

Executive Summary

Product Analytics Case Study

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Project Overview

This case study evaluates the full product lifecycle using a synthetic dataset of **50,000 users** (with **5,277 purchasers** and 12-week retention tracking). The goal was to identify funnel bottlenecks, assess an activation-focused A/B experiment, quantify revenue impact, evaluate retention durability, and model churn risk to inform product decisions.

Headline Metrics

| Metric | Value | Notes |
|--------------------------------|-----------|-------------------------------|
| Signups | 50,000 | User base size |
| Activated users | 18,874 | Activation rate = 0.3775 |
| Purchasers | 5,277 | Overall conversion = 0.1055 |
| Purchase rate (from activated) | 0.2796 | Purchasers / Activated |
| Total revenue | \$392,280 | Sum of transactions |
| ARPU (all users) | \$7.8456 | Avg. revenue per user |
| ARPPU (paying users) | \$74.3377 | Avg. revenue among purchasers |

Results

1) Funnel Performance

- The primary drop-off occurs at **activation** (activation rate = **0.3775**), making activation the highest-leverage stage for conversion improvement.
- Device split shows meaningful conversion differences:
 - Desktop overall conversion: 0.1151** (2,320 / 20,148)
 - Mobile overall conversion: 0.0991** (2,957 / 29,852)
- By segment, **power users activate at 0.4478**, vs **price-sensitive at 0.3513** and **casual at 0.3423**, indicating engagement quality varies strongly by segment.

2) A/B Experiment Impact (Control vs Treatment)

- Activation improved from **0.3536 (control)** to **0.4012 (treatment)**: an absolute lift of **+0.0476** ($\approx +13.5\%$ relative).

- The activation lift is statistically significant (two-proportion z-test: $z = -10.9835$, $p = 4.59 \times 10^{-28}$).
- Overall conversion increased from **0.1004 (control)** to **0.1106 (treatment)**: absolute lift **+0.0102**.

3) Retention and Cohort Durability

- Overall retention declines from **0.9294 (Week 0)** to **0.5359 (Week 8)** and **0.4722 (Week 10)**, indicating substantial early churn typical of consumer products.
- Early-window retention (Weeks 0–3 average) differs by experiment group:
 - **Control: 0.8593** vs **Treatment: 0.8210**
- This pattern suggests a **quality–quantity trade-off**: higher activation under treatment coincides with modestly weaker early retention.

4) Revenue Impact and Value Concentration

- Revenue improves under treatment:
 - **Control: \$183,580** (ARPU = **\$7.3703**, paying users = **2,501**)
 - **Treatment: \$208,700** (ARPU = **\$8.3174**, paying users = **2,776**)
- Revenue is concentrated in the **power segment** (ARPU = **\$9.7229**), vs **casual (\$7.0751)** and **price-sensitive (\$7.0181)**.
- Joint view: treatment increases both activation and ARPU (activation **0.3536 → 0.4012**, ARPU **\$7.37 → \$8.32**), but retention risk indicates the need for segment-aware rollout.

5) Churn Modeling

A logistic regression churn model (label: inactive by Week 8) achieved **ROC-AUC = 0.8641**, indicating strong separability. The most actionable interpretation remains product-driven: **early engagement** and **segment/device context** materially influence churn risk, supporting targeted interventions in the first few weeks.

Discussion and Recommendations

Interpretation: The experiment delivers a clear activation lift and higher ARPU, but early retention is modestly weaker under treatment. This indicates the experiment may attract additional users with lower downstream engagement or introduce friction affecting early-week stickiness.

Recommendations:

- **Roll out selectively**: prioritize **desktop** and **power users** where downstream value is higher.
- **Address early retention**: add Week 1–2 engagement nudges (onboarding checklists, reminders, value prompts), especially for **mobile** and **price-sensitive** cohorts.
- **Optimize to LTV-weighted metrics**: evaluate future experiments with retention-adjusted conversion (e.g., activation \times Week-4 retention proxy) rather than activation alone.

Conclusion: The treatment improves activation and revenue per user, but retention signals justify a targeted rollout and early-engagement refinement to maximize durable value creation.