Load the Data

In [1]:
```
import pandas as pd
import zipfile
import os

# Function to load CSV from a ZIP file with multiple files
def load_csv_from_zip(zip_path, csv_filename):
    with zipfile.ZipFile(zip_path, 'r') as z:
        # Extract and read the specific CSV file
        with z.open(csv_filename) as f:
            return pd.read_csv(f)

# Define the relative path to the datasets folder
datasets_path = os.path.join('..', 'Datasets')

# Load datasets from zipped CSV files specifying the correct CSV filenames
df_gb = load_csv_from_zip(os.path.join(datasets_path, 'GBvideos.csv.zip'), 'GB
df_us = load_csv_from_zip(os.path.join(datasets_path, 'USvideos.csv.zip'), 'US

# Add a new column 'location' in each data file
df_gb['location'] = 'Great Britain'
df_us['location'] = 'USA'

# Merge 5 files into 1
merged_df = pd.concat([df_gb, df_us], ignore_index=True)

# Check the first few rows of the merged DataFrame
print(merged_df.head())
```

```
      video_id trending_date  \
0  Jw1Y-zhQURU      17.14.11
1  3s1rvMFUweQ      17.14.11
2  n1WpP7iowLc      17.14.11
3  PUTEiSjKwJU      17.14.11
4  rHwDegptbI4      17.14.11

                                                title  \
0      John Lewis Christmas Ad 2017 - #MozTheMonster
1          Taylor Swift: …Ready for It? (Live) - SNL
2         Eminem - Walk On Water (Audio) ft. Beyoncé
3  Goals from Salford City vs Class of 92 and Fri...
4  Dashcam captures truck's near miss with child ...

                channel_title  category_id              publish_time  \
0                  John Lewis           26  2017-11-10T07:38:29.000Z
1         Saturday Night Live           24  2017-11-12T06:24:44.000Z
2                  EminemVEVO           10  2017-11-10T17:00:03.000Z
3  Salford City Football Club           17  2017-11-13T02:30:38.000Z
4            Cute Girl Videos           25  2017-11-13T01:45:13.000Z

                                                tags     views   likes  \
0  christmas|"john lewis christmas"|"john lewis"|...   7224515   55681
1  SNL|"Saturday Night Live"|"SNL Season 43"|"Epi...   1053632   25561
2  Eminem|"Walk"|"On"|"Water"|"Aftermath/Shady/In...  17158579  787420
3  Salford City FC|"Salford City"|"Salford"|"Clas...     27833     193
4                                           [none]      9815      30

   dislikes  comment_count                                thumbnail_link  \
0     10247           9479  https://i.ytimg.com/vi/Jw1Y-zhQURU/default.jpg
1      2294           2757  https://i.ytimg.com/vi/3s1rvMFUweQ/default.jpg
2     43420         125882  https://i.ytimg.com/vi/n1WpP7iowLc/default.jpg
3        12             37  https://i.ytimg.com/vi/PUTEiSjKwJU/default.jpg
4         2             30  https://i.ytimg.com/vi/rHwDegptbI4/default.jpg

   comments_disabled  ratings_disabled  video_error_or_removed  \
0              False             False                   False
1              False             False                   False
2              False             False                   False
3              False             False                   False
4              False             False                   False

                                         description       location
0  Click here to continue the story and make your...  Great Britain
1  Musical guest Taylor Swift performs …Ready for...  Great Britain
2  Eminem's new track Walk on Water ft. Beyoncé i...  Great Britain
3  Salford drew 4-4 against the Class of 92 and F...  Great Britain
4  Dashcam captures truck's near miss with child ...  Great Britain
```

Check Missing Values

In [2]:
```
# Check for missing values in the merged DataFrame
print("Missing values")
print(merged_df.isnull().sum())
```

```
Missing values
video_id                    0
trending_date               0
title                       0
channel_title               0
category_id                 0
publish_time                0
tags                        0
views                       0
likes                       0
dislikes                    0
comment_count               0
thumbnail_link              0
comments_disabled           0
ratings_disabled            0
video_error_or_removed      0
description              1182
location                    0
dtype: int64
```

In [3]:
```
df = merged_df.dropna()
```

In [4]:
```
# Check for missing values in the merged DataFrame
print("Missing values")
print(df.isnull().sum())
```

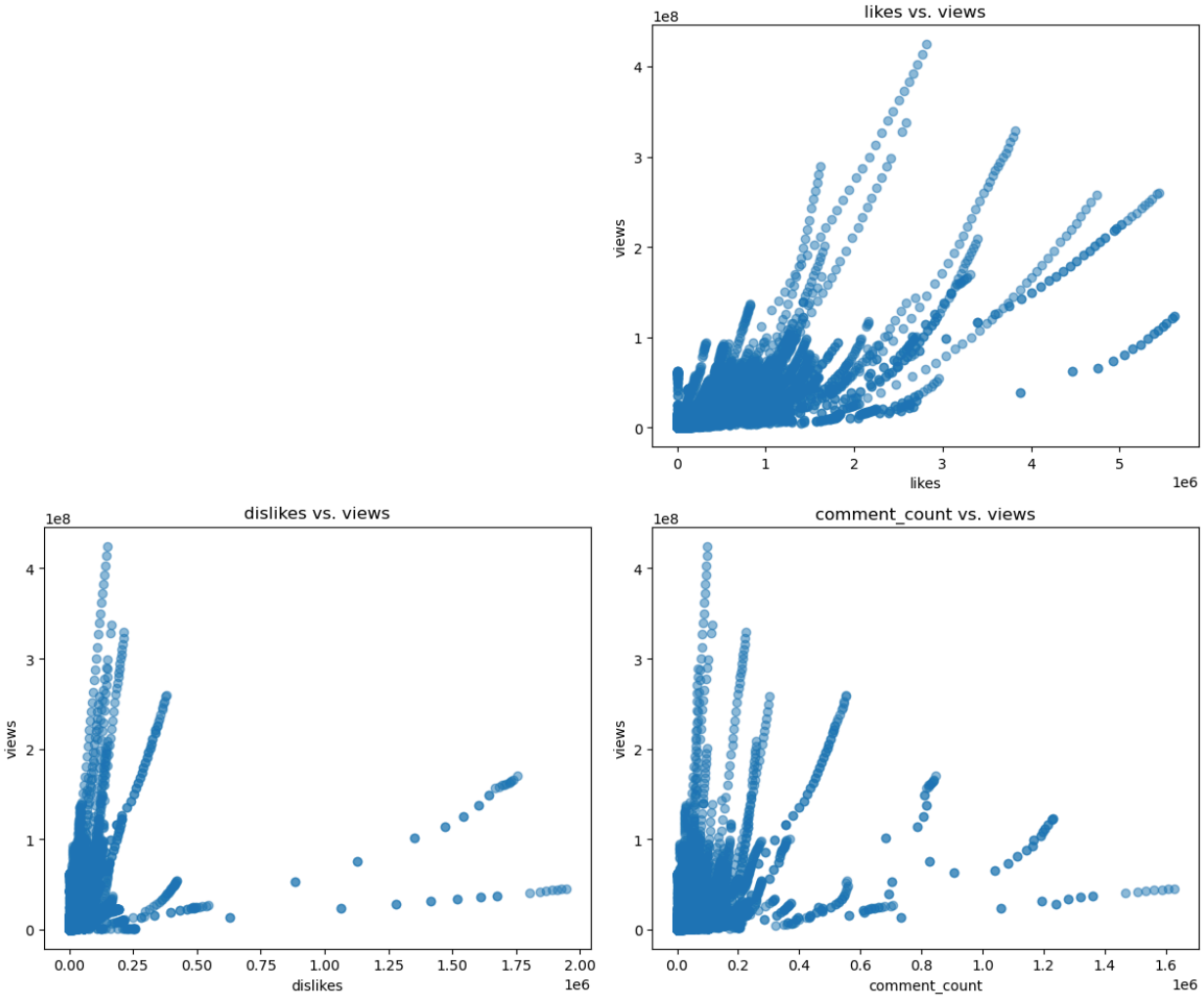
```
Missing values
video_id                  0
trending_date             0
title                     0
channel_title             0
category_id               0
publish_time              0
tags                      0
views                     0
likes                     0
dislikes                  0
comment_count             0
thumbnail_link            0
comments_disabled         0
ratings_disabled          0
video_error_or_removed    0
description               0
location                  0
dtype: int64
```

Exploratory Data Analysis (EDA)

Check Outliers

In [5]:
```
import seaborn as sns
import matplotlib.pyplot as plt

# Define numerical columns
numerical_columns = ['views', 'likes', 'dislikes', 'comment_count']
```

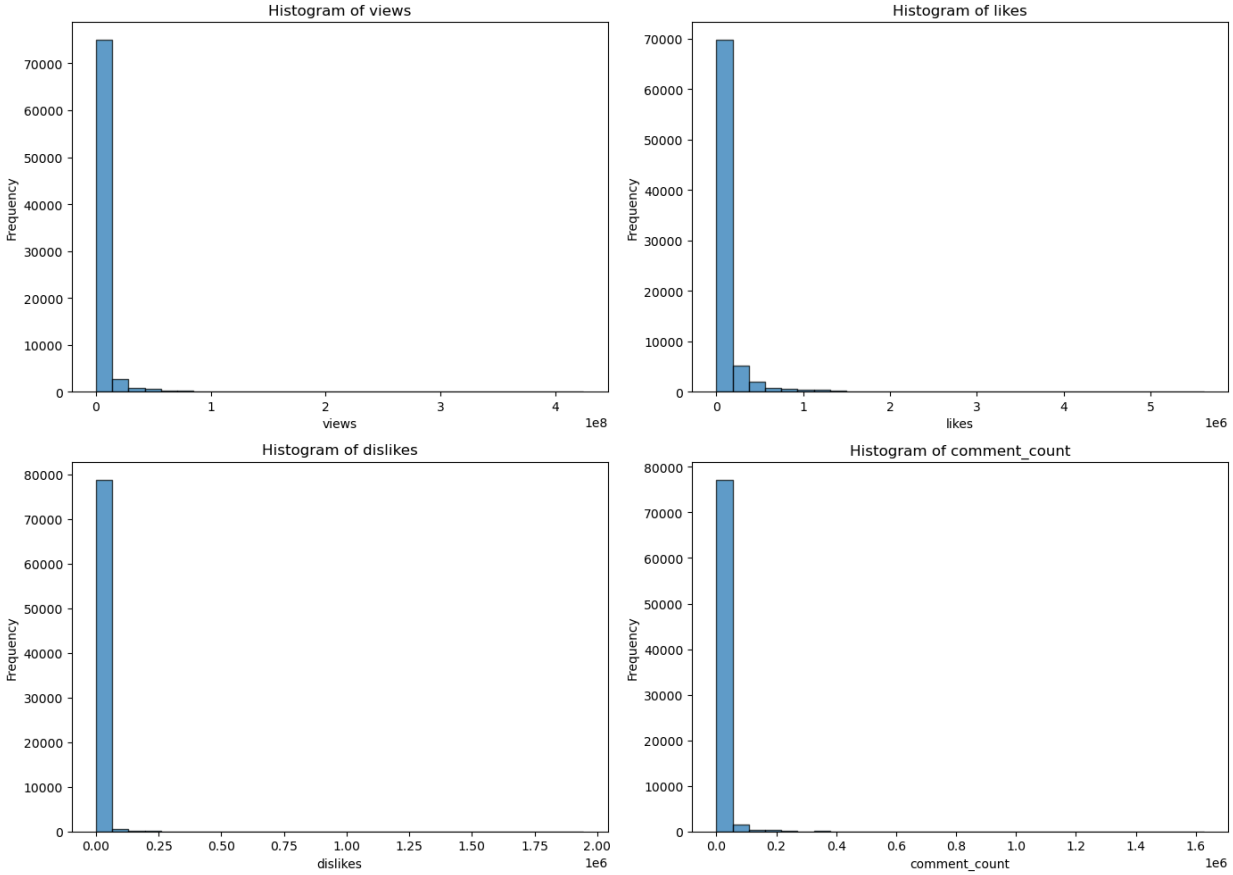
```
# Scatter plots for each numerical column vs. 'views'
plt.figure(figsize=(12, 10))
for i, column in enumerate(numerical_columns, 1):
    if column != 'views':
        plt.subplot(2, 2, i)
        plt.scatter(merged_df[column], merged_df['views'], alpha=0.5)
        plt.title(f'{column} vs. views')
        plt.xlabel(column)
        plt.ylabel('views')

plt.tight_layout()
plt.show()
```



EDA for Numerical Variables

In [6]:
```
#data exploration for numerical columns
import matplotlib.pyplot as plt

# Define numerical columns
numerical_columns = ['views', 'likes', 'dislikes', 'comment_count']

# Create histograms for each numerical column
plt.figure(figsize=(14, 10))
for i, column in enumerate(numerical_columns, 1):
```

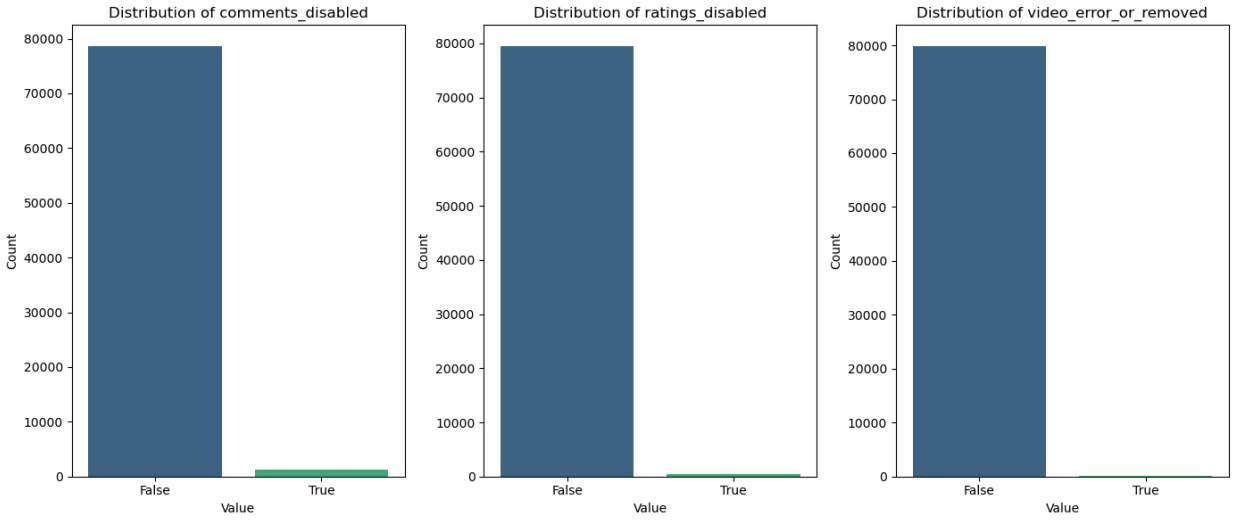
```
    plt.subplot(2, 2, i)
    plt.hist(merged_df[column], bins=30, alpha=0.7, edgecolor='black')
    plt.title(f'Histogram of {column}')
    plt.xlabel(column)
    plt.ylabel('Frequency')

plt.tight_layout()
plt.show()
```



EDA for Boolean Variables

In [7]:

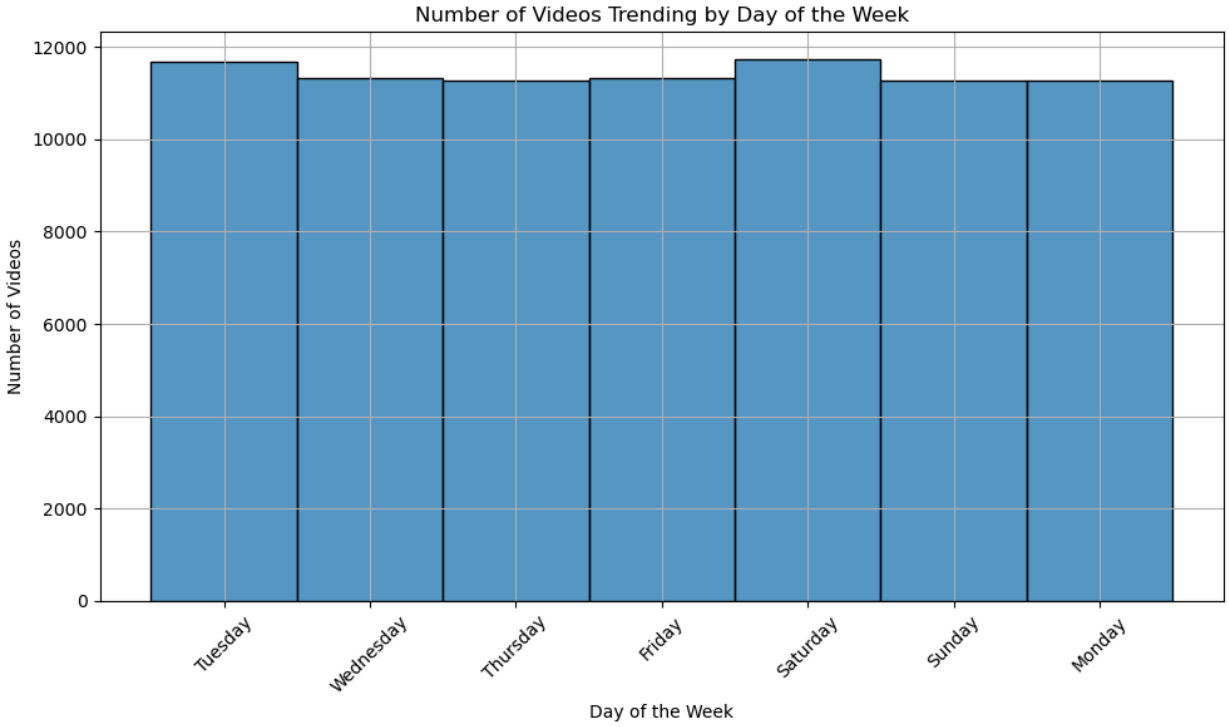
```
import seaborn as sns

# Define boolean columns
boolean_columns = ['comments_disabled', 'ratings_disabled', 'video_error_or_re

# Plot bar plots for each boolean column
plt.figure(figsize=(14, 6))
for i, column in enumerate(boolean_columns, 1):
    plt.subplot(1, 3, i)
    # Count the occurrences of each boolean value
    counts = merged_df[column].value_counts()
    # Plot bar plot
    sns.barplot(x=counts.index, y=counts.values, palette='viridis')
    plt.title(f'Distribution of {column}')
    plt.xlabel('Value')
    plt.ylabel('Count')

plt.tight_layout()
plt.show()
```



EDA for Date-Time Variables

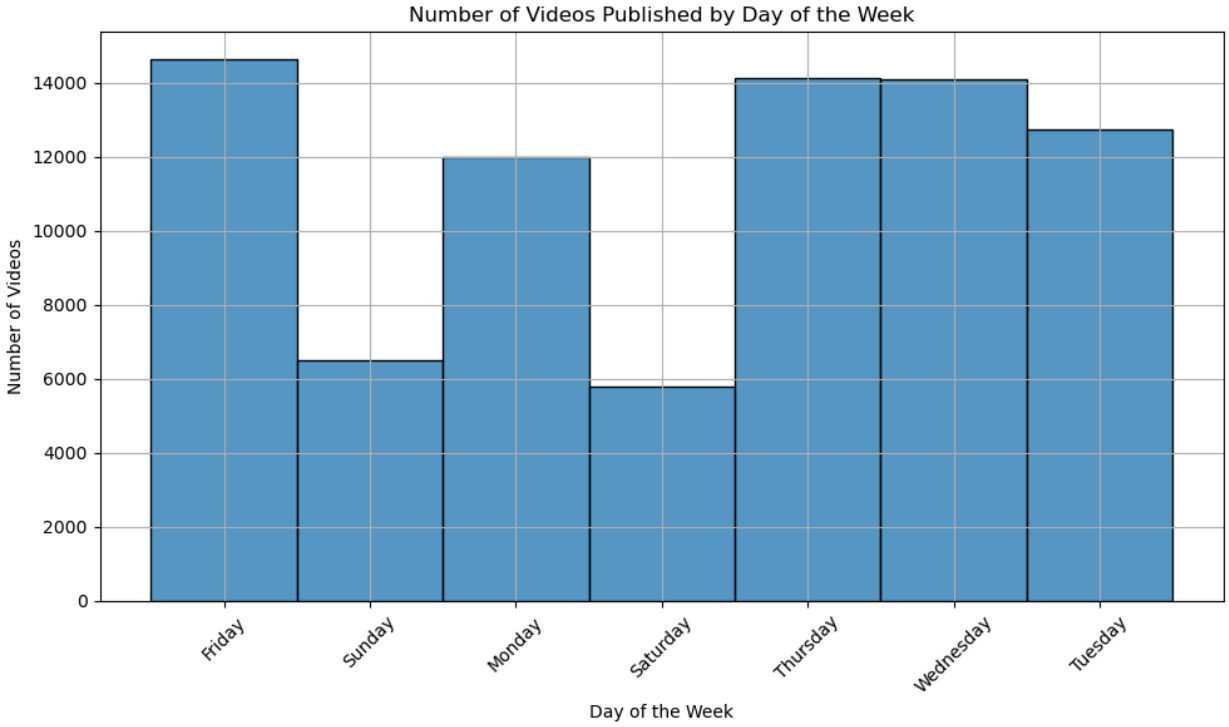
In [8]:
```
# convert the trending_date to datetime type
merged_df['trending_date'] = pd.to_datetime(merged_df['trending_date'], format=
# Extract day of the week from 'trending_date'
merged_df['trending_day_of_week'] = merged_df['trending_date'].dt.day_name()

# Plot histogram of trending day of the week
plt.figure(figsize=(10, 6))
sns.histplot(merged_df['trending_day_of_week'], discrete=True, palette='viridis
plt.title('Number of Videos Trending by Day of the Week')
plt.xlabel('Day of the Week')
plt.ylabel('Number of Videos')
plt.xticks(rotation=45)  # Rotate x-axis labels for better readability
plt.grid(True)
plt.tight_layout()
plt.show()
```

```
/var/folders/yn/hnpfh1r15tq8t0xq_j4_rzmh0000gn/T/ipykernel_76892/1621989413.p
y:8: UserWarning: Ignoring `palette` because no `hue` variable has been assign
ed.
  sns.histplot(merged_df['trending_day_of_week'], discrete=True, palette='viri
dis')
```



In [9]:
```
#convert the publish_date to datetime type
merged_df['publish_time'] = pd.to_datetime(merged_df['publish_time'], format='s
# Extract day of the week from 'publish_time'
merged_df['day_of_week'] = merged_df['publish_time'].dt.day_name()

# Plot histogram of day of the week
plt.figure(figsize=(10, 6))
sns.histplot(merged_df['day_of_week'], discrete=True, palette='viridis')
plt.title('Number of Videos Published by Day of the Week')
plt.xlabel('Day of the Week')
plt.ylabel('Number of Videos')
plt.xticks(rotation=45)
plt.grid(True)
plt.tight_layout()
plt.show()
```

```
/var/folders/yn/hnpfh1r15tq8t0xq_j4_rzmh0000gn/T/ipykernel_76892/1346077495.p
y:8: UserWarning: Ignoring `palette` because no `hue` variable has been assign
ed.
  sns.histplot(merged_df['day_of_week'], discrete=True, palette='viridis')
```



Statistical Description

In [10]:
```
numerical_description = merged_df.describe()
print(numerical_description)
```

```
                      trending_date   category_id  \
count                         79865  79865.000000
mean   2018-02-25 07:57:45.132410880     18.440205
min              2017-11-14 00:00:00      1.000000
25%              2018-01-02 00:00:00     10.000000
50%              2018-02-23 00:00:00     22.000000
75%              2018-04-21 00:00:00     24.000000
max              2018-06-14 00:00:00     43.000000
std                              NaN      7.818304

                       publish_time         views         likes  \
count                         79865  7.986500e+04  7.986500e+04
mean   2018-01-30 08:51:14.599436544  4.091166e+06  1.036262e+05
min              2006-07-23 08:24:11  5.490000e+02  0.000000e+00
25%              2017-12-22 15:58:16  2.464170e+05  5.642000e+03
50%              2018-02-14 05:01:24  7.961060e+05  2.092200e+04
75%              2018-04-09 08:59:51  2.535704e+06  7.824800e+04
max              2018-06-14 01:31:53  4.245389e+08  5.613827e+06
std                              NaN  1.439125e+07  2.957265e+05

           dislikes  comment_count
count  7.986500e+04   7.986500e+04
mean   5.612328e+03   1.070850e+04
min    0.000000e+00   0.000000e+00
25%    2.010000e+02   6.420000e+02
50%    7.120000e+02   2.099000e+03
75%    2.527000e+03   7.220000e+03
max    1.944971e+06   1.626501e+06
std    4.124462e+04   4.443679e+04
```

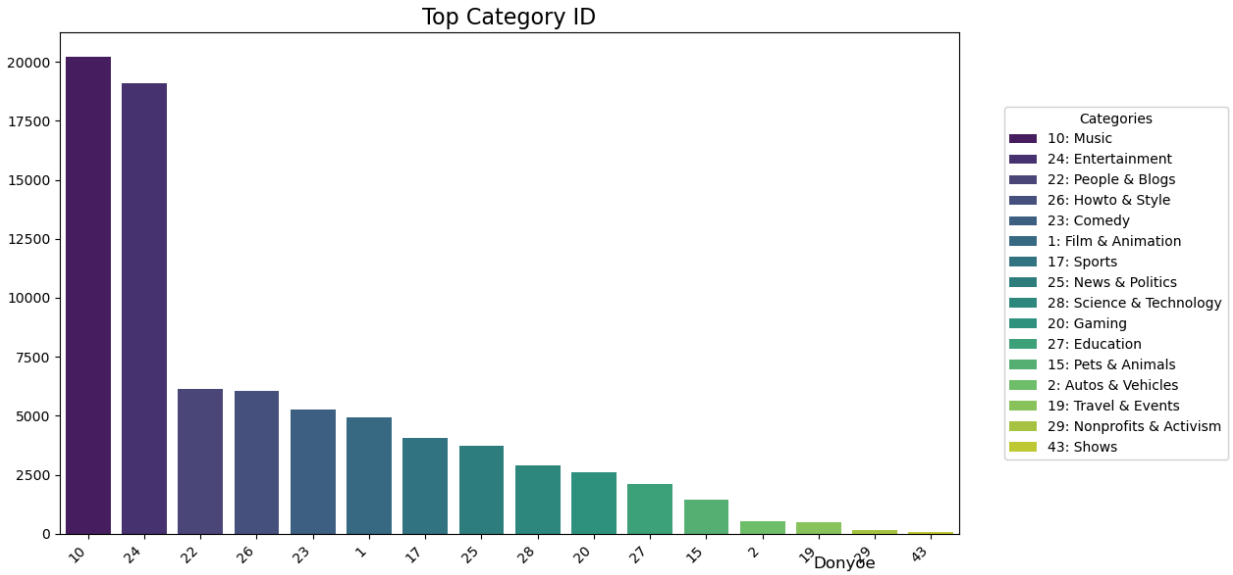
In [11]:
```
# Statistical description of categorical columns
categorical_description = merged_df[['category_id', 'location']].describe()
print(categorical_description)
```

```
        category_id
count  79865.000000
mean      18.440205
std        7.818304
min        1.000000
25%       10.000000
50%       22.000000
75%       24.000000
max       43.000000
```

Visualization for Categorical ID

In [12]:
```
import matplotlib.pyplot as plt
import seaborn as sns
import pandas as pd

# Group by 'category_id' and count occurrences
category_counts = merged_df.groupby('category_id').size().reset_index(name='N'

# Sort by 'N' in descending order
category_counts = category_counts.sort_values(by='N', ascending=False)
category_counts['category_id'] = pd.Categorical(category_counts['category_id']

# Create a dictionary to map 'category_id' to descriptive names
category_names = {
    1: "1: Film & Animation",
    2: "2: Autos & Vehicles",
    10: "10: Music",
    15: "15: Pets & Animals",
    17: "17: Sports",
    18: "18: Short Movies",
    19: "19: Travel & Events",
    20: "20: Gaming",
    21: "21: Videoblogging",
    22: "22: People & Blogs",
    23: "23: Comedy",
    24: "24: Entertainment",
    25: "25: News & Politics",
    26: "26: Howto & Style",
    27: "27: Education",
    28: "28: Science & Technology",
    29: "29: Nonprofits & Activism",
    30: "30: Movies",
    31: "31: Anime/Animation",
    32: "32: Action/Adventure",
    33: "33: Classics",
    34: "34: Comedy",
    35: "35: Documentary",
    36: "36: Drama",
    37: "37: Family",
    38: "38: Foreign",
    39: "39: Horror",
    40: "40: Sci-Fi/Fantasy",
```

```
    41: "41: Thriller",
    42: "42: Shorts",
    43: "43: Shows",
    44: "44: Trailers"
}

# Map 'category_id' to names in the 'category_counts' DataFrame
category_counts['category_name'] = category_counts['category_id'].map(category_

# Plot using seaborn
plt.figure(figsize=(10, 6))
barplot = sns.barplot(data=category_counts, x='category_id', y='N', palette='v

# Customize the plot to match your ggplot2 example
plt.title("Top Category ID", fontsize=16)
plt.xlabel(None)
plt.ylabel(None)
plt.xticks(rotation=45, ha='right')
plt.tight_layout()
plt.figtext(0.9, 0.02, "Donyoe", horizontalalignment='right', fontsize=12)

# Add a custom legend for category names on the side
handles = barplot.patches
legend_labels = [category_names[int(c)] for c in category_counts['category_id']

# Position the legend on the right of the plot using 'bbox_to_anchor'
plt.legend(handles=handles[:len(legend_labels)], labels=legend_labels, title='(
           bbox_to_anchor=(1.05, 0.5), loc='center left', borderaxespad=0)

plt.show()
```



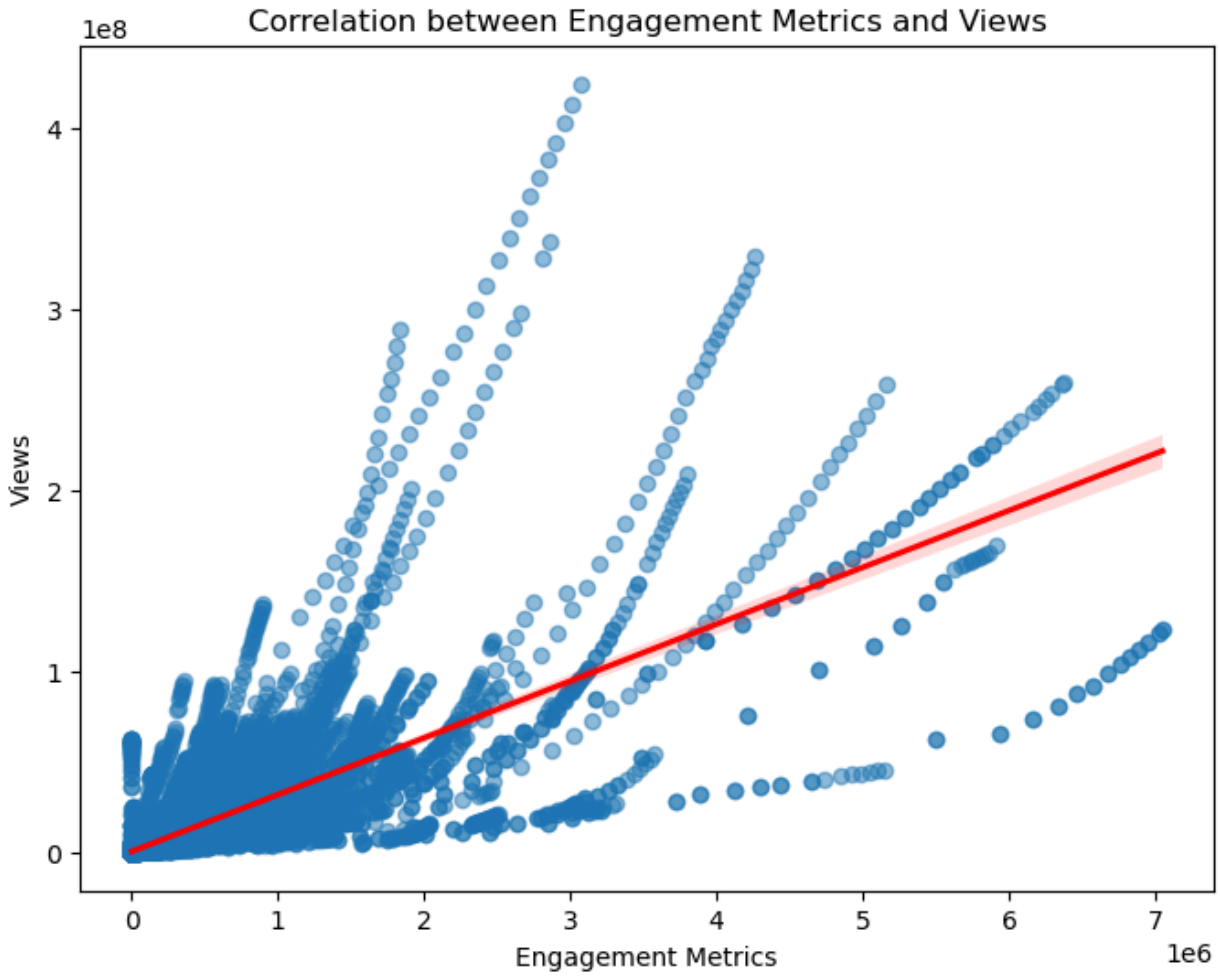
Data Transformation-Create Engagement Metrics

In [13]:
```
# Create a new column
merged_df['Engagement Metrics'] = merged_df['likes'] + merged_df['dislikes'] +
# Display the DataFrame to check the new column
print(merged_df[['likes', 'dislikes', 'comment_count', 'Engagement Metrics']].h
```

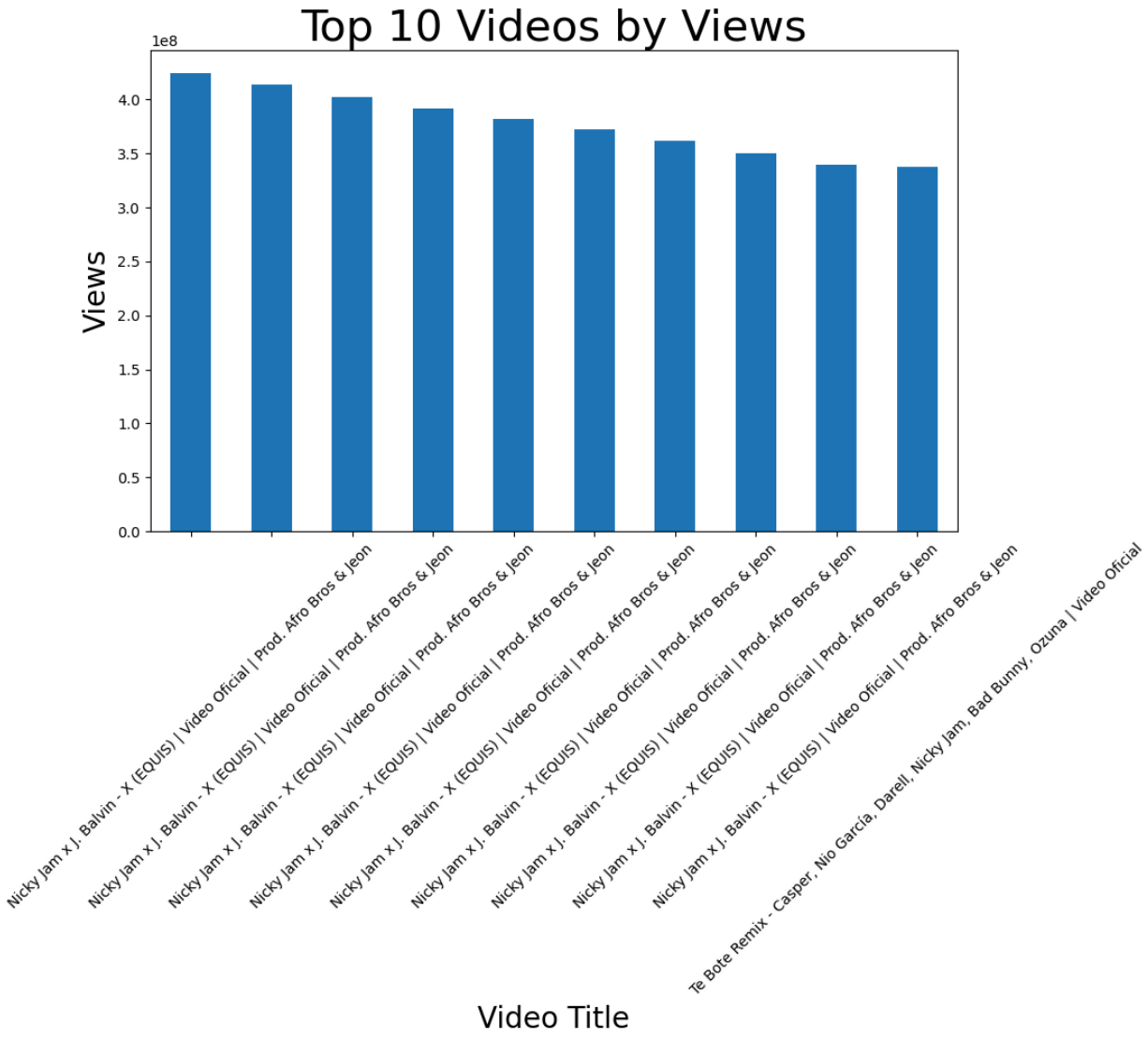
	likes	dislikes	comment_count	Engagement Metrics
0	55681	10247	9479	75407
1	25561	2294	2757	30612
2	787420	43420	125882	956722
3	193	12	37	242
4	30	2	30	62

Visualization-Engagement Metrics

In [14]:
```
# Create a scatter plot with a regression line
plt.figure(figsize=(8, 6))
sns.regplot(x='Engagement Metrics', y='views', data=merged_df, scatter_kws={'a
plt.title('Correlation between Engagement Metrics and Views')
plt.xlabel('Engagement Metrics')
plt.ylabel('Views')
plt.show()
```



In [15]:
```
top_videos = merged_df.nlargest(10, 'views')[['title', 'views']]


top_videos.set_index('title')['views'].plot(kind='bar', figsize=(10, 6))
plt.xlabel('Video Title',fontsize=20)
plt.ylabel('Views',fontsize=20)
plt.title('Top 10 Videos by Views',fontsize=30)
plt.xticks(rotation=45)
plt.show()
```



In [16]:

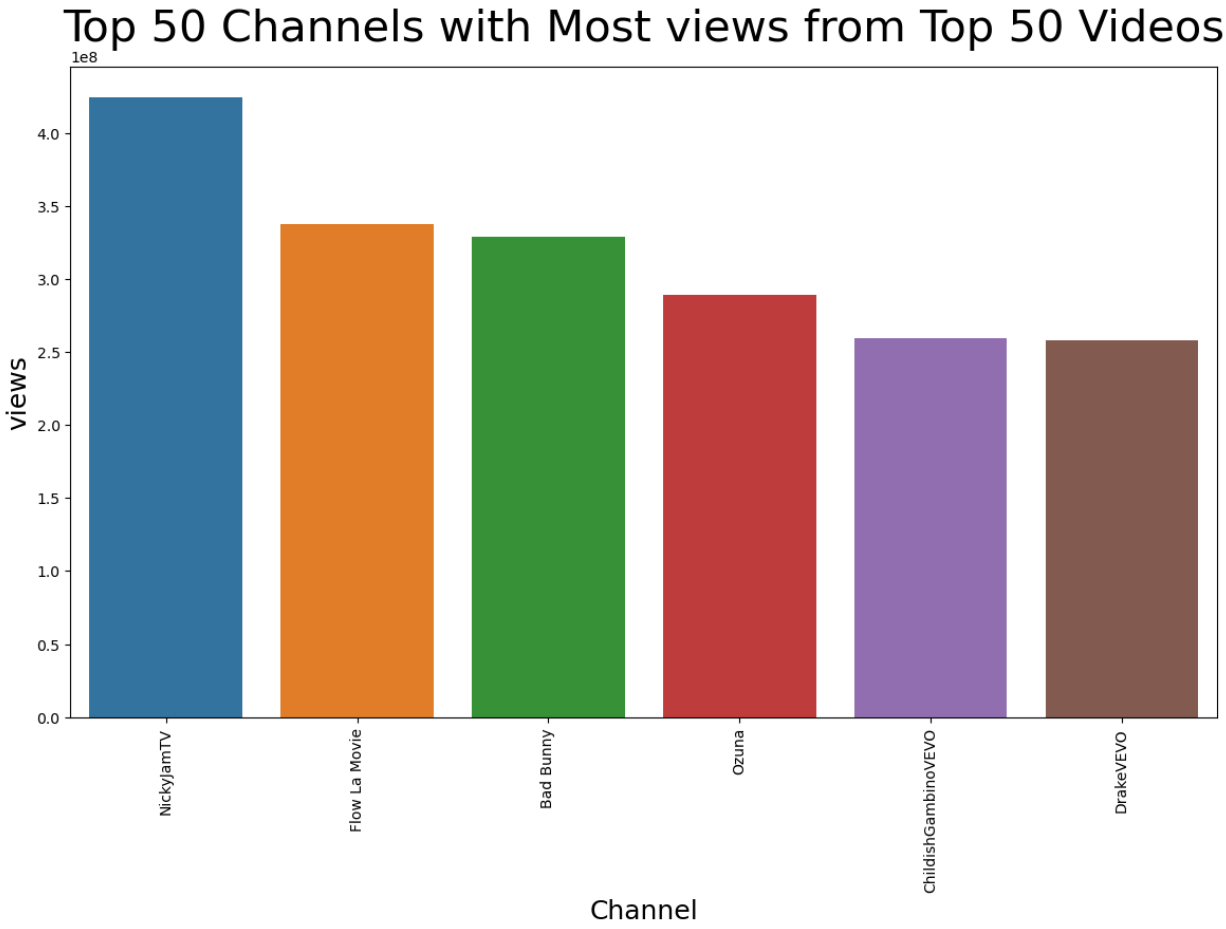
```
# Engagement metrics for top 50 videos
top_50_videos = merged_df.nlargest(50, 'views')
print(top_50_videos[['title', 'Engagement Metrics','location']])
```

```
                                                    title  Engagement Metrics
\
28412  Nicky Jam x J. Balvin - X (EQUIS) | Video Ofic...              3067426
28212  Nicky Jam x J. Balvin - X (EQUIS) | Video Ofic...              3011515
28008  Nicky Jam x J. Balvin - X (EQUIS) | Video Ofic...              2956724
27811  Nicky Jam x J. Balvin - X (EQUIS) | Video Ofic...              2902891
27615  Nicky Jam x J. Balvin - X (EQUIS) | Video Ofic...              2845332
27424  Nicky Jam x J. Balvin - X (EQUIS) | Video Ofic...              2786627
27241  Nicky Jam x J. Balvin - X (EQUIS) | Video Ofic...              2723032
27052  Nicky Jam x J. Balvin - X (EQUIS) | Video Ofic...              2650114
26861  Nicky Jam x J. Balvin - X (EQUIS) | Video Ofic...              2582218
34460  Te Bote Remix - Casper, Nio García, Darell, Ni...              2862074
25545              Bad Bunny - Amorfoda | Video Oficial               4264625
34292  Te Bote Remix - Casper, Nio García, Darell, Ni...              2813339
26671  Nicky Jam x J. Balvin - X (EQUIS) | Video Ofic...              2505131
25341              Bad Bunny - Amorfoda | Video Oficial               4231351
25137              Bad Bunny - Amorfoda | Video Oficial               4198350
26477  Nicky Jam x J. Balvin - X (EQUIS) | Video Ofic...              2427694
24935              Bad Bunny - Amorfoda | Video Oficial               4167420
24738              Bad Bunny - Amorfoda | Video Oficial               4135956
24540              Bad Bunny - Amorfoda | Video Oficial               4103146
26280  Nicky Jam x J. Balvin - X (EQUIS) | Video Ofic...              2350490
33729  Te Bote Remix - Casper, Nio García, Darell, Ni...              2661680
24339              Bad Bunny - Amorfoda | Video Oficial               4062651
33613  Te Bote Remix - Casper, Nio García, Darell, Ni...              2610210
24137              Bad Bunny - Amorfoda | Video Oficial               4026487
21162          Ozuna x Romeo Santos - El Farsante Remix               1836833
26079  Nicky Jam x J. Balvin - X (EQUIS) | Video Ofic...              2269962
23938              Bad Bunny - Amorfoda | Video Oficial               3996243
20957          Ozuna x Romeo Santos - El Farsante Remix               1815236
23728              Bad Bunny - Amorfoda | Video Oficial               3966424
33441  Te Bote Remix - Casper, Nio García, Darell, Ni...              2538184
25883  Nicky Jam x J. Balvin - X (EQUIS) | Video Ofic...              2192147
23528              Bad Bunny - Amorfoda | Video Oficial               3930504
20752          Ozuna x Romeo Santos - El Farsante Remix               1792693
23324              Bad Bunny - Amorfoda | Video Oficial               3894230
33270  Te Bote Remix - Casper, Nio García, Darell, Ni...              2474011
25688  Nicky Jam x J. Balvin - X (EQUIS) | Video Ofic...              2107200
20551          Ozuna x Romeo Santos - El Farsante Remix               1768430
23122              Bad Bunny - Amorfoda | Video Oficial               3849549
38401  Childish Gambino - This Is America (Official V...              6377774
38235  Childish Gambino - This Is America (Official V...              6356524
25936                                 Drake - God’s Plan              5156827
33106  Te Bote Remix - Casper, Nio García, Darell, Ni...              2412367
38056  Childish Gambino - This Is America (Official V...              6286180
20353          Ozuna x Romeo Santos - El Farsante Remix               1741314
25482  Nicky Jam x J. Balvin - X (EQUIS) | Video Ofic...              2031387
22926              Bad Bunny - Amorfoda | Video Oficial               3791325
37879  Childish Gambino - This Is America (Official V...              6243463
25741                                 Drake - God’s Plan              5089683
37705  Childish Gambino - This Is America (Official V...              6193738
32939  Te Bote Remix - Casper, Nio García, Darell, Ni...              2352426

           location
28412  Great Britain
28212  Great Britain
28008  Great Britain
27811  Great Britain
27615  Great Britain
27424  Great Britain
```

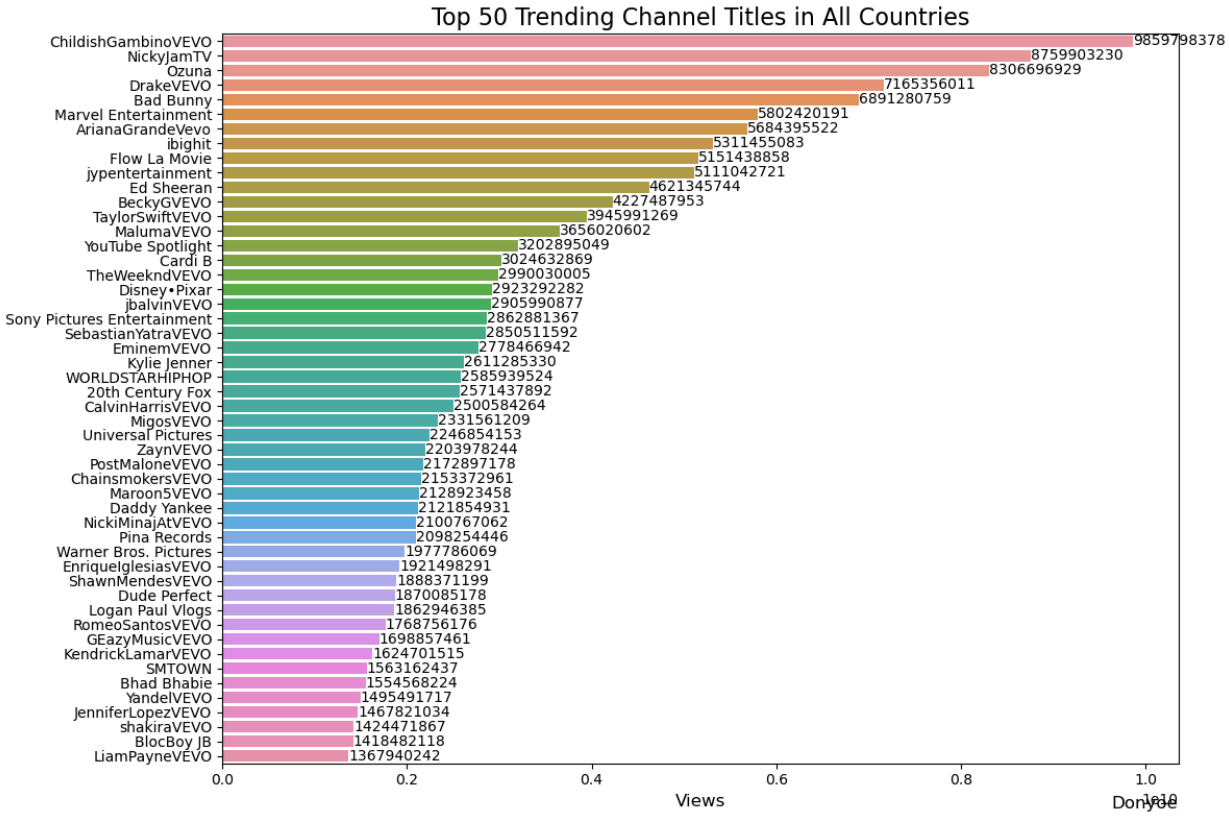
```
27241  Great Britain
27052  Great Britain
26861  Great Britain
34460  Great Britain
25545  Great Britain
34292  Great Britain
26671  Great Britain
25341  Great Britain
25137  Great Britain
26477  Great Britain
24935  Great Britain
24738  Great Britain
24540  Great Britain
26280  Great Britain
33729  Great Britain
24339  Great Britain
33613  Great Britain
24137  Great Britain
21162  Great Britain
26079  Great Britain
23938  Great Britain
20957  Great Britain
23728  Great Britain
33441  Great Britain
25883  Great Britain
23528  Great Britain
20752  Great Britain
23324  Great Britain
33270  Great Britain
25688  Great Britain
20551  Great Britain
23122  Great Britain
38401  Great Britain
38235  Great Britain
25936  Great Britain
33106  Great Britain
38056  Great Britain
20353  Great Britain
25482  Great Britain
22926  Great Britain
37879  Great Britain
25741  Great Britain
37705  Great Britain
32939  Great Britain
```

In [17]:

```
import seaborn as snb
content = top_50_videos.groupby('channel_title')['views'].max()

# Sort values to get the top 50 channels with the most views
content = content.sort_values(ascending=False).head(50)
content = content.reset_index()  # Convert index to column

# Plotting the results
plt.figure(figsize=(14, 8))
snb.barplot(x='channel_title', y='views', data=content)
plt.title('Top 50 Channels with Most views from Top 50 Videos', fontsize=30)
plt.ylabel('views', fontsize=18)
plt.xlabel('Channel', fontsize=18)
plt.xticks(rotation=90)
plt.show()
```



In [18]:
```
channel_counts = merged_df.groupby('channel_title')['views'].sum().reset_index

# Sort values and select top 10 channels
top_10_channels = channel_counts.sort_values(by='views', ascending=False).head

# Plot using seaborn
plt.figure(figsize=(12, 8))
ax = sns.barplot(x='views', y='channel_title', data=top_10_channels,orient='h'

# Add labels
for index, value in enumerate(top_10_channels['views']):
    ax.text(value, index, str(value), va='center', ha='left', color='black')

# Customize the plot
plt.title('Top 50 Trending Channel Titles in All Countries', fontsize=16)
plt.xlabel('Views', fontsize=12)
plt.ylabel(None)
plt.xticks(rotation=0)  # x-axis ticks don't need rotation in horizontal bar p
plt.tight_layout()

# Add caption
plt.figtext(0.95, 0.02, "Donyoe", horizontalalignment='right', fontsize=12)

# Show the plot
plt.show()
```

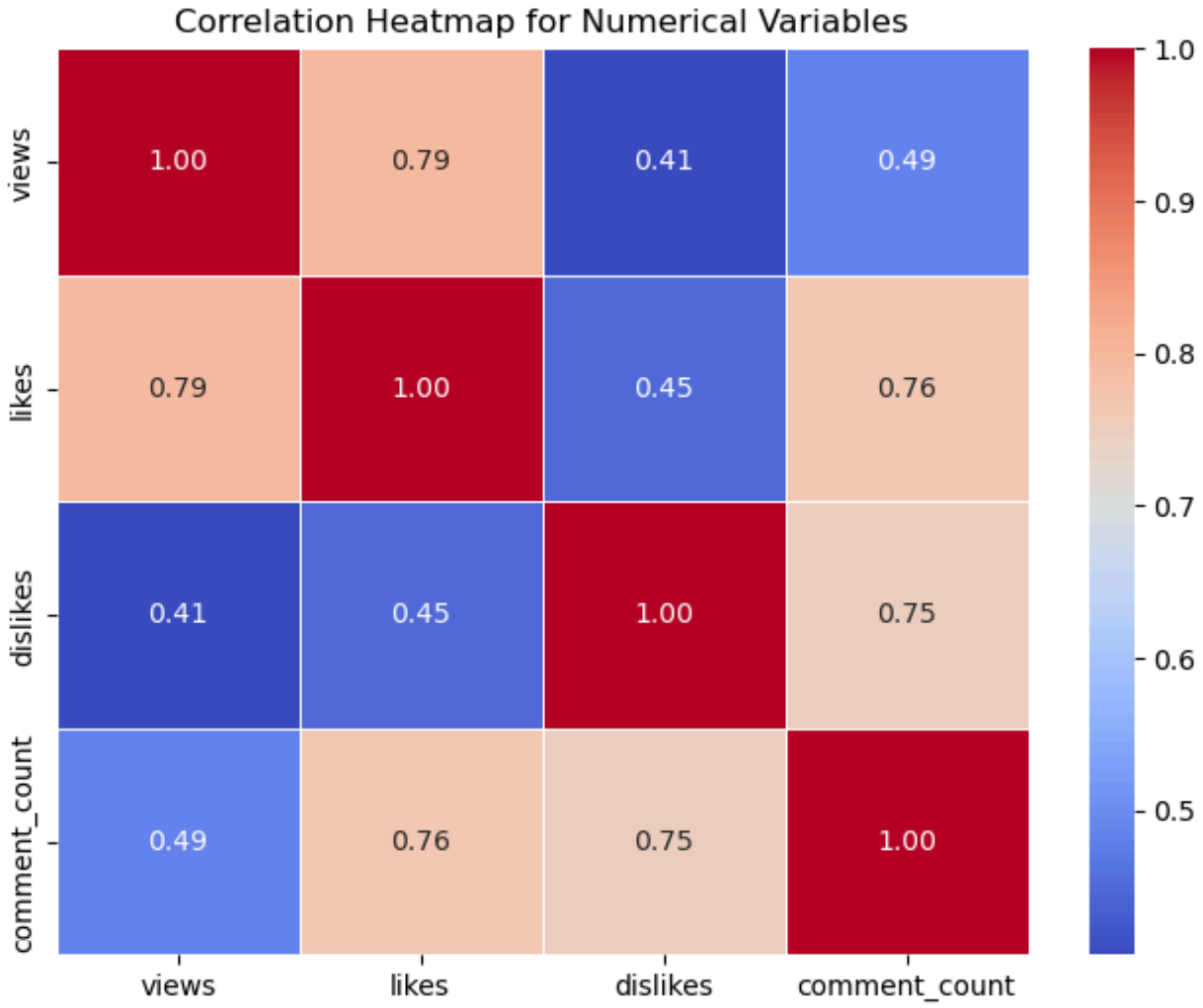


Normalize and Standardize Data

Correlation Metrics for Variables

In [19]:
```
# add category_id to numerical columns
numerical_columns = ['views', 'likes', 'dislikes', 'comment_count', ]

# Compute the correlation matrix
correlation_matrix = merged_df[numerical_columns].corr()
# Display the correlation matrix
print(correlation_matrix)

# Plot the correlation matrix as a heatmap
plt.figure(figsize=(8, 6))
sns.heatmap(correlation_matrix, annot=True, cmap='coolwarm', fmt='.2f', linewi
plt.title('Correlation Heatmap for Numerical Variables')
plt.show()
```

```
                views     likes  dislikes  comment_count
views          1.000000  0.791670  0.405290       0.485986
likes          0.791670  1.000000  0.448010       0.763192
dislikes       0.405290  0.448010  1.000000       0.745064
comment_count  0.485986  0.763192  0.745064       1.000000
```



Assign Score for Numerical Values

In [20]:
```
import pandas as pd

# Assuming the correlation values are manually entered from the heatmap
correlation_values = {
    'likes': 0.784,          # Correlation of likes with views
    'dislikes': 0.416,       # Correlation of dislikes with views
    'comment_count': 0.502 # Correlation of comment_count with views
}

# Convert the correlation values to absolute values
abs_correlations = {key: abs(value) for key, value in correlation_values.items

# Calculate the total sum of absolute correlations
total_correlation = sum(abs_correlations.values())

# Calculate weights by normalizing the absolute correlation values
weights = {key: value / total_correlation for key, value in abs_correlations.i

# Convert the weights to a DataFrame for better visualization
weights_df = pd.DataFrame(list(weights.items()), columns=['Variable', 'Weight']

# Display the weights
```

```
print("Calculated Weights of Independent Variables Relative to 'Views':")
print(weights_df)
```

```
Calculated Weights of Independent Variables Relative to 'Views':
        Variable    Weight
0          likes  0.460635
1       dislikes  0.244418
2  comment_count  0.294947
```

In [21]:

```
import pandas as pd

weights = {
    'likes': 0.460435,
    'dislikes': 0.244418,
    'comment_count': 0.294947
}

merged_df['score'] = (
    weights['likes'] * merged_df['likes'] -
    weights['dislikes'] * merged_df['dislikes'] +
    weights['comment_count'] * merged_df['comment_count']
)

merged_df['rank'] = merged_df['score'].rank(ascending=False, method='min')

df_sorted = merged_df.sort_values(by='rank')

print(df_sorted)

#output_filename = 'ranked_videos_combined.csv'
#df_sorted.to_csv(output_filename, index=False)

#print("Listing of Every Video with Individual Scores and Ranks Across All Loca
#print(df_sorted[['video_id', 'views', 'likes', 'dislikes', 'comment_count', '
#print(f"\nThe ranking of all videos from all locations has been saved to '{ou
```

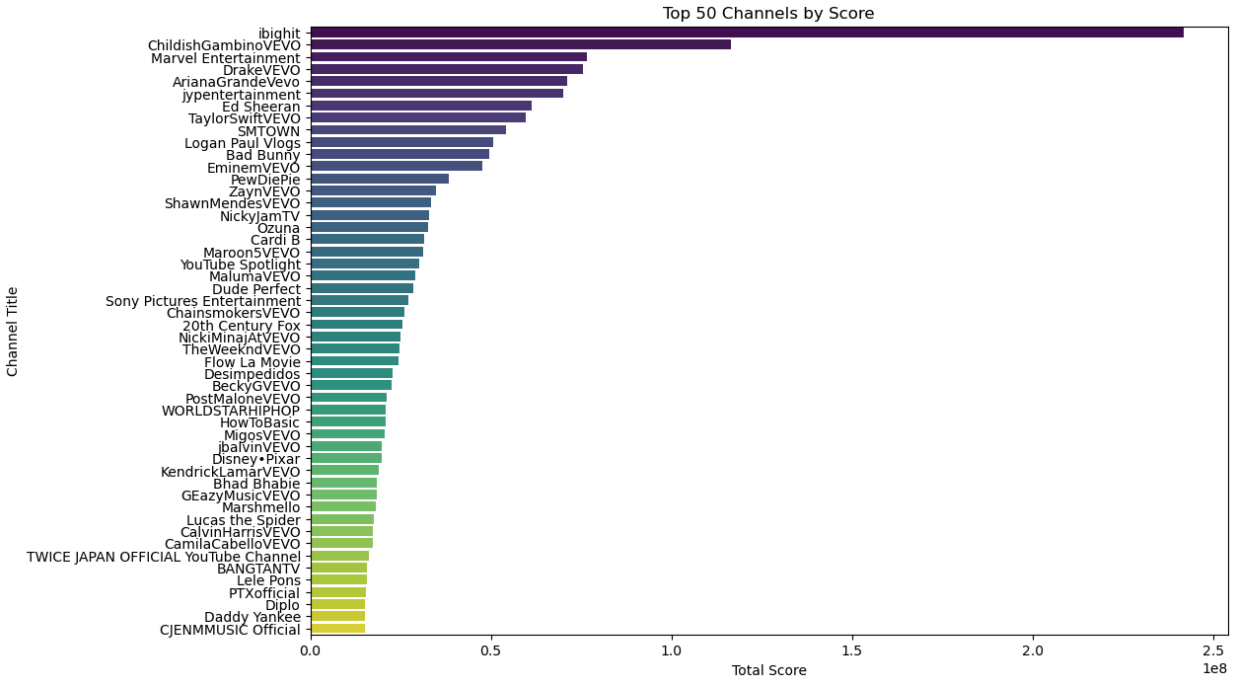
```
          video_id trending_date                                 title  \
36638  7C2z4GqqS5E    2018-06-01    BTS (방탄소년단) 'FAKE LOVE' Official MV
77189  7C2z4GqqS5E    2018-06-01    BTS (방탄소년단) 'FAKE LOVE' Official MV
76988  7C2z4GqqS5E    2018-05-31    BTS (방탄소년단) 'FAKE LOVE' Official MV
36468  7C2z4GqqS5E    2018-05-31    BTS (방탄소년단) 'FAKE LOVE' Official MV
36288  7C2z4GqqS5E    2018-05-30    BTS (방탄소년단) 'FAKE LOVE' Official MV
...            ...           ...                                   ...
9146   LFhT6H6pRWg    2017-12-29  PSA from Chairman of the FCC Ajit Pai
9354   LFhT6H6pRWg    2017-12-30  PSA from Chairman of the FCC Ajit Pai
9575   LFhT6H6pRWg    2017-12-31  PSA from Chairman of the FCC Ajit Pai
9777   LFhT6H6pRWg    2018-01-01  PSA from Chairman of the FCC Ajit Pai
9985   LFhT6H6pRWg    2018-01-02  PSA from Chairman of the FCC Ajit Pai

      channel_title  category_id        publish_time  \
36638       ibighit           10 2018-05-18 09:00:02
77189       ibighit           10 2018-05-18 09:00:02
76988       ibighit           10 2018-05-18 09:00:02
36468       ibighit           10 2018-05-18 09:00:02
36288       ibighit           10 2018-05-18 09:00:02
...             ...          ...                  ...
9146   Daily Caller           22 2017-12-13 22:52:57
9354   Daily Caller           22 2017-12-13 22:52:57
9575   Daily Caller           22 2017-12-13 22:52:57
9777   Daily Caller           22 2017-12-13 22:52:57
9985   Daily Caller           22 2017-12-13 22:52:57

                                                    tags      views    likes
\
36638  BIGHIT|"빅히트"|"방탄소년단"|"BTS"|"BANGTAN"|"방탄"|"FAK...  123010920  56138
27
77189  BIGHIT|"빅히트"|"방탄소년단"|"BTS"|"BANGTAN"|"방탄"|"FAK...  123010920  56138
27
76988  BIGHIT|"빅히트"|"방탄소년단"|"BTS"|"BANGTAN"|"방탄"|"FAK...  121219886  55952
03
36468  BIGHIT|"빅히트"|"방탄소년단"|"BTS"|"BANGTAN"|"방탄"|"FAK...  121219886  55952
03
36288  BIGHIT|"빅히트"|"방탄소년단"|"BTS"|"BANGTAN"|"방탄"|"FAK...  115664850  55305
68
...                                                  ...       ...      ...
9146   thedc|"dc"|"washington dc"|"washington"|"the d...    1324657    10426
9354   thedc|"dc"|"washington dc"|"washington"|"the d...    1331204    10463
9575   thedc|"dc"|"washington dc"|"washington"|"the d...    1336646    10501
9777   thedc|"dc"|"washington dc"|"washington"|"the d...    1342131    10538
9985   thedc|"dc"|"washington dc"|"washington"|"the d...    1348067    10576

       dislikes  ...  comments_disabled ratings_disabled  \
36638    206892  ...              False           False
77189    206892  ...              False           False
76988    205565  ...              False           False
36468    205565  ...              False           False
36288    200995  ...              False           False
...         ...  ...                ...             ...
9146     253677  ...              False           False
9354     254899  ...              False           False
9575     255956  ...              False           False
9777     256816  ...              False           False
9985     258504  ...              False           False

       video_error_or_removed  \
36638                   False
```

```
77189                  False
76988                  False
36468                  False
36288                  False
...                      ...
9146                   False
9354                   False
9575                   False
9777                   False
9985                   False

                                                 description       location  \
36638  BTS (방탄소년단) 'FAKE LOVE' Official MVDirector : ...  Great Britain
77189  BTS (방탄소년단) 'FAKE LOVE' Official MVDirector : ...            USA
76988  BTS (방탄소년단) 'FAKE LOVE' Official MVDirector : ...            USA
36468  BTS (방탄소년단) 'FAKE LOVE' Official MVDirector : ...  Great Britain
36288  BTS (방탄소년단) 'FAKE LOVE' Official MVDirector : ...  Great Britain
...                                                      ...            ...
9146   Ajit Pai has been at the heart of the net neut...  Great Britain
9354   Ajit Pai has been at the heart of the net neut...  Great Britain
9575   Ajit Pai has been at the heart of the net neut...  Great Britain
9777   Ajit Pai has been at the heart of the net neut...  Great Britain
9985   Ajit Pai has been at the heart of the net neut...  Great Britain

      trending_day_of_week day_of_week Engagement Metrics         score  \
36638               Friday      Friday            7049374  2.896622e+06
77189               Friday      Friday            7049374  2.896622e+06
76988             Thursday      Friday            7026094  2.887390e+06
36468             Thursday      Friday            7026094  2.887390e+06
36288            Wednesday      Friday            6944735  2.855162e+06
...                    ...         ...                ...           ...
9146                Friday   Wednesday             297589 -4.732613e+04
9354              Saturday   Wednesday             299013 -4.755911e+04
9575                Sunday   Wednesday             300273 -4.775130e+04
9777                Monday   Wednesday             301035 -4.798428e+04
9985               Tuesday   Wednesday             302889 -4.834161e+04

          rank
36638      1.0
77189      1.0
76988      3.0
36468      3.0
36288      5.0
...        ...
9146   79861.0
9354   79862.0
9575   79863.0
9777   79864.0
9985   79865.0

[79865 rows x 22 columns]
```

EDA for Score for Top 50 Channels

In [22]:
```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns

# Assuming your DataFrame is named 'train'
```

```
weights = {
    'likes': 0.460435,
    'dislikes': 0.244418,
    'comment_count': 0.294947
}

# Calculate score and rank
merged_df['score'] = (
    weights['likes'] * merged_df['likes'] -
    weights['dislikes'] * merged_df['dislikes'] +
    weights['comment_count'] * merged_df['comment_count']
)

merged_df['rank'] = merged_df['score'].rank(ascending=False, method='min')

# Group by channel_title and sum the scores
channel_scores = merged_df.groupby('channel_title')['score'].sum().reset_index

# Sort by total score and get top 50 channels
top_channels = channel_scores.sort_values(by='score', ascending=False).head(50

# Create a bar plot for the top 50 channels
plt.figure(figsize=(12, 8))
sns.barplot(x='score', y='channel_title', data=top_channels, palette='viridis'
plt.title('Top 50 Channels by Score')
plt.xlabel('Total Score')
plt.ylabel('Channel Title')
plt.show()
```



Create Word Cloud

Video Titles

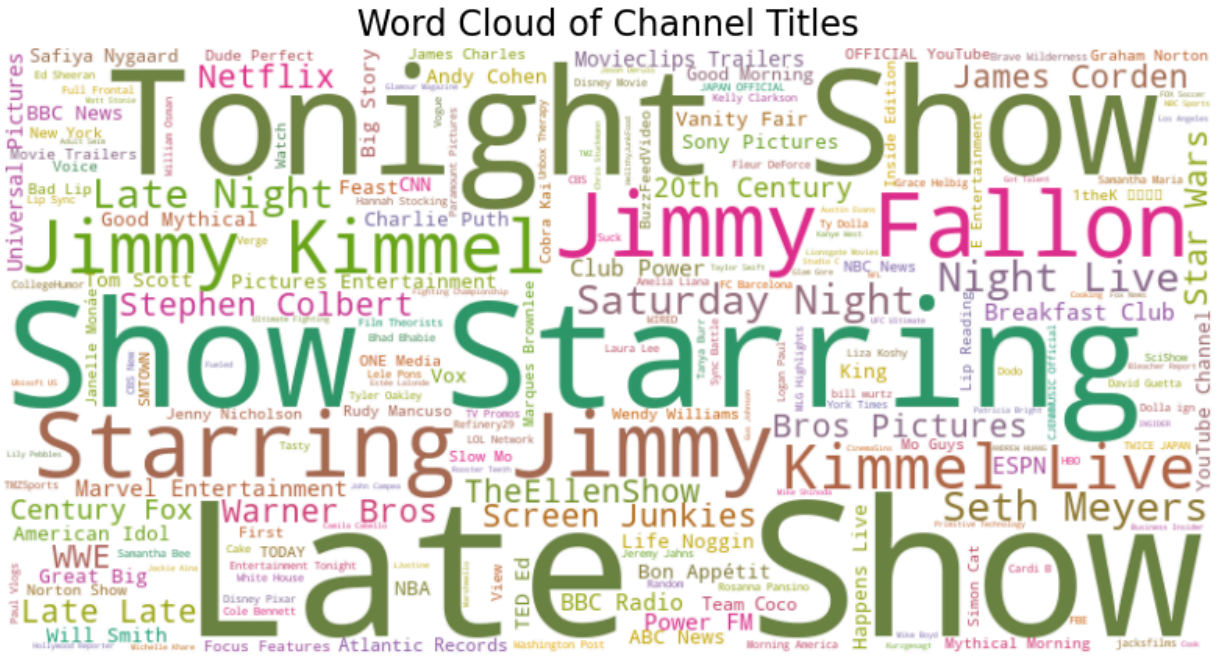
In [23]:
```
from wordcloud import WordCloud
from palettable.colorbrewer.qualitative import Dark2_6
```

```
# Assuming your DataFrame is named 'mergeda_df'
# Concatenate all titles into a single string
all_titles = " ".join(merged_df['title'].astype(str))

# Set up the color palette (equivalent to R's "Dark2")
cmap = Dark2_6.mpl_colormap

# Create a WordCloud object
wordcloud = WordCloud(
    background_color="white",
    max_words=200,
    colormap=cmap,
    width=800,
    height=400,
    random_state=42
)

# Generate the word cloud from the titles
wordcloud.generate(all_titles)

# Plot the word cloud
plt.figure(figsize=(10, 6))
plt.imshow(wordcloud, interpolation="bilinear")
plt.axis("off")  # Turn off the axis
plt.title('Word Cloud of Video Titles', fontsize=16)
plt.show()
```

Channel Titles

In [24]:
```
all_channel_titles = " ".join(merged_df['channel_title'].astype(str))

# Set up the color palette (equivalent to R's "Dark2")
cmap = Dark2_6.mpl_colormap

# Create a WordCloud object
wordcloud = WordCloud(
```

```
    background_color="white",
    max_words=200,
    colormap=cmap,
    width=800,
    height=400,
    random_state=42
)

# Generate the word cloud from the titles
wordcloud.generate(all_channel_titles)

# Plot the word cloud
plt.figure(figsize=(10, 6))
plt.imshow(wordcloud, interpolation="bilinear")
plt.axis("off")  # Turn off the axis
plt.title('Word Cloud of Channel Titles', fontsize=16)
plt.show()
```



Video Tags

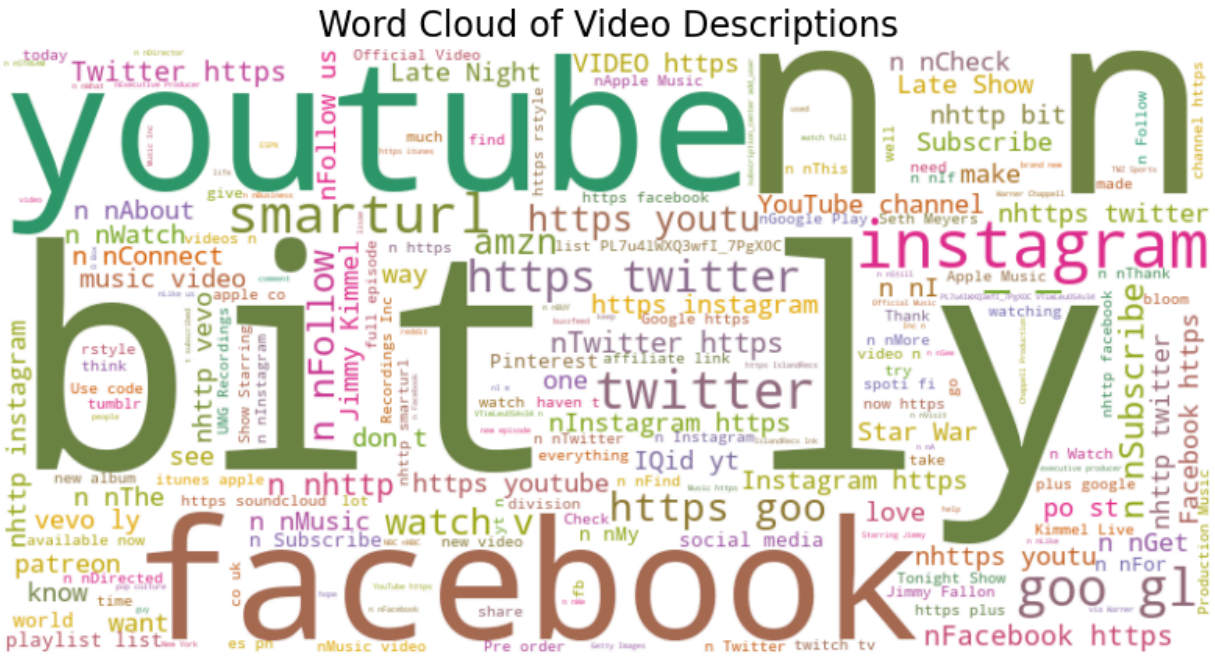
In [25]:

```
# Creating Word Cloud-tags
all_tags = " ".join(merged_df['tags'].astype(str))

# Set up the color palette (equivalent to R's "Dark2")
cmap = Dark2_6.mpl_colormap

# Create a WordCloud object
wordcloud = WordCloud(
    background_color="white",
    max_words=200,
    colormap=cmap,
    width=800,
    height=400,
    random_state=42
)

# Generate the word cloud from the titles
```

```
wordcloud.generate(all_tags)

# Plot the word cloud
plt.figure(figsize=(10, 6))
plt.imshow(wordcloud, interpolation="bilinear")
plt.axis("off")  # Turn off the axis
plt.title('Word Cloud of Tags', fontsize=16)
plt.show()
```

Video Descriptions

In [26]:
```
all_description = " ".join(merged_df['description'].astype(str))

# Set up the color palette (equivalent to R's "Dark2")
cmap = Dark2_6.mpl_colormap

# Create a WordCloud object
wordcloud = WordCloud(
    background_color="white",
    max_words=200,
    colormap=cmap,
    width=800,
    height=400,
    random_state=42
)

# Generate the word cloud from the titles
wordcloud.generate(all_description)

# Plot the word cloud
plt.figure(figsize=(10, 6))
plt.imshow(wordcloud, interpolation="bilinear")
plt.axis("off")  # Turn off the axis
plt.title('Word Cloud of Video Descriptions', fontsize=16)
plt.show()
```



Drop Unnecessary Columns

In [27]:
```
#drop columns needed
merged_df.drop(columns=['thumbnail_link', 'video_id','comments_disabled','ratin

print(merged_df.head())
```

```
  trending_date                                              title  \
0    2017-11-14      John Lewis Christmas Ad 2017 - #MozTheMonster
1    2017-11-14          Taylor Swift: …Ready for It? (Live) - SNL
2    2017-11-14         Eminem - Walk On Water (Audio) ft. Beyoncé
3    2017-11-14  Goals from Salford City vs Class of 92 and Fri...
4    2017-11-14  Dashcam captures truck's near miss with child ...

                channel_title  category_id        publish_time  \
0                  John Lewis           26 2017-11-10 07:38:29
1         Saturday Night Live           24 2017-11-12 06:24:44
2                   EminemVEVO           10 2017-11-10 17:00:03
3  Salford City Football Club           17 2017-11-13 02:30:38
4            Cute Girl Videos           25 2017-11-13 01:45:13

                                                tags     views   likes  \
0  christmas|"john lewis christmas"|"john lewis"|...   7224515   55681
1  SNL|"Saturday Night Live"|"SNL Season 43"|"Epi...   1053632   25561
2  Eminem|"Walk"|"On"|"Water"|"Aftermath/Shady/In...  17158579  787420
3  Salford City FC|"Salford City"|"Salford"|"Clas...     27833     193
4                                            [none]      9815      30

   dislikes  comment_count                                        description
\
0     10247           9479  Click here to continue the story and make your...
1      2294           2757  Musical guest Taylor Swift performs …Ready for...
2     43420         125882  Eminem's new track Walk on Water ft. Beyoncé i...
3        12             37  Salford drew 4-4 against the Class of 92 and F...
4         2             30  Dashcam captures truck's near miss with child ...

        location trending_day_of_week day_of_week  Engagement Metrics  \
0  Great Britain              Tuesday      Friday               75407
1  Great Britain              Tuesday      Sunday               30612
2  Great Britain              Tuesday      Friday              956722
3  Great Britain              Tuesday      Monday                 242
4  Great Britain              Tuesday      Monday                  62

           score     rank
0   25928.732602  24933.0
1   12021.653022  36735.0
2  389071.616394   1782.0
3      96.843978  77301.0
4      22.172624  78623.0
```

Text Preprocessing

In [28]:

```
import nltk
nltk.download('stopwords')
from nltk.corpus import stopwords
import re

# Get the list of default English stopwords
stop_words = set(stopwords.words('english'))

# Function to remove stopwords and clean text
def clean_text(text):
    # Lowercase the text
    text = text.lower()
```

```
    # Remove non-alphabetical characters (retain only letters and spaces)
    text = re.sub(r'[^a-z\s]', '', text)

    # Split text into words
    words = text.split()

    # Remove stopwords
    remove_stopwords = [word for word in words if word not in stop_words]

    # Join the cleaned words back into a string
    new_text = ' '.join(remove_stopwords)

    return new_text
    data = {'title','description','text'}

# Apply the clean_text function to the 'title' column in merged_df1
merged_df['new_text'] = merged_df['title'].apply(clean_text)

# Display the cleaned DataFrame
print(merged_df)
```

```
[nltk_data] Downloading package stopwords to
[nltk_data]     /Users/yuhanzhao/nltk_data...
[nltk_data]   Package stopwords is already up-to-date!
```

```
      trending_date                                              title  \
0        2017-11-14      John Lewis Christmas Ad 2017 - #MozTheMonster
1        2017-11-14          Taylor Swift: …Ready for It? (Live) - SNL
2        2017-11-14         Eminem - Walk On Water (Audio) ft. Beyoncé
3        2017-11-14  Goals from Salford City vs Class of 92 and Fri...
4        2017-11-14  Dashcam captures truck's near miss with child ...
...             ...                                                ...
79860    2018-06-14                       The Cat Who Caught the Laser
79861    2018-06-14                         True Facts : Ant Mutualism
79862    2018-06-14  I GAVE SAFIYA NYGAARD A PERFECT HAIR MAKEOVER ...
79863    2018-06-14                How Black Panther Should Have Ended
79864    2018-06-14  Official Call of Duty®: Black Ops 4 — Multipla...

                   channel_title  category_id        publish_time  \
0                     John Lewis           26 2017-11-10 07:38:29
1             Saturday Night Live           24 2017-11-12 06:24:44
2                       EminemVEVO           10 2017-11-10 17:00:03
3      Salford City Football Club           17 2017-11-13 02:30:38
4                Cute Girl Videos           25 2017-11-13 01:45:13
...                           ...          ...                  ...
79860               AaronsAnimals           15 2018-05-18 13:00:04
79861                    zefrank1           22 2018-05-18 01:00:06
79862                  Brad Mondo           24 2018-05-18 17:34:22
79863    How It Should Have Ended            1 2018-05-17 17:00:04
79864                Call of Duty           20 2018-05-17 17:09:38

                                                     tags     views   likes  \
0      christmas|"john lewis christmas"|"john lewis"|...   7224515   55681
1      SNL|"Saturday Night Live"|"SNL Season 43"|"Epi...   1053632   25561
2      Eminem|"Walk"|"On"|"Water"|"Aftermath/Shady/In...  17158579  787420
3      Salford City FC|"Salford City"|"Salford"|"Clas...     27833     193
4                                                 [none]      9815      30
...                                                  ...       ...     ...
79860  aarons animals|"aarons"|"animals"|"cat"|"cats"...   1685609   38160
79861                                             [none]   1064798   60008
79862  I gave safiya nygaard a perfect hair makeover ...   1066451   48068
79863  Black Panther|"HISHE"|"Marvel"|"Infinity War"|...   5660813  192957
79864      call of duty|"cod"|"activision"|"Black Ops 4"  10306119  357079

       dislikes  comment_count  \
0         10247           9479
1          2294           2757
2         43420         125882
3            12             37
4             2             30
...         ...            ...
79860      1385           2657
79861       382           3936
79862      1032           3992
79863      2846          13088
79864    212976         144795

                                              description       location  \
0      Click here to continue the story and make your...  Great Britain
1      Musical guest Taylor Swift performs …Ready for...  Great Britain
2      Eminem's new track Walk on Water ft. Beyoncé i...  Great Britain
3      Salford drew 4-4 against the Class of 92 and F...  Great Britain
4      Dashcam captures truck's near miss with child ...  Great Britain
...                                                  ...            ...
79860     The Cat Who Caught the Laser - Aaron's Animals            USA
```

```
79861                                                NaN           USA
79862  I had so much fun transforming Safiyas hair in...           USA
79863  How Black Panther Should Have EndedWatch More ...           USA
79864  Call of Duty: Black Ops 4 Multiplayer raises t...           USA

      trending_day_of_week day_of_week  Engagement Metrics          score  \
0                  Tuesday      Friday               75407   25928.732602
1                  Tuesday      Sunday               30612   12021.653022
2                  Tuesday      Friday              956722  389071.616394
3                  Tuesday      Monday                 242      96.843978
4                  Tuesday      Monday                  62      22.172624
...                    ...         ...                 ...           ...
79860             Thursday      Friday               42202   18015.354849
79861             Thursday      Friday               64326   28697.327196
79862             Thursday      Friday               53092   23057.378628
79863             Thursday    Thursday              208891   92008.809003
79864             Thursday    Thursday              714850  155063.352262

          rank                                              new_text
0      24933.0              john lewis christmas ad mozthemonster
1      36735.0                        taylor swift ready live snl
2       1782.0                   eminem walk water audio ft beyonc
3      77301.0  goals salford city vs class friends peninsula ...
4      78623.0     dashcam captures trucks near miss child norway
...        ...                                                ...
79860  30213.0                                cat caught laser
79861  23409.0                           true facts ant mutualism
79862  26601.0  gave safiya nygaard perfect hair makeover base...
79863   9923.0                                black panther ended
79864   5863.0  official call duty black ops multiplayer revea...

[79865 rows x 18 columns]
```

In [29]:
```
# Check the data types of each column
print(merged_df.dtypes)
```

```
trending_date          datetime64[ns]
title                          object
channel_title                  object
category_id                     int64
publish_time           datetime64[ns]
tags                           object
views                           int64
likes                           int64
dislikes                        int64
comment_count                   int64
description                    object
location                       object
trending_day_of_week           object
day_of_week                    object
Engagement Metrics              int64
score                         float64
rank                          float64
new_text                       object
dtype: object
```

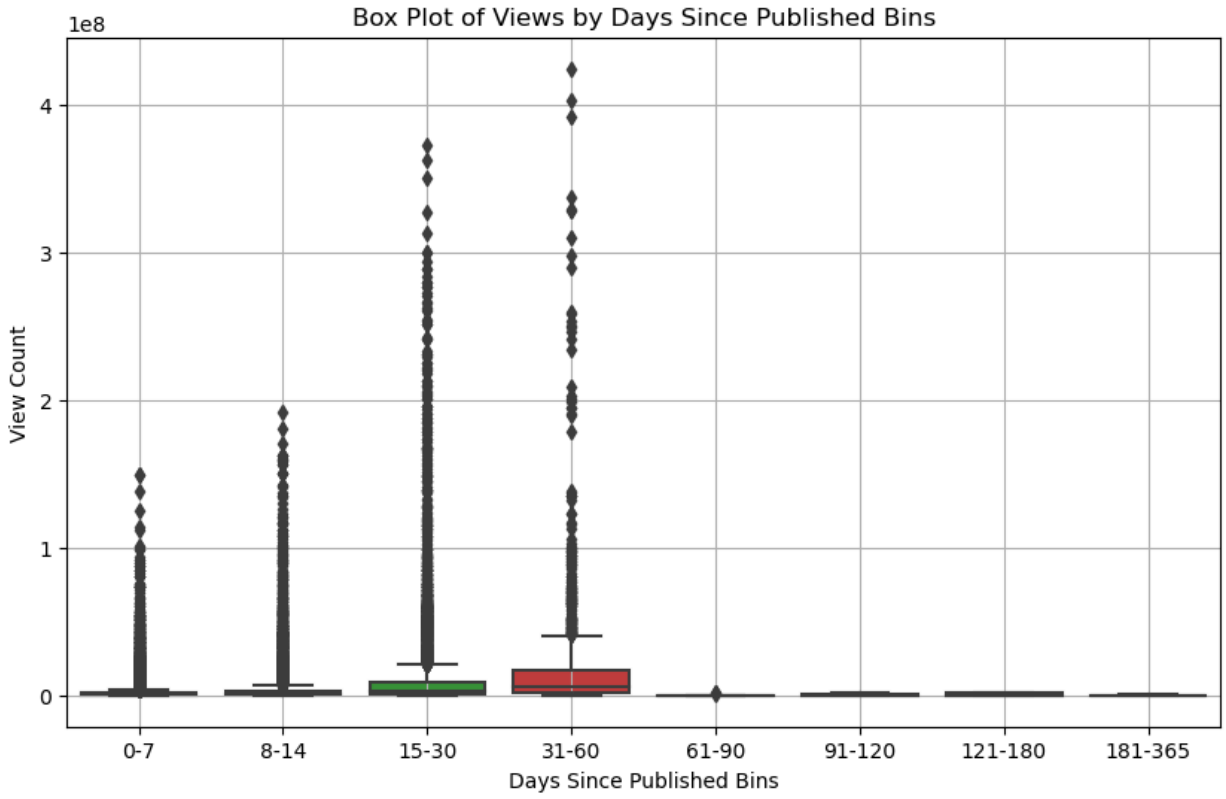
Split the Dataset into Train and Test by 80/20

In [30]:
```
from sklearn.model_selection import train_test_split

X = merged_df.drop(columns=['views'])  # Drop 'views' from features to get X
y = merged_df['views']
# Assuming you have a dataset with features X and target y
X_train, X_test, y_train, y_test = train_test_split(X,y, test_size=0.2, random_

train = pd.DataFrame(X_train)
train['views'] = y_train.values

test = pd.DataFrame(X_test)
test['views'] = y_test.values
```

Feature Engineering

Days Since Published

In [31]:
```
#convert the type of publish time
train['publish_time'] = pd.to_datetime(train['publish_time'])
train['trending_date'] = pd.to_datetime(train['trending_date'], format='%Y-%m-%

# Creating a new feature 'days_since_published'
train['days_since_published'] = (train['trending_date'] - train['publish_time']

# Creating bins for days since published
bins = [0, 7, 14, 30, 60, 90, 120, 180, 365]  # Example bins
labels = ['0-7', '8-14', '15-30', '31-60', '61-90', '91-120', '121-180', '181-
train['days_bins'] = pd.cut(train['days_since_published'], bins=bins, labels=la

plt.figure(figsize=(10, 6))
sns.boxplot(data=train, x='days_bins', y='views')
plt.title('Box Plot of Views by Days Since Published Bins')
plt.xlabel('Days Since Published Bins')
plt.ylabel('View Count')
plt.grid(True)
plt.show()
```



Sentimental Analysis

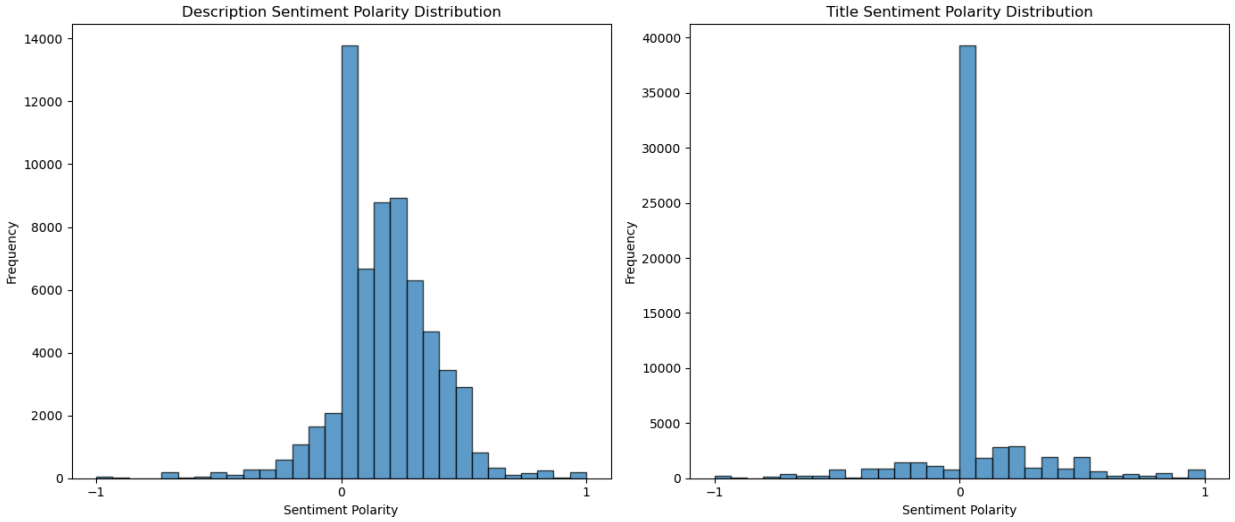
In [32]:
```
!pip install textblob
```

Sentiment Polarity Distribution

In [33]:
```
from textblob import TextBlob
import matplotlib.pyplot as plt

# Calculate sentiment polarity for description and title
def get_sentiment(text):
    return TextBlob(text).sentiment.polarity

# Apply sentiment analysis
train['description_sentiment'] = train['description'].fillna('').apply(get_sen
train['title_sentiment'] = train['title'].fillna('').apply(get_sentiment)

# Calculate average sentiment scores
avg_description_sentiment = train['description_sentiment'].mean()
avg_title_sentiment = train['title_sentiment'].mean()

print("Average Description Sentiment Score:", avg_description_sentiment)
print("Average Title Sentiment Score:", avg_title_sentiment)

# Plotting the sentiment distributions
plt.figure(figsize=(14, 6))

# Description Sentiment Histogram
plt.subplot(1, 2, 1)
plt.hist(train['description_sentiment'], bins=30, alpha=0.7, edgecolor='black'
plt.title('Description Sentiment Polarity Distribution')
```

```
plt.xlabel('Sentiment Polarity')
plt.ylabel('Frequency')
plt.xticks([-1, 0, 1])

# Title Sentiment Histogram
plt.subplot(1, 2, 2)
plt.hist(train['title_sentiment'], bins=30, alpha=0.7, edgecolor='black')
plt.title('Title Sentiment Polarity Distribution')
plt.xlabel('Sentiment Polarity')
plt.ylabel('Frequency')
plt.xticks([-1, 0, 1])

plt.tight_layout()
plt.show()
```

```
Average Description Sentiment Score: 0.1716764242965884
Average Title Sentiment Score: 0.0477964529239135
```

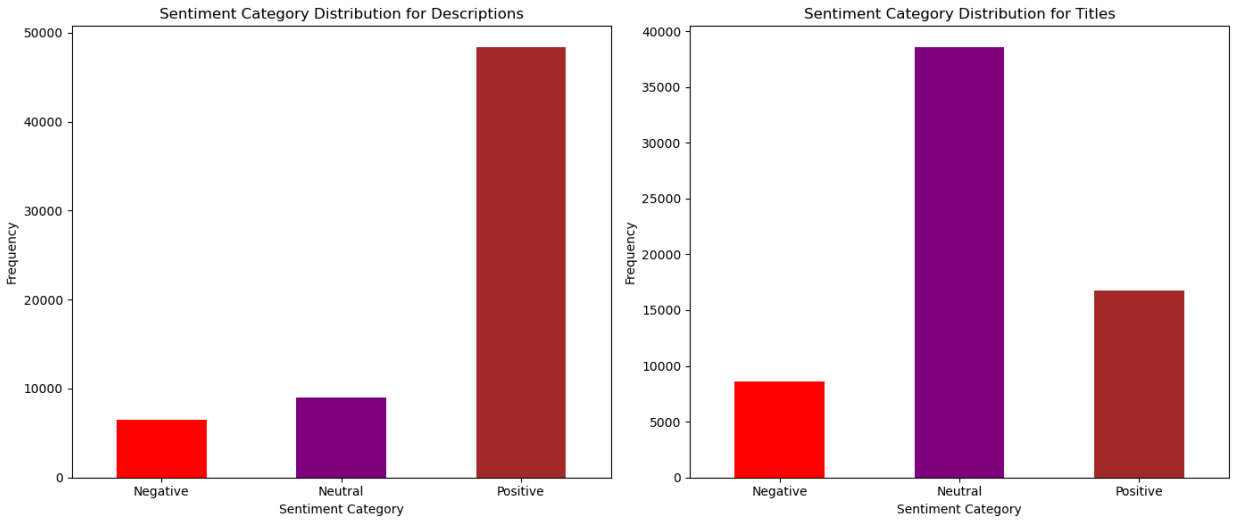


Visualize the Sentiment Distrubution Category

In [34]:

```
import pandas as pd
import matplotlib.pyplot as plt

# Define sentiment categories
def categorize_sentiment(polarity):
    if polarity > 0:
        return 'Positive'
    elif polarity < 0:
        return 'Negative'
    else:
        return 'Neutral'

# Apply categorization to sentiment columns
train['description_sentiment_category'] = train['description_sentiment'].apply
train['title_sentiment_category'] = train['title_sentiment'].apply(categorize_s

# Plot sentiment category distribution for descriptions and titles
plt.figure(figsize=(14, 6))

# Custom order for categories
category_order = ['Negative', 'Neutral', 'Positive']

# Plot description sentiment distribution
```

```
plt.subplot(1, 2, 1)
description_sentiment_counts = train['description_sentiment_category'].value_c
description_sentiment_counts.plot(kind='bar', color=['red', 'purple', 'brown']
plt.title('Sentiment Category Distribution for Descriptions')
plt.xlabel('Sentiment Category')
plt.ylabel('Frequency')
plt.xticks(rotation=0)

# Plot title sentiment distribution
plt.subplot(1, 2, 2)
title_sentiment_counts = train['title_sentiment_category'].value_counts().rein
title_sentiment_counts.plot(kind='bar', color=['red', 'purple', 'brown'])
plt.title('Sentiment Category Distribution for Titles')
plt.xlabel('Sentiment Category')
plt.ylabel('Frequency')
plt.xticks(rotation=0)

plt.tight_layout()
plt.show()
```



Create TF-IDF Feature

`description` Column

In [35]:
```
from sklearn.feature_extraction.text import TfidfVectorizer
import numpy as np

# Ensure the 'description' column exists in the DataFrame
if 'description' in train.columns:
    # Assuming 'description' column contains the text data
    text_data = train['description'].fillna('')  # Handle missing values

    # Check if text_data is iterable, not a single string
    if isinstance(text_data, pd.Series):
        # Initialize the TF-IDF Vectorizer
        tfidf_vectorizer = TfidfVectorizer(max_features=100, stop_words='engli

        # Fit and transform the text data to generate the TF-IDF matrix
        tfidf_matrix = tfidf_vectorizer.fit_transform(text_data)
```

```
        # Convert the sparse matrix into a DataFrame for easier manipulation
        tfidf_df = pd.DataFrame(tfidf_matrix.toarray(), columns=tfidf_vectorize

        # Function to get top N features per row based on TF-IDF score
        def get_top_tfidf_features(row, features, top_n=5):
            top_indices = np.argsort(row)[::-1][:top_n]  # Get the indices of
            top_features = [(features[i], row[i]) for i in top_indices]  # Get
            return top_features

        # Apply the function to each row in the TF-IDF matrix
        top_tfidf_features = [get_top_tfidf_features(row, tfidf_vectorizer.get_
                              for row in tfidf_matrix.toarray()]

        # Add the top TF-IDF features as a new column in the original DataFrame
        train['top_tfidf_features'] = top_tfidf_features

        # Display the entire first 5 rows of the DataFrame including the top TF
        print(train.head(5))
    else:
        print("The 'description' column should be a pandas Series.")
else:
    print("The DataFrame does not contain a 'description' column.")
```

```
      trending_date                                              title  \
23604    2018-03-14                  Marshmello & Anne-Marie: Friends
25630    2018-03-24  Kirby Star Allies' Surprising HD Rumble Secret...
68698    2018-04-20  Stephen A.: Kevin Hart 'got his feelings hurt'...
39559    2017-11-17                              How to be an Aquarius
62877    2018-03-16  Charlie Puth - Done For Me (feat. Kehlani) [Of...

                             channel_title  category_id  \
23604  The Tonight Show Starring Jimmy Fallon           23
25630                            GameXplain           20
68698                                  ESPN           17
39559                              Sailor J           24
62877                           Charlie Puth           10

            publish_time                                                tags
\
23604 2018-03-07 14:00:03  The Tonight Show|"Jimmy Fallon"|"Marshmello"|"...
25630 2018-03-16 04:00:01  Kirby|"Kirby Star Allies"|"Dedede"|"Meta Knigh...
68698 2018-04-17 14:55:31  espn|"dwyane wade"|"dwayne wade"|"d wade"|"76e...
39559 2017-11-15 13:29:28                Zodiac|"makeup"|"comedy"|"aquarius"
62877 2018-03-15 16:02:17  Charlie|"Puth"|"charlie puth"|"Charlie Puth - ...

       likes  dislikes  comment_count  \
23604  45011      1156           2365
25630   2716        52            450
68698   6829       537           1445
39559   5172       453            976
62877  84227       739           8663

                                          description  ...     rank  \
23604  Music guest Marshmello & Anne-Marie performs F...  ...  27872.0
25630  Kirby Star Allies does something pretty fun wi...  ...  67076.0
68698  First Take's Stephen A. Smith says Kevin Hart ...  ...  57168.0
39559  Ya'll asked lol. What sign should I do next? D...  ...  60832.0
62877  Download & Stream Done For Me (feat. Kehlani):...  ...  18947.0

                                       new_text    views  \
23604                    marshmello annemarie friends  1443792
25630  kirby star allies surprising hd rumble secret ...   106398
68698  stephen kevin hart got feelings hurt dwyane wa...   976783
39559                                    aquarius    88644
62877     charlie puth done feat kehlani official audio   722009

       days_since_published  days_bins  description_sentiment title_sentiment
\
23604                     6        0-7                0.232292        0.000000
25630                     7        0-7                0.137500        0.141667
68698                     2        0-7                0.168333        0.250000
39559                     1        0-7                0.400000        0.000000
62877                     0        NaN                0.400000        0.000000

       description_sentiment_category  title_sentiment_category  \
23604                        Positive                   Neutral
25630                        Positive                  Positive
68698                        Positive                  Positive
39559                        Positive                   Neutral
62877                        Positive                   Neutral

                                top_tfidf_features
23604  [(jimmy, 0.6973441834478303), (nbc, 0.47929685...
```

```
25630  [(patreon, 0.5185912254067347), (com, 0.407894...
68698  [(http, 0.6127313163416526), (youtube, 0.33885...
39559  [(ll, 0.5094338648331312), (don, 0.47521836732...
62877  [(nhttp, 0.4915874738421169), (com, 0.44499439...

[5 rows x 25 columns]
```

`tags` Column

In [36]:

```
from sklearn.feature_extraction.text import TfidfVectorizer
import numpy as np

# Ensure the 'description' column exists in the DataFrame
if 'tags' in train.columns:
    # Assuming 'description' column contains the text data
    text_data = train['tags'].fillna('')  # Handle missing values

    # Check if text_data is iterable, not a single string
    if isinstance(text_data, pd.Series):
        # Initialize the TF-IDF Vectorizer
        tfidf_vectorizer = TfidfVectorizer(max_features=100, stop_words='engli

        # Fit and transform the text data to generate the TF-IDF matrix
        tfidf_matrix = tfidf_vectorizer.fit_transform(text_data)

        # Convert the sparse matrix into a DataFrame for easier manipulation
        tfidf_df = pd.DataFrame(tfidf_matrix.toarray(), columns=tfidf_vectoriz

        # Function to get top N features per row based on TF-IDF score
        def get_top_tfidf_features(row, features, top_n=5):
            top_indices = np.argsort(row)[::-1][:top_n]  # Get the indices of
            top_features = [(features[i], row[i]) for i in top_indices]  # Get
            return top_features

        # Apply the function to each row in the TF-IDF matrix
        top_tfidf_features = [get_top_tfidf_features(row, tfidf_vectorizer.get_
                              for row in tfidf_matrix.toarray()]

        # Add the top TF-IDF features as a new column in the original DataFram
        train['top_tfidf_features'] = top_tfidf_features

        # Display the entire first 5 rows of the DataFrame including the top TF
        print(train.head(5))
    else:
        print("The 'description' column should be a pandas Series.")
else:
    print("The DataFrame does not contain a 'description' column.")
```

```
      trending_date                                              title  \
23604    2018-03-14                  Marshmello & Anne-Marie: Friends
25630    2018-03-24  Kirby Star Allies' Surprising HD Rumble Secret...
68698    2018-04-20  Stephen A.: Kevin Hart 'got his feelings hurt'...
39559    2017-11-17                              How to be an Aquarius
62877    2018-03-16  Charlie Puth - Done For Me (feat. Kehlani) [Of...

                             channel_title  category_id  \
23604  The Tonight Show Starring Jimmy Fallon           23
25630                            GameXplain           20
68698                                  ESPN           17
39559                              Sailor J           24
62877                           Charlie Puth           10

            publish_time                                               tags
\
23604 2018-03-07 14:00:03  The Tonight Show|"Jimmy Fallon"|"Marshmello"|"...
25630 2018-03-16 04:00:01  Kirby|"Kirby Star Allies"|"Dedede"|"Meta Knigh...
68698 2018-04-17 14:55:31  espn|"dwyane wade"|"dwayne wade"|"d wade"|"76e...
39559 2017-11-15 13:29:28                Zodiac|"makeup"|"comedy"|"aquarius"
62877 2018-03-15 16:02:17  Charlie|"Puth"|"charlie puth"|"Charlie Puth - ...

       likes  dislikes  comment_count  \
23604  45011      1156           2365
25630   2716        52            450
68698   6829       537           1445
39559   5172       453            976
62877  84227       739           8663

                                          description  ...     rank  \
23604  Music guest Marshmello & Anne-Marie performs F...  ...  27872.0
25630  Kirby Star Allies does something pretty fun wi...  ...  67076.0
68698  First Take's Stephen A. Smith says Kevin Hart ...  ...  57168.0
39559  Ya'll asked lol. What sign should I do next? D...  ...  60832.0
62877  Download & Stream Done For Me (feat. Kehlani):...  ...  18947.0

                                       new_text    views  \
23604                    marshmello annemarie friends  1443792
25630  kirby star allies surprising hd rumble secret ...   106398
68698  stephen kevin hart got feelings hurt dwyane wa...   976783
39559                                    aquarius    88644
62877     charlie puth done feat kehlani official audio   722009

       days_since_published  days_bins  description_sentiment title_sentiment
\
23604                     6        0-7               0.232292        0.000000
25630                     7        0-7               0.137500        0.141667
68698                     2        0-7               0.168333        0.250000
39559                     1        0-7               0.400000        0.000000
62877                     0        NaN               0.400000        0.000000

       description_sentiment_category  title_sentiment_category  \
23604                        Positive                   Neutral
25630                        Positive                  Positive
68698                        Positive                  Positive
39559                        Positive                   Neutral
62877                        Positive                   Neutral

                                top_tfidf_features
23604  [(nbc, 0.5956553280243344), (funny, 0.39716641...
```

```
25630  [(game, 0.7740105820359334), (review, 0.371423...
68698  [(smith, 0.7615203128745558), (game, 0.4952950...
39559  [(makeup, 0.7864204819004292), (comedy, 0.6176...
62877  [(charlie, 0.988515653214018), (official, 0.11...

[5 rows x 25 columns]
```

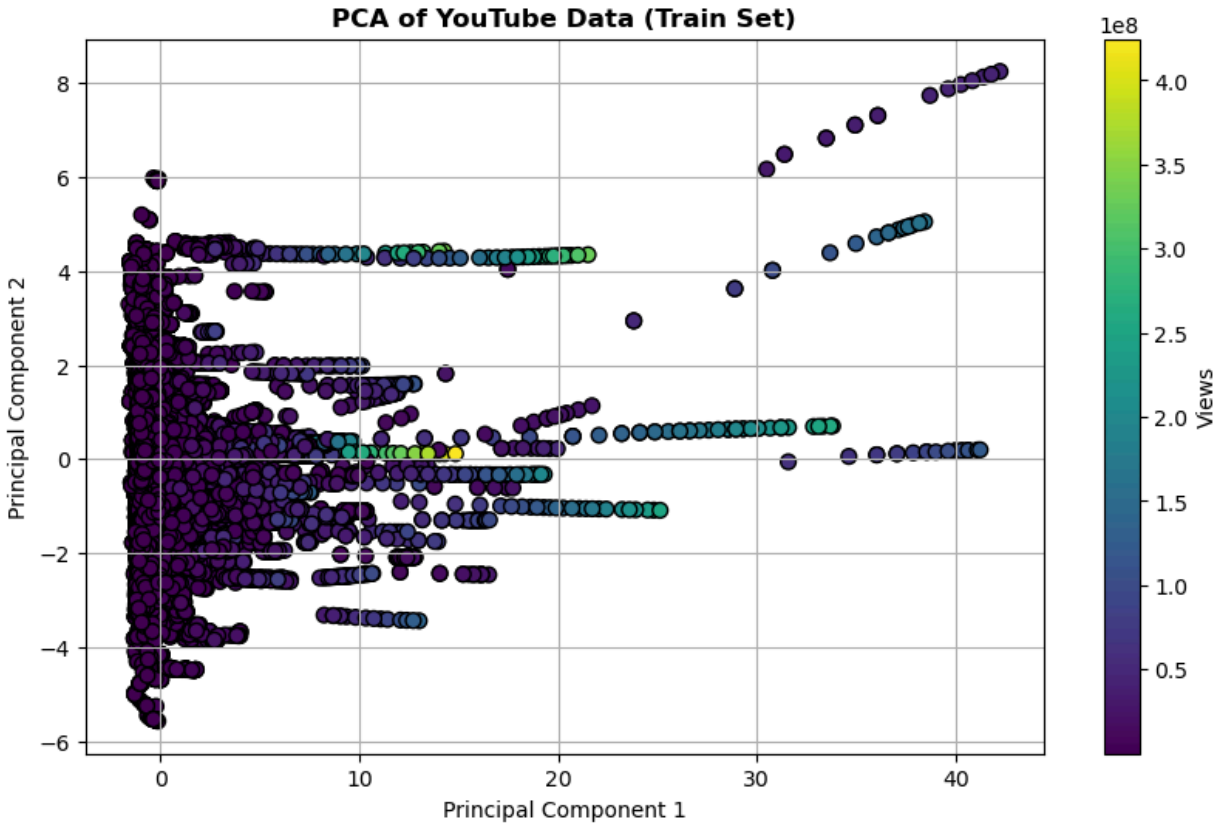
Dimension Reduction-PCA

In [37]:
```
from sklearn.preprocessing import StandardScaler
from sklearn.decomposition import PCA

non_numeric_cols = ['publish_time', 'title', 'channel_title', 'tags', 'descrip
X_train_model = train.drop(columns=non_numeric_cols + ['views']).select_dtypes
X_test_model = test.drop(columns=non_numeric_cols + ['views']).select_dtypes(i

X_test_model = X_test_model.reindex(columns=X_train_model.columns, fill_value=

scaler = StandardScaler()
X_train_scaled = scaler.fit_transform(X_train_model)
X_test_scaled = scaler.transform(X_test_model)

print("Missing values in X_train_model:\n", X_train_model.isna().sum())
print("Missing values in X_test_model:\n", X_test_model.isna().sum())
```

```
Missing values in X_train_model:
 category_id              0
likes                     0
dislikes                  0
comment_count             0
Engagement Metrics        0
score                     0
rank                      0
days_since_published      0
description_sentiment     0
title_sentiment           0
dtype: int64
Missing values in X_test_model:
 category_id              0
likes                     0
dislikes                  0
comment_count             0
Engagement Metrics        0
score                     0
rank                      0
days_since_published      0
description_sentiment     0
title_sentiment           0
dtype: int64
```

In [38]:
```
# Apply PCA (Reduce to n components to capture 95% of variance)
pca = PCA(n_components=0.95)
X_train_pca = pca.fit_transform(X_train_scaled)
X_test_pca = pca.transform(X_test_scaled)

# Visualize the PCA results (Plot only the first two components)
plt.figure(figsize=(10, 6))
plt.scatter(X_train_pca[:, 0], X_train_pca[:, 1], c=y_train, cmap='viridis', e
```

```
plt.colorbar(label='Views')
plt.title('PCA of YouTube Data (Train Set)', weight='bold')
plt.xlabel('Principal Component 1')
plt.ylabel('Principal Component 2')
plt.grid(True)
plt.show()

# Explained variance for all components selected by PCA
explained_variance = pca.explained_variance_ratio_
print("Explained Variance per component:")
for i, variance in enumerate(explained_variance, start=1):
     print(f"PC{i}: {variance:.2%}")
```




```
Explained Variance per component:
PC1: 43.35%
PC2: 12.56%
PC3: 11.40%
PC4: 10.22%
PC5: 7.73%
PC6: 7.47%
PC7: 5.90%
```

In [ ]:

In [ ]:

In [ ]: