Case Study: Gaming Behavior Analysis Project

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1. Project Overview

- **Title:** Gaming Behavior Analysis Project
- **Objective:** To analyze player behavior and identify key insights that can inform game design, player engagement strategies, and monetization opportunities.
- **Tools & Technologies:** SQL, Python (Pandas, NumPy, Matplotlib, Seaborn), Tableau (for visualization), and Excel (for data cleaning and exploration).
- **Stakeholders:** Data Analysts, Game Designers, Product Managers, Marketing Teams

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2. Business Problem

- **Context:** Understanding player behavior is crucial for optimizing player experience, increasing player retention, and driving revenue. This project seeks to analyze player behavior data to uncover trends, patterns, and actionable insights.
- **Problem Statement:** How can we identify player engagement drivers, player churn patterns, and the impact of in-game events on player activity?

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3. Objectives & Goals

- **Primary Goal:** Identify the key factors influencing player behavior, engagement, and churn.
- **Sub-Objectives:**
  - Identify the most frequently used in-game features.
  - Understand the impact of player engagement.
  - Provide actionable insights to improve player retention.

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4. Data Overview

- **Dataset Name:** gaming_behavior_dataset_cleaned.csv
- **Data Source:** User-uploaded file and Kaggle dataset ([View Dataset](#)).
- **Data Description:** The dataset contains player activity logs, player demographics, session details, in-game event triggers, and transactional data.
- **Data Structure:**
  - **PlayerID**: Unique identifier for each player.
  - **Age**: Age of the player.

○ **Gender**: Gender of the player.
○ **Location**: Geographic location of the player.
○ **GameGenre**: Genre of the game the player is engaged in.
○ **PlayTimeHours**: Average hours spent playing per session.
○ **InGamePurchases**: Indicates whether the player makes in-game purchases (0 = No, 1 = Yes).
○ **GameDifficulty**: Difficulty level of the game.
○ **SessionsPerWeek**: Number of gaming sessions per week.
○ **AvgSessionDurationMinutes**: Average duration of each gaming session in minutes.
○ **PlayerLevel**: Current level of the player in the game.
○ **AchievementsUnlocked**: Number of achievements unlocked by the player.
○ **EngagementLevel**: Categorized engagement level reflecting player retention ('High', 'Medium', 'Low').

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5. Data Cleaning & Preparation

● **Initial Data Review:** Check for null values, duplicates, and inconsistent data formats.
● **Data Cleaning Steps:**
  ○ Removed duplicate rows.
  ○ Imputed missing values for key metrics like session start and end times.
  ○ Reformatted date-time fields to ensure proper analysis of player sessions.
  ○ Verified unique identifiers (PlayerID and SessionID) for data integrity.
  ○ Added new calculated columns, including PurchasesPerHour, TotalWeeklyPlaytime, AgeGroup, PurchaseCategory, PurchasesPerSession, and AchievementsPerSession.
● **Tools Used:** Excel for data cleaning and calculation.

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6. Key Insights & Findings

● **Player Demographics:** The majority of players fall into the 21-30 age group, with male players dominating across all age ranges. Female players are less represented overall, indicating a possible opportunity for more inclusive game marketing.
● **Average Weekly Sessions by Age Group and Gender:** Female players in the 10-20 and 40+ age groups have slightly higher average sessions per week, while male players in the 21-30 range show consistent engagement. Younger age groups demonstrate the highest activity overall.
● **Popular Game Genres:** The Strategy and Sports genres are the most popular, with the highest total playtime. These genres require competitive or team-based gameplay, appealing to a broad audience.

- **Engagement by Difficulty Level:** Players engage most with Medium and Hard difficulty levels, highlighting the importance of balanced difficulty for retention, while Easy difficulty shows slightly lower engagement.
- **Regional Analysis:** Players in Asia and Europe demonstrate the highest average purchases and playtime, making these regions key markets for monetization strategies.
- **Player Levels and Achievements:** Lower-level players have the highest player count, but higher-level players unlock more achievements, indicating experienced players are more engaged with the achievement system.
- **Achievements Per Session by Difficulty:** Hard difficulty yields the highest achievements per session, rewarding more skilled or dedicated players, which may incentivize replayability.
- **Insights on Purchase Categories:** Players in categories with higher engagement levels have longer playtimes and more frequent sessions, suggesting that targeted offers in these categories could drive revenue.
- **Average Session Duration by Game Genre:** Strategy and Simulation games have the longest session durations, reflecting their complexity and the time commitment required.
- **Game Category with Most Purchases:** Strategy and Sports genres lead in total purchases, reinforcing their popularity and profitability in the gaming market.

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7. Visualization & Dashboard Design
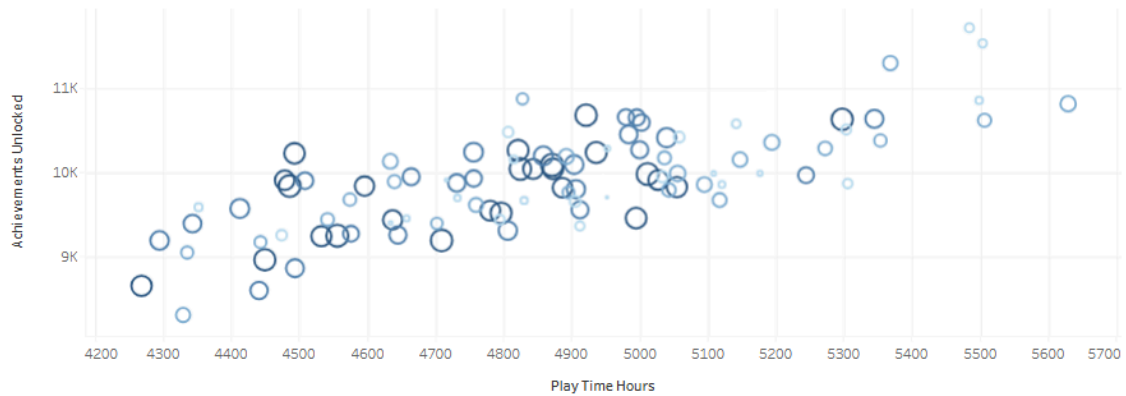
Player Count by Location
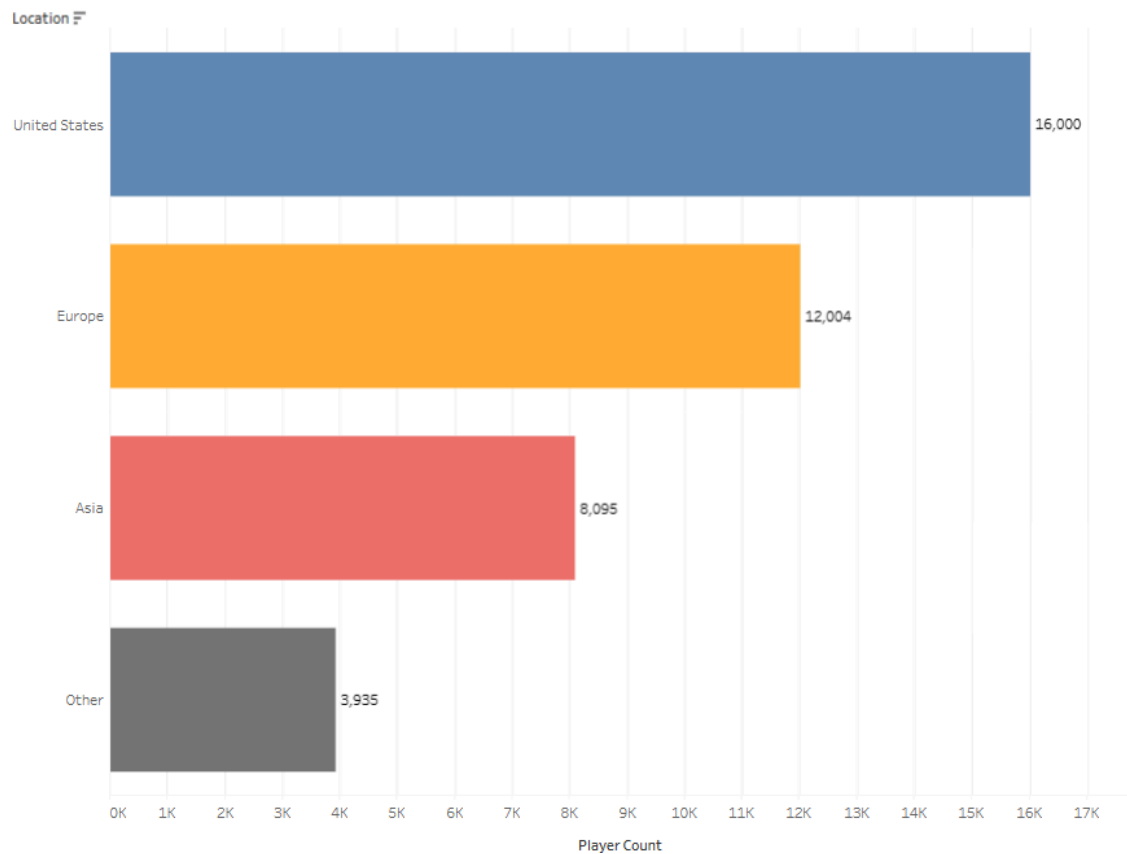
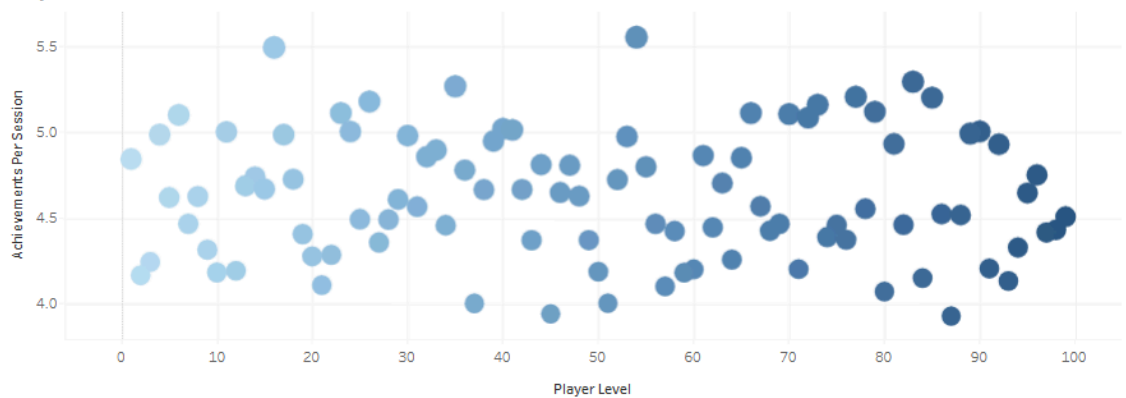This horizontal bar chart shows **Player Count by Location**:

- **United States** leads with **16,000 players**.
- **Europe** follows with **12,004 players**.
- **Asia** has **8,095 players**, and **Other** regions have **3,935 players**.

The United States and Europe dominate, while Asia and Other regions have lower player counts.

Play Time vs. Achievements Unlocked

## Player Level vs. Achievements Per Session

This image contains two scatter plots:

1. **Top Chart: Play Time vs. Achievements Unlocked**
   - Shows a positive trend: as **Play Time** increases, **Achievements Unlocked** tend to rise, clustering between **4500-5200 hours** and **9K-11K achievements**.
2. **Bottom Chart: Player Level vs. Achievements Per Session**
   - Players at **higher levels (60-100)** generally achieve **fewer achievements per session** (~4.0-5.0), while mid-level players (20-50) have slightly higher values (~5.5).
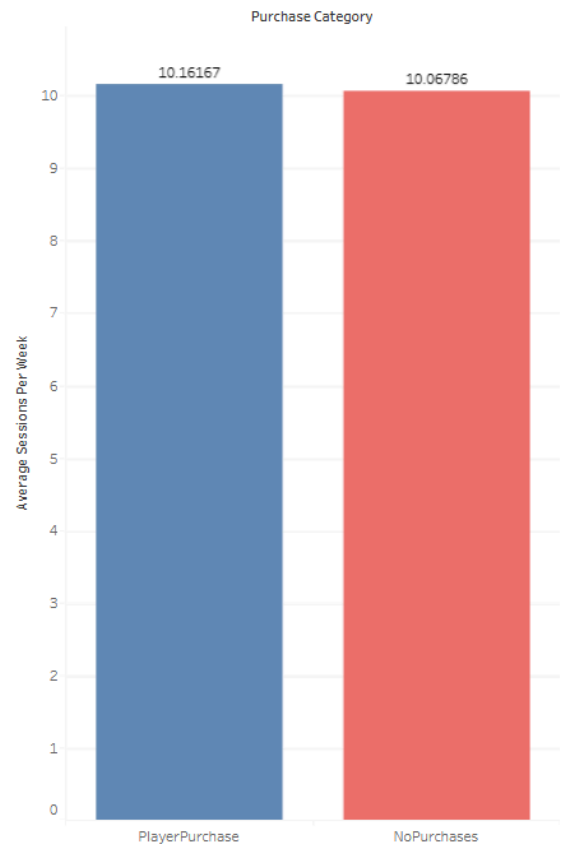
Summary:

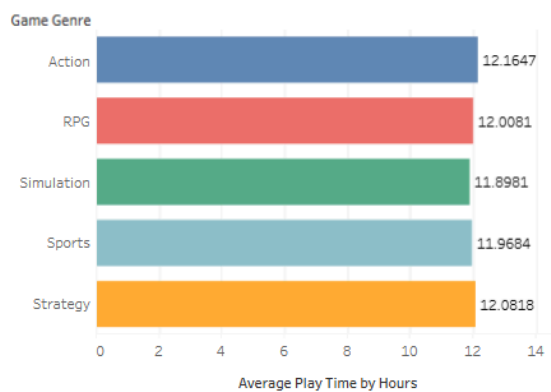- Longer playtime correlates with more achievements.

Player Behavior by Game Difficulty
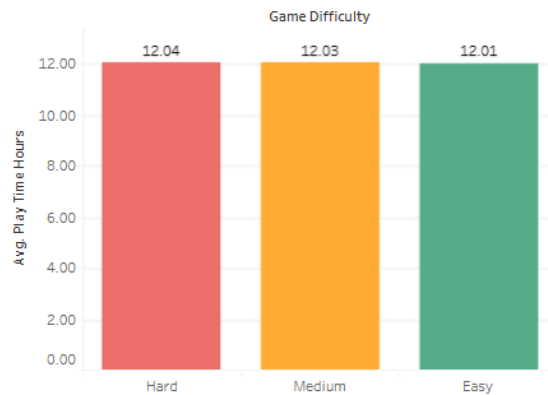
Game Difficulty

| 12.04 | 12.03 | 12.01 |
| Hard | Medium | Easy |

Average Sessions Per Week by Purchase Category

Purchase Category

| 10.16167 | 10.06786 |
| PlayerPurchase | NoPurchases |

Average Playtime by Game Genre

Game Genre

| Action | 12.1647 |
RPG	12.0081
Simulation	11.8981
Sports	11.9684
Strategy	12.0818

Average Play Time by Hours

This image contains three visualizations:

1. **Player Behavior by Game Difficulty** (Top Left, Bar Chart):
   - ○ **X-axis**: Game Difficulty (Hard, Medium, Easy)
   - ○ **Y-axis**: Average Play Time Hours
   - ○ Findings:
     - ■ Hard: **12.04 hours**
     - ■ Medium: **12.03 hours**
     - ■ Easy: **12.01 hours**
   - ○ Minimal difference in playtime across difficulties.
2. **Average Sessions Per Week by Purchase Category** (Top Right, Bar Chart):
   - ○ **X-axis**: Purchase Category (PlayerPurchase, NoPurchases)
   - ○ **Y-axis**: Average Sessions Per Week
   - ○ Findings:
     - ■ Players with purchases: **10.16 sessions/week**
     - ■ Players without purchases: **10.07 sessions/week**
   - ○ Conclusion: Purchased players have slightly higher weekly sessions.
3. **Average Playtime by Game Genre** (Bottom, Horizontal Bar Chart):
   - ○ **X-axis**: Average Play Time Hours
   - ○ **Y-axis**: Game Genre (Action, RPG, Simulation, Sports, Strategy)

- ○ Findings:
  - ■ **Action** leads with **12.16 hours**.
  - ■ **Strategy** follows with **12.08 hours**.
  - ■ **RPG**: **12.00 hours**, Simulation and Sports are slightly lower.

Summary:

- Players with purchases show marginally higher weekly engagement.
- Action and Strategy games dominate average playtime by genre
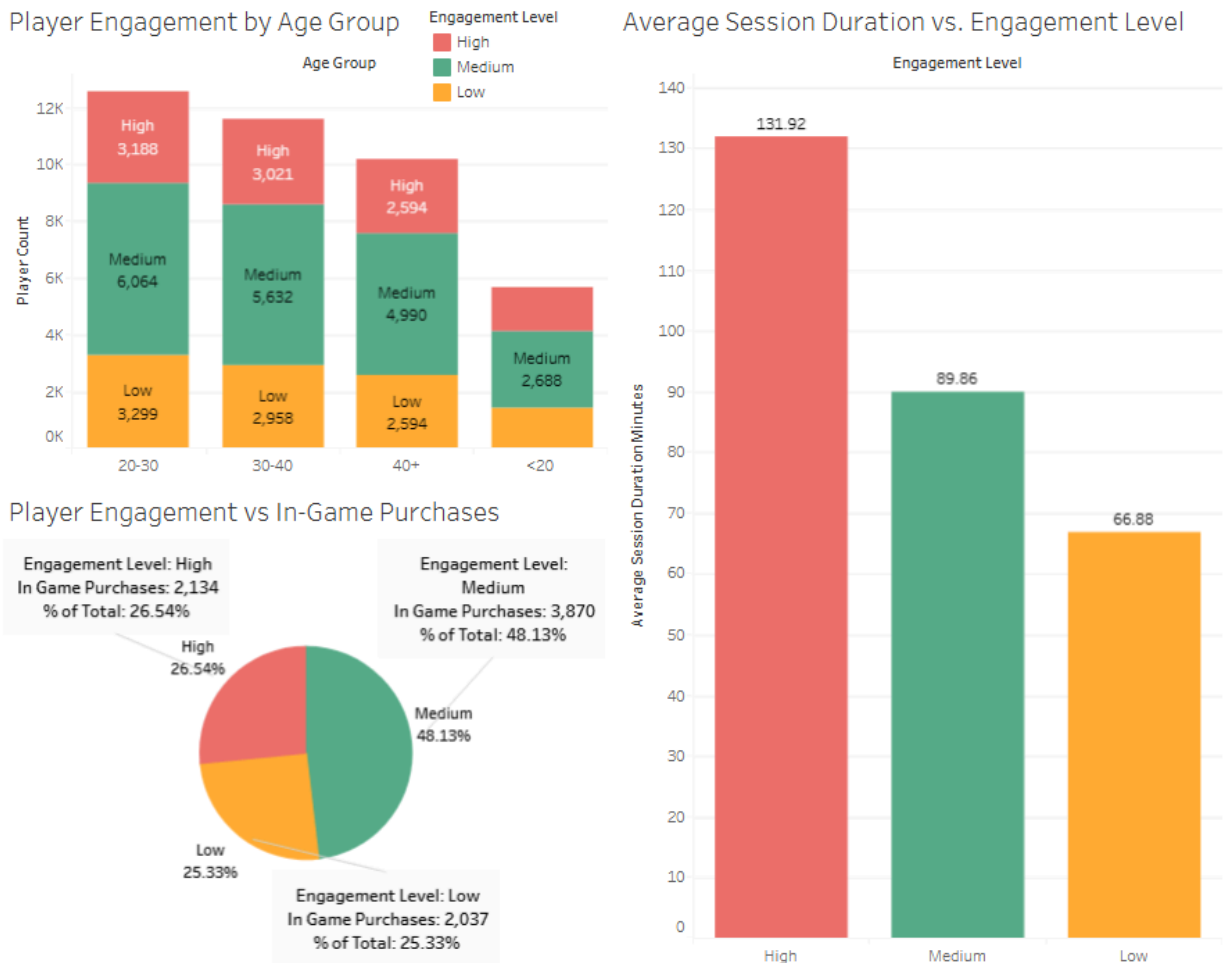
This image contains three visualizations:

1. Player Engagement by Age Group (Top Left, Stacked Bar Chart)

- **X-axis**: Age Group
- **Y-axis**: Player Count
- **Engagement Levels**: High (red), Medium (green), Low (yellow)
  Key Findings:

- The **20-30 age group** has the highest overall engagement.
  - High: **3,188**, Medium: **6,064**, Low: **3,299**.
- The **<20 group** shows lower engagement overall but still notable Medium engagement (**2,688 players**).

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2. Average Session Duration vs. Engagement Level (Top Right, Bar Chart)

- **X-axis**: Engagement Level (High, Medium, Low)
- **Y-axis**: Average Session Duration (Minutes)
  Key Findings:
- High engagement players have the longest session duration: **131.92 minutes**.
- Medium engagement: **89.86 minutes**.
- Low engagement players have the shortest session duration: **66.88 minutes**.

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3. Player Engagement vs. In-Game Purchases (Bottom Left, Pie Chart)

- **Breakdown**: Engagement Level and Percentage of In-Game Purchases
  Key Findings:
- **Medium engagement players** contribute the most to in-game purchases at **48.13%**.
- High engagement players: **26.54%**.
- Low engagement players: **25.33%**.

Summary:

- **20-30-year-olds** dominate player engagement.
- Players with **high engagement** spend significantly longer per session.
- **Medium engagement players** are the biggest contributors to in-game purchases.

Final Summary for Dashboard Analysis

The dashboards provide a comprehensive analysis of player behavior, focusing on engagement, playtime, and purchase patterns. Key insights include:

1. **Player Engagement**:
   - The **20-30 age group** dominates player engagement with the highest player count and significant "High" and "Medium" engagement levels.
   - **<20 players** show potential for targeted strategies to boost engagement.
2. **Session Duration by Engagement Level**:
   - Players with **High engagement** have significantly longer average session durations (**131.92 minutes**) compared to Medium (**89.86 minutes**) and Low (**66.88 minutes**).
   - Longer playtime indicates deeper player involvement and higher potential for retention.
3. **In-Game Purchases**:
   - **Medium engagement players** contribute the most to in-game purchases (**48.13%**), followed by High (**26.54%**) and Low engagement levels (**25.33%**).
   - This highlights Medium engagement players as a key monetization segment.

8. Actionable Recommendations & Next Steps

Based on the insights from the analysis and dashboards, the following actionable recommendations aim to improve player engagement, retention, and monetization. Each recommendation includes a specific action, the rationale behind it, and measurable goals to track progress.

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1. Increase Engagement Among Medium-Engagement Players

Insight: Medium-engagement players contribute the most to in-game purchases (48.13%) but have the potential to be converted into high-engagement players.
Action Steps:

- **Personalized Offers & Discounts**: Implement in-game offers (like time-limited discounts or exclusive items) that are personalized based on player behavior.
- **Incentive System**: Use in-game pop-ups or notifications to notify players of exclusive challenges, offers, or in-game rewards when their engagement drops.
- **Goal**: Increase the proportion of high-engagement players by **10% over the next 3 months**.

Next Steps:

1. Launch **3 in-game campaigns** over the next 90 days targeting Medium-engagement players with personalized incentives.

2. Track the shift in engagement levels from Medium to High using **weekly engagement reports**.

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2. Boost Engagement for the <20 Age Group

Insight: The <20 age group has lower engagement compared to the 20-30 age group, but it represents a valuable growth segment.
Action Steps:

- **Introduce Age-Specific Challenges**: Create beginner-friendly challenges with easy milestones for younger players.
- **Gamification Features**: Add social features, such as competitive leaderboards, daily login rewards, or multiplayer events to encourage continuous play.
- **Goal**: Increase the **session count for the <20 age group by 15% within 60 days**.

Next Steps:

1. Roll out a **"New Player Challenge" campaign** with specific rewards for players under 20.
2. Introduce a weekly **leaderboard challenge** for players under 20 to encourage healthy competition.
3. Measure the change in the number of weekly sessions from the <20 group before and after the campaign.

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3. Leverage High-Engagement Players for Retention

Insight: High-engagement players have the longest session durations (131.92 minutes), indicating deeper involvement.
Action Steps:

- **Loyalty Rewards Program**: Launch a loyalty rewards program that offers exclusive skins, in-game currency, or badges for consistent play.
- **Elite Challenges**: Create **"Elite-only" weekly challenges** that reward highly skilled players with unique rewards (like rare items or badges).
- **Goal**: Increase the **retention rate of high-engagement players by 5% within 90 days**.

Next Steps:

1. Develop a **VIP loyalty program** with tiered rewards for dedicated players.
2. Launch **Elite-only challenge events** every 2 weeks to boost replayability.
3. Track the **retention rate** of high-engagement players after introducing these events.

4. Expand Monetization in High-Potential Regions (Asia & Europe)

Insight: Players in Europe and Asia demonstrate higher playtime and purchase activity, making them prime targets for regional marketing and monetization.
Action Steps:

- **Localized Offers & Promotions**: Create country-specific promotions, like "Europe-exclusive" or "Asia-exclusive" in-game offers, to increase purchase frequency.
- **Regionalized Ad Campaigns**: Launch online marketing campaigns focused on Europe and Asia, emphasizing the most popular game genres (like Strategy and Action).
- **Goal**: Increase **purchase frequency in Asia and Europe by 20% in the next 90 days**.

Next Steps:

1. Launch localized marketing campaigns with region-specific holiday promotions.
2. Collaborate with game influencers/streamers in Asia and Europe to promote time-limited offers.
3. Track in-game purchases made by players in Europe and Asia before and after campaign execution.

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5. Optimize Game Difficulty for Engagement

Insight: Player engagement remains steady across difficulty levels, but Hard difficulty yields higher achievements per session.
Action Steps:

- **Dynamic Difficulty Adjustment (DDA)**: Introduce an adaptive difficulty system that rewards players with in-game currency, items, or achievements for playing at higher difficulties.
- **Difficulty-Based Challenges**: Implement weekly challenges that require players to complete stages on Hard or Medium difficulty for exclusive rewards.
- **Goal**: Increase the number of **players opting for Hard difficulty by 10% in the next 60 days**.

Next Steps:

1. Launch **"Challenge the Hardest Mode"** campaign to encourage players to try Hard difficulty.
2. Offer exclusive in-game badges and XP boosts to players who complete challenges on Hard.
3. Measure the increase in player participation for Hard difficulty before and after the event.

6. Promote Strategy and Action Game Genres

Insight: Strategy and Action genres have the highest playtime, making them prime candidates for engagement and monetization.
Action Steps:

- **In-Game Events for Strategy & Action**: Organize special in-game events like tournaments, exclusive strategy challenges, and bonus weekends for these genres.
- **Highlight in Marketing**: Promote Strategy and Action games in **targeted ad campaigns** and game announcements.
- **Goal**: Increase playtime in Strategy and Action games by **15% over 90 days**.

Next Steps:

1. Organize **monthly events** (like "Strategy Week" or "Action Weekend") to increase playtime.
2. Market Strategy and Action games in **push notifications** and email announcements.
3. Track the change in playtime hours in Strategy and Action games.

Final Summary of Recommendations

Objective	Insight	Action	Goal
Increase Medium Engagement	Medium engagement drives 48% of purchases	Personalized offers, time-limited incentives	Increase high-engagement players by **10%**
Boost Engagement for <20	<20 group has lower engagement	Age-specific campaigns, social features	Increase <20 age group sessions by **15%**
Leverage High-Engagement Players	High-engagement players have 131 min sessions	Loyalty program, elite challenges	Increase retention of high-engagement players by **5%**

Monetize Asia & Europe	Europe & Asia lead in purchases & playtime	Localized promotions, targeted regional offers	Increase purchase frequency in these regions by **20%**
Optimize Difficulty	Hard difficulty players have higher achievements	Challenges and rewards for higher difficulties	Increase Hard difficulty participation by **10%**
Promote Strategy & Action	Strategy & Action lead in total playtime	Special in-game events, ad promotions	Increase playtime in Strategy & Action games by **15%**

Next Steps

1. **Prioritize Initiatives**: Start with actions that have the highest impact:
   - **Target Medium-engagement players** (since they contribute the most to purchases).
   - **Regional monetization (Europe & Asia)** (since these regions have proven purchase power).
2. **Set SMART Goals for Each Initiative**:
   - Specific: Target **Medium-engagement players** with personalized offers.
   - Measurable: Track engagement growth by **10%** over 3 months.
   - Achievable: Implement 3 targeted campaigns over 3 months.
   - Relevant: This aligns with the goal to increase engagement.
   - Time-bound: Complete this within 90 days.
3. **Monitor Metrics & Feedback**:
   - Track key engagement metrics for all player segments (e.g., High, Medium, Low engagement).
   - Measure changes in playtime, purchase frequency, and participation for **regional promotions and difficulty-based challenges**.