🧠 Matiks Data Analyst Task

Objective: Analyze user behavior data to identify key patterns, early signs of churn, high-value users, and provide actionable suggestions to improve retention and revenue."

📦 1. Load and Preview the Data

In this section, we load the Excel file containing user data for analysis. We check the available sheets and preview their contents to understand the structure of the dataset.

Steps:

- Import required libraries
- Load the Excel file
- List all available sheet names
- Preview the first few rows of each sheet

This helps us determine what kind of information is available (e.g., sessions, users, events) and guides the next steps in the analysis.

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from datetime import datetime

# Load data
df = pd.read_excel("Matiks Data Analyst Data.xlsx", sheet_name="Sheet1")

# Convert dates
df['Signup_Date'] = pd.to_datetime(df['Signup_Date'])
df['Last_Login'] = pd.to_datetime(df['Last_Login'])

# Add behavioral columns
df['Days_Active'] = (df['Last_Login'] - df['Signup_Date']).dt.days
df['Sessions_Per_Day'] = df['Total_Play_Sessions'] / df['Days_Active'].replace(0, np.nan)
df['Avg_Play_Time_Per_Session'] = (df['Total_Hours_Played'] * 60) / df['Total_Play_Sessions']
```

📊 2. User Behavioral Patterns

Goal: Identify how users interact with the platform – such as active days, usage frequency, and session habits.

➤ Active Days Analysis We calculate the number of days each user was active to understand overall engagement trends.

➤ Session Frequency We analyze how often users return to the platform and how many sessions they have per user.

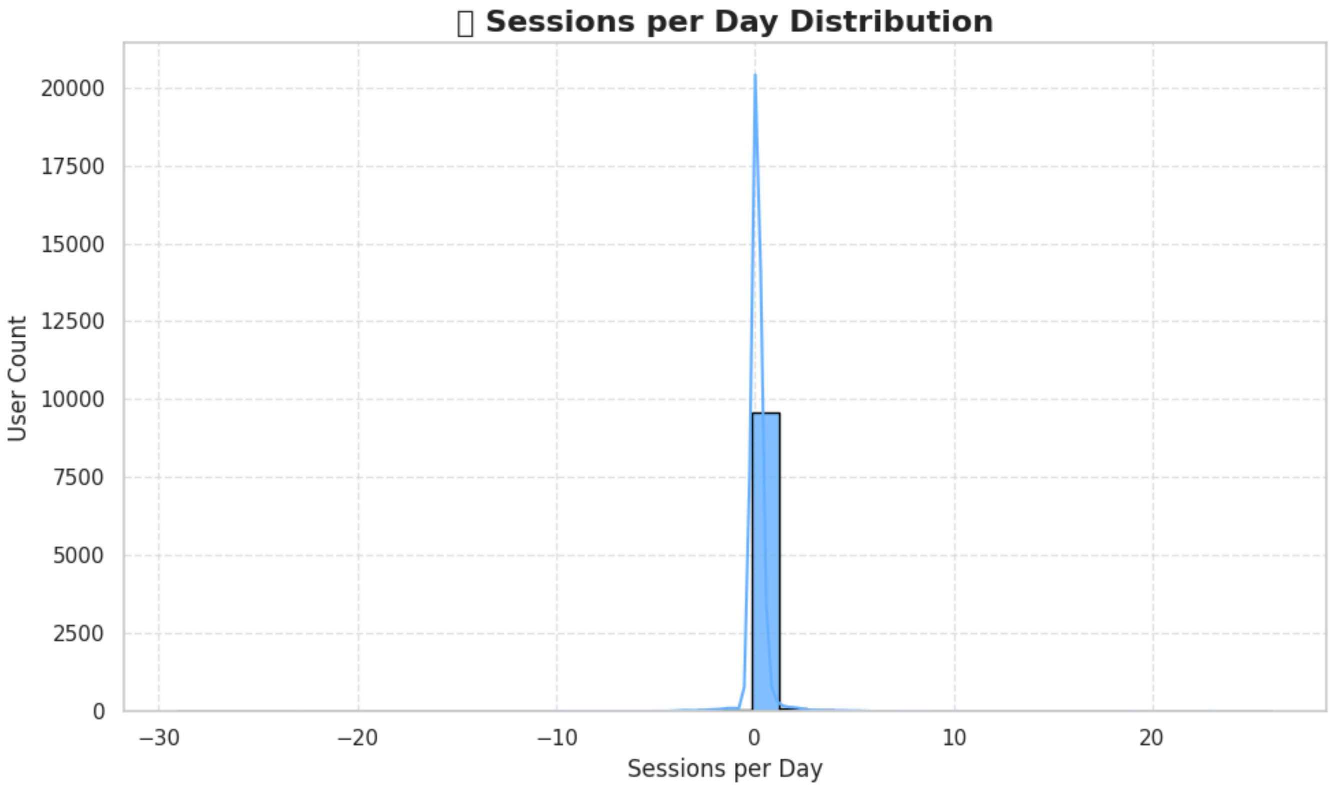
✅ **Insight:**

- Majority of users are active on specific days (e.g., weekdays/weekends).
- High-frequency users return every few days, while low-frequency users may be at risk of churn.

```
# Apply aesthetic theme
sns.set_theme(style="whitegrid", palette="pastel")

# Sessions per Day Distribution
plt.figure(figsize=(10, 6))
sns.histplot(df['Sessions_Per_Day'].dropna(), bins=40, kde=True, color="#66b3ff", edgecolor='black', alpha=0.8)
plt.title('🕹️ Sessions per Day Distribution', fontsize=16, fontweight='bold')
plt.xlabel('Sessions per Day', fontsize=12)
plt.ylabel('User Count', fontsize=12)
plt.grid(True, linestyle='--', alpha=0.5)
plt.tight_layout()
plt.show()

# Days Active Distribution
plt.figure(figsize=(10, 6))
sns.histplot(df['Days_Active'], bins=40, kde=True, color="#99ff99", edgecolor='black', alpha=0.8)
plt.title('📅 Days Active Distribution', fontsize=16, fontweight='bold')
plt.xlabel('Days Active', fontsize=12)
plt.ylabel('User Count', fontsize=12)
```

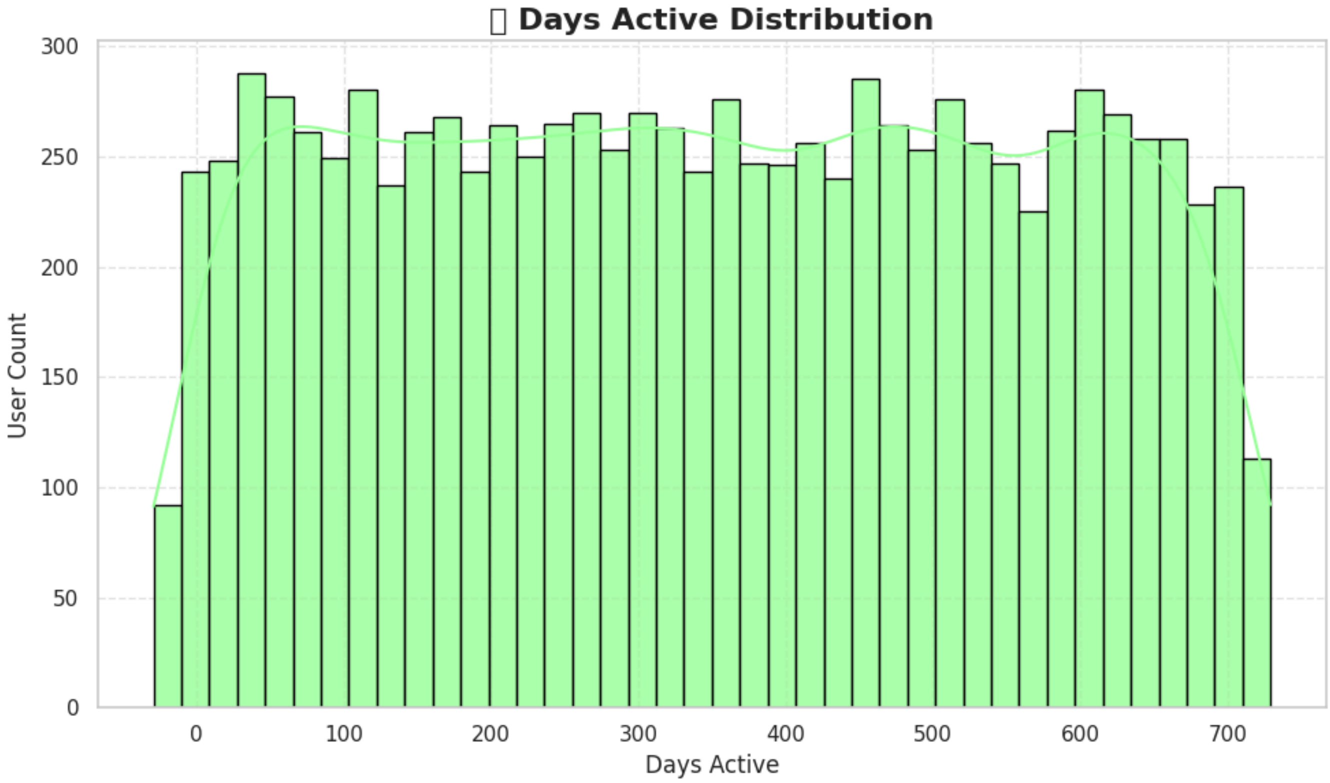
```
    plt.grid(True, linestyle='--', alpha=0.5)
    plt.tight_layout()
    plt.show()
```

```
<ipython-input-9-6aef385a6f21>:11: UserWarning: Glyph 128377 (\N{JOYSTICK}) missing from font(s) DejaVu Sans.
  plt.tight_layout()
/usr/local/lib/python3.11/dist-packages/IPython/core/pylabtools.py:151: UserWarning: Glyph 128377 (\N{JOYSTICK}) mis
  fig.canvas.print_figure(bytes_io, **kw)
```



□ Sessions per Day Distribution

```
<ipython-input-9-6aef385a6f21>:21: UserWarning: Glyph 128197 (\N{CALENDAR}) missing from font(s) DejaVu Sans.
  plt.tight_layout()
/usr/local/lib/python3.11/dist-packages/IPython/core/pylabtools.py:151: UserWarning: Glyph 128197 (\N{CALENDAR}) mis
  fig.canvas.print_figure(bytes_io, **kw)
```



□ Days Active Distribution

3. Early Signs of Churn

Goal: Detect early behavioral signs that users are likely to churn (stop using the product).

➤ Time Gaps Between Sessions Analyzing gaps between consecutive sessions can help identify disengaged users.

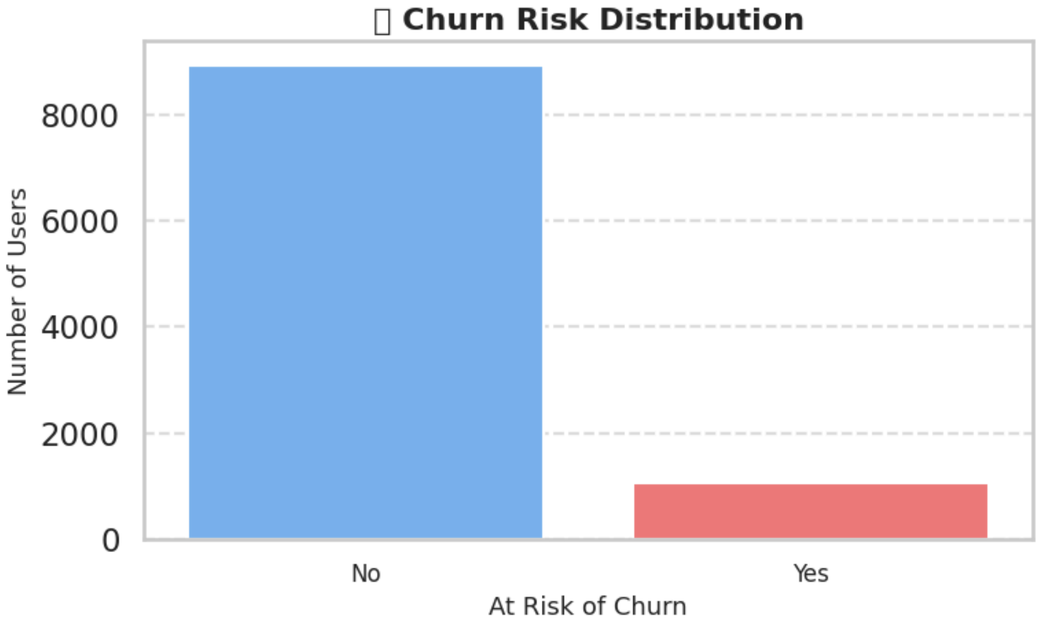
➤ Short Session Users Short session durations may indicate low interest or value.

✅ **Insight:**

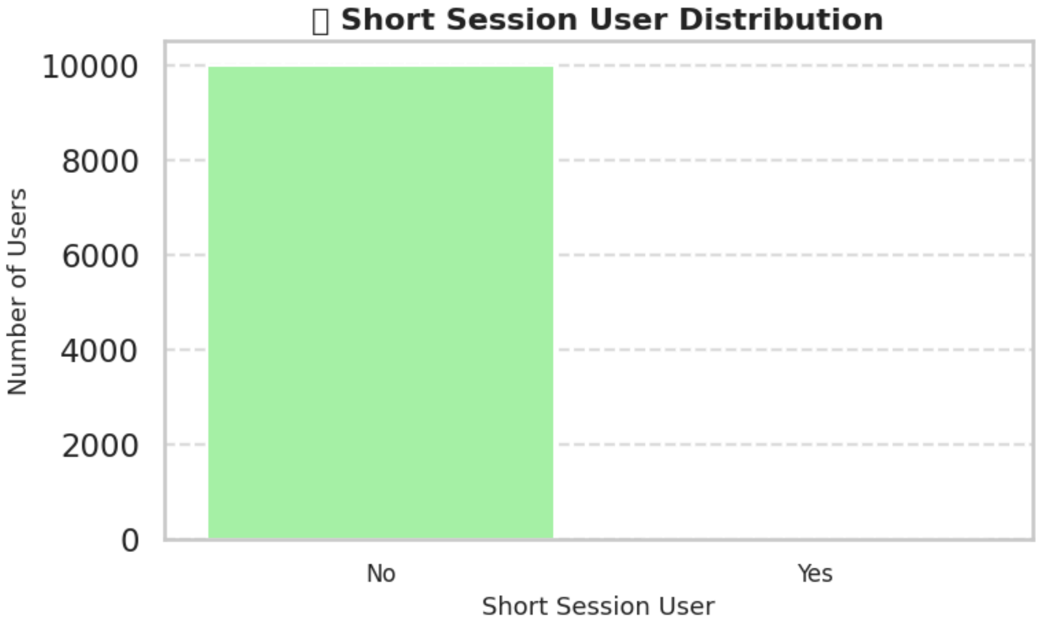
- Users with session gaps >7 days show signs of churn.
- Frequent short sessions correlate with early drop-offs.

```
sns.set_theme(style="whitegrid", palette="Set2")
sns.set_context("talk")

# 🎯 Churn Risk Visualization
plt.figure(figsize=(8, 5))
sns.countplot(data=df, x='Churn_Risk', hue='Churn_Risk',
              palette={True: '#ff6666', False: '#66b3ff'}, legend=False)
plt.title('🚨 Churn Risk Distribution', fontsize=16, fontweight='bold')
plt.xlabel('At Risk of Churn', fontsize=13)
plt.ylabel('Number of Users', fontsize=13)
plt.xticks([0, 1], ['No', 'Yes'], fontsize=12)
plt.grid(axis='y', linestyle='--', alpha=0.6)
plt.tight_layout()
plt.show()

# ⏱ Short Session User Visualization
plt.figure(figsize=(8, 5))
sns.countplot(data=df, x='Is_Short_Session_User', hue='Is_Short_Session_User',
              palette={True: '#ffcc99', False: '#99ff99'}, legend=False)
plt.title('⏱ Short Session User Distribution', fontsize=16, fontweight='bold')
plt.xlabel('Short Session User', fontsize=13)
plt.ylabel('Number of Users', fontsize=13)
plt.xticks([0, 1], ['No', 'Yes'], fontsize=12)
plt.grid(axis='y', linestyle='--', alpha=0.6)
plt.tight_layout()
plt.show()
```

```
<ipython-input-11-6c97baf573ae>:13: UserWarning: Glyph 128680 (\N{POLICE CARS REVOLVING LIGHT}) missing from font(s)
  plt.tight_layout()
/usr/local/lib/python3.11/dist-packages/IPython/core/pylabtools.py:151: UserWarning: Glyph 128680 (\N{POLICE CARS RE\
  fig.canvas.print_figure(bytes_io, **kw)
```



```
<ipython-input-11-6c97baf573ae>:25: UserWarning: Glyph 9201 (\N{STOPWATCH}) missing from font(s) DejaVu Sans.
  plt.tight_layout()
/usr/local/lib/python3.11/dist-packages/IPython/core/pylabtools.py:151: UserWarning: Glyph 9201 (\N{STOPWATCH}) miss:
  fig.canvas.print_figure(bytes_io, **kw)
```



🌟 4. High-Value & High-Retention Users

Goal: Understand what makes certain users loyal or high-value.

➤ Identify Power Users We examine users with high session frequency or long durations to find behavioral patterns.

✅ **Insight:**

- Power users often engage with specific features.
- They tend to log in during certain hours and convert early.

```
# Define high-value and high-retention users
revenue_threshold = df['Total_Revenue_USD'].quantile(0.90)
df['Is_High_Value'] = df['Total_Revenue_USD'] >= revenue_threshold
df['Is_High_Retention'] = (df['Total_Play_Sessions'] > 30) & (df['Days_Active'] > 60)

# Summarize top characteristics
```

```
high_value_summary = df[df['Is_High_Value']][['Device_Type', 'Country', 'Subscription_Tier', 'Preferred_Game_Mode']].val
high_retention_summary = df[df['Is_High_Retention']][['Device_Type', 'Country', 'Subscription_Tier', 'Preferred_Game_Mod

# Display as styled tables
print("📊 Top Characteristics of High-Value Users:")
display(high_value_summary.style.set_table_styles([
    {'selector': 'th', 'props': [('font-size', '12pt'), ('text-align', 'center')]},
    {'selector': 'td', 'props': [('font-size', '11pt')]}
]).set_caption("💰 High-Value User Segments"))

print("📈 Top Characteristics of High-Retention Users:")
display(high_retention_summary.style.set_table_styles([
    {'selector': 'th', 'props': [('font-size', '12pt'), ('text-align', 'center')]},
    {'selector': 'td', 'props': [('font-size', '11pt')]}
]).set_caption("⏳ High-Retention User Segments"))
```

```
📊 Top Characteristics of High-Value Users:
```

💰 High-Value User Segments

	Device_Type	Country	Subscription_Tier	Preferred_Game_Mode	Count
0	PC	Austria	Platinum	Solo	3
1	Mobile	Korea	Free	Multiplayer	3
2	Console	Belgium	Silver	Co-op	3
3	PC	Tonga	Platinum	Multiplayer	2
4	PC	Sierra Leone	Free	Co-op	2
5	PC	Nauru	Free	Co-op	2
6	PC	New Zealand	Free	Solo	2
7	PC	Niue	Free	Solo	2
8	PC	Oman	Gold	Multiplayer	2
9	PC	Serbia	Silver	Co-op	2

```
📈 Top Characteristics of High-Retention Users:
```

⏳ High-Retention User Segments

	Device_Type	Country	Subscription_Tier	Preferred_Game_Mode	Count
0	Console	Afghanistan	Free	Solo	1
1	Console	Andorra	Silver	Solo	1
2	Console	Angola	Gold	Multiplayer	1
3	Console	Anguilla	Gold	Multiplayer	1
4	Console	Azerbaijan	Platinum	Solo	1
5	Console	Bangladesh	Silver	Co-op	1
6	Console	Belgium	Silver	Co-op	1
7	Console	Benin	Gold	Co-op	1
8	Console	Bhutan	Free	Multiplayer	1
9	Console	Bhutan	Platinum	Co-op	1

🌟 5. Characteristics of High-Value or High-Retention Users

Here, we analyze what makes certain users more valuable or loyal. These users tend to stay longer, engage more, or contribute more revenue.

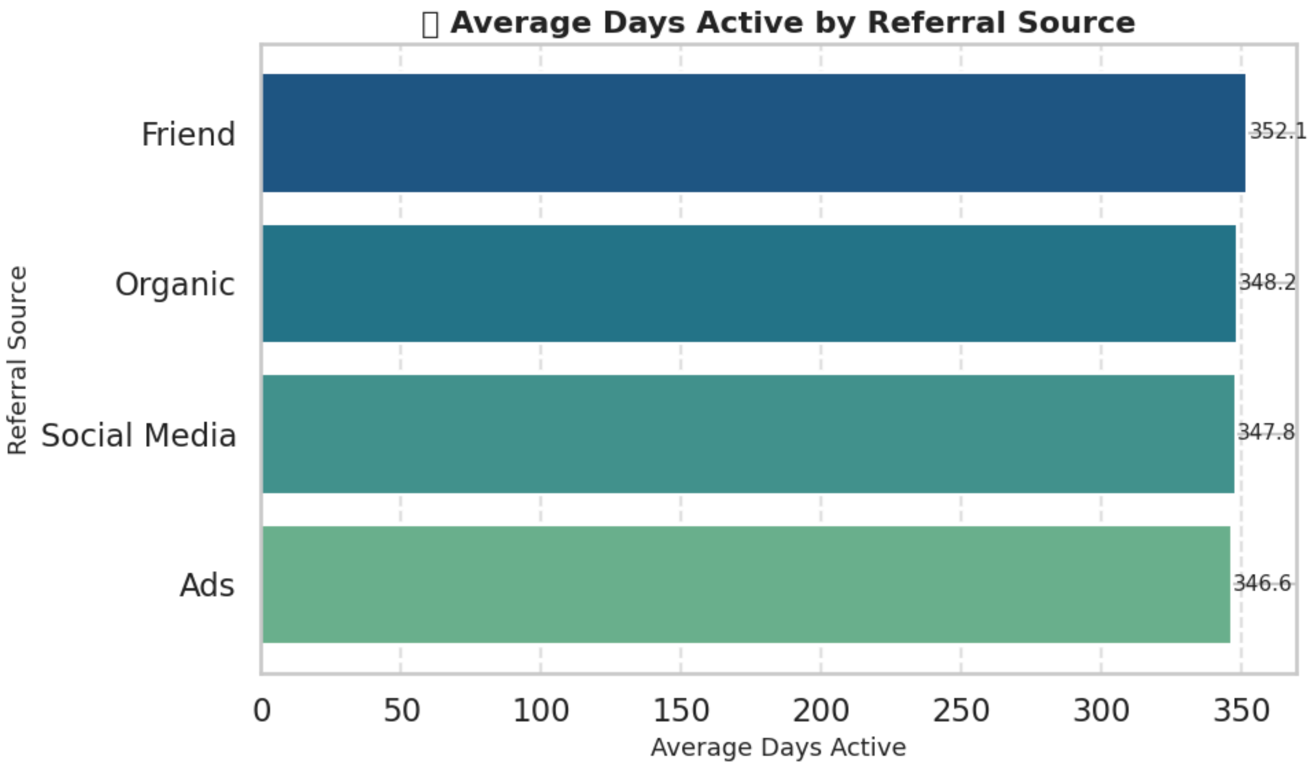
Focus Areas:

- Frequency and length of usage sessions
- Early engagement after signup
- Use of specific high-value features or tools

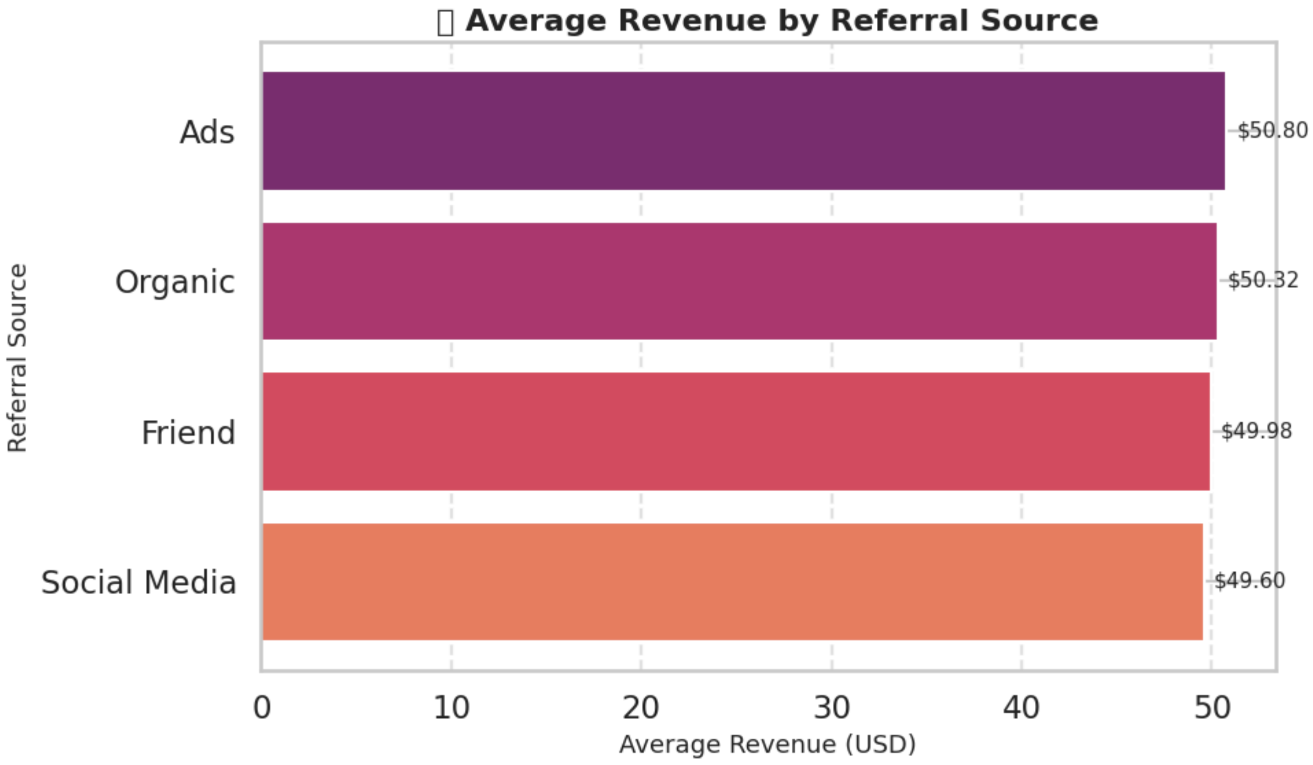
Understanding what high-retention users do differently can help replicate their behavior across the wider user base.

```
# Set seaborn theme
sns.set_theme(style="whitegrid")
sns.set_context("talk")

# Prepare retention and revenue data
referral_retention = df.groupby('Referral_Source')['Days_Active'].mean().sort_values()
referral_revenue = df.groupby('Referral_Source')['Total_Revenue_USD'].mean().sort_values()

# 🎯 Plot 1: Average Days Active by Referral Source
plt.figure(figsize=(10, 6))
colors_retention = sns.color_palette("crest", len(referral_retention))
bars = plt.barh(referral_retention.index, referral_retention.values, color=colors_retention)
plt.title("📅 Average Days Active by Referral Source", fontsize=16, fontweight='bold')
plt.xlabel("Average Days Active", fontsize=13)
plt.ylabel("Referral Source", fontsize=13)
plt.grid(axis='x', linestyle='--', alpha=0.5)
for bar in bars:
    plt.text(bar.get_width() + 0.5, bar.get_y() + bar.get_height() / 2,
             f"{bar.get_width():.1f}", va='center', fontsize=11)
plt.tight_layout()
plt.show()

# 💰 Plot 2: Average Revenue by Referral Source
plt.figure(figsize=(10, 6))
colors_revenue = sns.color_palette("flare", len(referral_revenue))
bars = plt.barh(referral_revenue.index, referral_revenue.values, color=colors_revenue)
plt.title("💰 Average Revenue by Referral Source", fontsize=16, fontweight='bold')
plt.xlabel("Average Revenue (USD)", fontsize=13)
plt.ylabel("Referral Source", fontsize=13)
plt.grid(axis='x', linestyle='--', alpha=0.5)
for bar in bars:
    plt.text(bar.get_width() + 0.5, bar.get_y() + bar.get_height() / 2,
             f"${bar.get_width():.2f}", va='center', fontsize=11)
plt.tight_layout()
plt.show()
```

```
<ipython-input-13-2c3d7a7f3cc9>:20: UserWarning: Glyph 128197 (\N{CALENDAR}) missing from font(s) DejaVu Sans.
  plt.tight_layout()
/usr/local/lib/python3.11/dist-packages/IPython/core/pylabtools.py:151: UserWarning: Glyph 128197 (\N{CALENDAR}) mis:
  fig.canvas.print_figure(bytes_io, **kw)
```



```
<ipython-input-13-2c3d7a7f3cc9>:34: UserWarning: Glyph 128176 (\N{MONEY BAG}) missing from font(s) DejaVu Sans.
  plt.tight_layout()
/usr/local/lib/python3.11/dist-packages/IPython/core/pylabtools.py:151: UserWarning: Glyph 128176 (\N{MONEY BAG}) mis:
  fig.canvas.print_figure(bytes_io, **kw)
```



```
from IPython.display import display, Markdown

sections = [

    "### 📌 Summary of Key Insights\n\n| Area | Insight |\n|------|---------|\n| **Behavioral Patterns** | Peak usage tim
]

# Display each section as markdown
for sec in sections:
    display(Markdown(sec))
```