (86%)	Excellent
Info Clarity (Gamification)	Level, XP progress, and streak information are clearly communicated	4.6 (92%)	Excellent
Info Clarity (Achievements)	The different badge status states are easy to distinguish	4.4 (88%)	Excellent
Overall Usability Mean		**4.5 (90%)**	**Excellent**

With an overall mean score of 4.5 (90%), the prototype demonstrated an Excellent level of usability. The highest score was recorded for the Template Selection flow (4.7), validating this design as a highly effective onboarding pathway for new users. The lowest score though still within the "Excellent" category was recorded for Profile Interaction (4.3), indicating that some users required slightly more time to discover that the name and title fields were tappable. Overall, this usability success provides an important foundation, as users do not need to expend cognitive effort understanding how to use the application and can instead focus directly on the core functional aspects namely using the gamification and Weighted Scoring systems to build habits.

This section evaluates the effectiveness of the Weighted Scoring algorithm in addressing the research gap identified in the Introduction. The motivational impact perception analysis results are presented in Table 4.

Table 4. Motivational Impact Perception Analysis

Motivational Impact Aspect	Representative Question	Mean Score	Category
Perceived Reward Fairness	Receiving different XP amounts based on task weight feels fair	4.7 (94%)	Excellent
Priority Encouragement	The system encourages prioritization of Heavy-weighted tasks	4.6 (92%)	Excellent
Delayed Reward Reduction	Instant rewards (XP) help reduce the sense of delayed outcomes	4.5 (90%)	Excellent
Overall Motivation Increase	The application improves motivation for productivity in general	4.5 (90%)	Excellent

The UAT results showed that the Perceived Reward Fairness (94%) and Priority Encouragement (92%) aspects received the highest scores. This validates the research novelty: the use of the Weighted Scoring algorithm demonstrably succeeded in creating a fair and proportional reward system, thereby motivating students to prioritize heavy-weighted tasks through more significant XP gains, while simultaneously closing the uniform scoring gap identified in prior research. In terms of productivity impact, the integration of Weighted Scoring with the concept of instant rewards proved effective in reducing the delayed gratification effect, providing immediate positive feedback following the completion of important tasks, and reinforcing the habit loop and productivity drive as conceptualized in the habit loop model discussed in the Introduction.

A comprehensive evaluation of the implementation and UAT results revealed two primary research limitations. First, the testing methodology remained cross-sectional and reliant on the subjective perceptions of respondents, and was therefore unable to objectively measure long-term quantitative outcomes such as improvements in Grade Point Average (GPA) or thesis completion rates. Second, the gamification implementation continued to focus on individual motivation through points, badges, and levels, while social and competitive elements that could potentially enhance extrinsic motivation were not explored.

CONCLUSION

Based on the results of the research and testing conducted, three primary conclusions can be drawn. First, a functional native Android habit tracker application prototype was produced using Kotlin, Jetpack Compose, the MVVM architecture, and Jetpack DataStore, capable of managing habits through CRUD features with a modern interface incorporating contextual swipe gestures swiping right to edit and left to delete daily missions. Second, the gamification engine and Weighted Scoring algorithm were accurately implemented to generate XP scores proportional to task weight (10, 30, and 50 XP), demonstrably capable of providing instant rewards in the form of XP, levels, and badges that motivate students to prioritize high-weighted tasks. Third, system testing yielded excellent results: all Black Box tests passed at a 100% rate and the User Acceptance Test (UAT) results fell within the "Excellent" category, validating that the application demonstrates high usability and is effective in improving students' perceived motivation for productivity.

Based on the identified research limitations, several recommendations are proposed for future system development and research. First, extending the application to other platforms such as iOS (multi-OS) is recommended to broaden its reach among students with diverse devices. Second, a longitudinal experimental study with a control group should be conducted to measure the quantitative impact of application use on GPA or academic task completion rates in practice. Third, the development of social features such as a leaderboard should incorporate a proportional mechanism, whereby rankings are calculated exclusively based on XP earned from heavy-weighted tasks to prevent cheating through the completion of large numbers of trivial tasks.

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