

# **IT & Data Analytics Consulting Final Exam Project Report**

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## **Executive Summary Prepared by: LDAT Consulting Solutions**

### **Background & Business Problem**

- Makeup by Holly LLC offers makeup, hair, and styling services, focusing on a holistic approach to beauty and leveraging social media to expand its global reach.

### **Data Cataloging & Data Techniques**

- The data includes Instagram reels April 2018 to August 2024 from the company account.
- We analyzed engagement metrics, post timing, and content characteristics using data management, Tableau, and regression techniques to identify key engagement drivers.

### **Exploratory Analysis**

- We analyzed engagement through data cleaning, correlation, regression analysis, and Tableau dashboards.

### **Results, Conclusions, and Recommendations**

- Mondays and Tuesdays yield the highest user interaction, with peak times at 12-1 PM for comments and 2-3 PM for views and plays. Shorter videos under 30 seconds, original audio, and high-quality visuals enhance engagement, while low-activity periods like Sunday mornings are better suited for routine content.

### **Limitations & Potential Future Research**

- Limitations include changes in Instagram features, repeat viewers, and lack of audience demographics; future research could refine engagement metrics and include audience data.

**Background**

Makeup by Holly LLC provides makeup, hair, and styling services to a diverse clientele. Their focus is to consult, educate, and provide beauty and branding services to entrepreneurs, corporations, professionals, and brides.

The purpose of Makeup by Holly LLC is to magnify an individual's true inner beauty. The company's holistic approach to beauty and branding allows for differentiation in a thriving market.

Fee-for-service is the business model of Makeup by Holly LLC, as this company provides services that include one-on-one consultations, weddings, special occasion beauty events, speaking engagements, and more for a fee.

Makeup by Holly LLC comprises a network of international makeup artists, hair stylists, and personal wardrobe stylists who take a collective approach to servicing clientele. The company currently employs its professionals as 1099 contractors and has 25 affiliates operating in VA, FL, MD, DC, LA, TX, and DE, providing on-location and in-studio hair, makeup, and personal styling services using traditional and/or airbrush makeup techniques with premium, camera-ready products. Makeup by Holly also leverages social media to expand its client base and increase brand awareness globally.

While the customers of Makeup by Holly LLC can be anyone in need of makeup, hair, branding, bridal, or any of the other services that they offer, their target market is composed of entrepreneurs, corporations, professionals, and brides.

The business structure is a Limited Liability Company, meaning that owners will not be personally liable for the debts of their business and have fewer requirements by the state (compared to Corporations).

## Business Problem

Makeup by Holly LLC operates in a competitive beauty industry and is looking to better utilize data analytics to enhance decision-making. The company has built a strong reputation by offering makeup, hair, and personal styling services across multiple states, but it currently lacks the ability to fully analyze and use insights from its social media data. This presents both a challenge and an opportunity to improve operations.

The primary issue is that the company doesn't have a clear system for managing and analyzing its social media data. Even though it collects engagement metrics like comments, views, plays, hashtags, mentions, and timestamps from Instagram reels, this data isn't being systematically analyzed. Without this analysis, the company misses out on identifying patterns or trends that could optimize its social media strategy. This gap affects the company's ability to bring in new clients, engage with existing ones, and build brand awareness efficiently.

There's an opportunity for Makeup by Holly to refine its social media approach using data-driven insights. By analyzing its Instagram engagement metrics, the company could:

1. **Understand Key Engagement Drivers:** Analyzing the impact of features like hashtags, mentions, and audio types on metrics such as comments, views, and plays can reveal what resonates most with the audience. For instance, reels that use popular hashtags may generate higher engagement.
2. **Develop Engagement Metrics:** Creating clear metrics such as engagement rates, average views per reel, etc. will provide measurable benchmarks for success and inform future content planning.
3. **Leverage Visual Tools for Insights:** Dashboards that showcase audience behavior, ideal posting times, and successful content formats will allow the team to make quicker, more

informed decisions. Such tools will also enable the CEO, Holly Byrd Miller, to track campaign performance and identify areas for improvement.

The data Makeup by Holly currently has (Instagram reel metrics and metadata like posting day, duration, and music usage) offers a starting point for analysis. The following steps can help utilize this data:

- 1. Data Cleaning and Preparation:** Address any missing or inconsistent data and create relationships between datasets for a comprehensive view.
- 2. Identifying Patterns in Data:** Use exploratory analysis to identify trends, such as optimal posting times or performance differences between original and trending audio.
- 3. Predictive Modeling:** Use regression analysis to predict future engagement based on historical data, helping the company optimize posting schedules and content strategies.
- 4. Create Dashboards:** Use Tableau to design easy-to-read dashboards that provide actionable insights and support decision-making.

## Data Cataloging

The dataset for Project Ben consists of Instagram reels collected from the account @makeupbyhollybpartners. These reels span a period from April 2018 to August 2024 and serve as the foundation for this business analytics consulting project. The primary objective of the data analysis is to extract actionable insights to enhance social media engagement and overall brand visibility.

## Key Components of the Data Set

The dataset comprises four interconnected tables, providing a holistic view of Instagram reels and their associated engagement metrics:

## 1. FactTable

The FactTable is the central repository of information about each reel, capturing the following attributes:

- Reel ID: A unique identifier for each reel
  - **Engagement metrics:**
    - commentsCount: The number of comments on the reel
    - videoViewCount: The number of video views on the reel
    - videoPlayCount: The number of video plays on the reel
  - **Video Attributes:**
    - videoKey: A unique identifier linking to the VideoResolution table.
    - videoDuration: The duration of the video in seconds
  - **Timing Information**
    - postDate: The date the reel was posted
    - timestamp: Precise posting time.
    - DayPartKey: The day part when the reel was posted linking to the DayPart table
    - DayKey: The day of the week when the reel was posted linking to the WeekDay table
  - **Content characteristics:**
    - musicInfo/uses\_original\_audio: Whether the reel uses original audio
    - HashtagsCount: The number of hashtags in the caption
    - MentionsCount: The number of mentions in the caption
    - songName: The name of the song used in the reel
    - artistName: The name of the artist of the song used in the reel

- **Additional Fields**

- url: The URL of the reel
- caption: The text accompanying each reel

## **2. WeekDay Table:**

The WeekDay table supplements the FactTable by defining the day of the week categories, including:

- DayKey: A unique identifier for each day
- DayOfWeek: The day of the week (e.g., Monday, Tuesday)

## **3. DayPart Table:**

The DayPart table further refines the temporal context by mapping day parts to their corresponding:

- DayPartKey: A unique identifier for each day part
- DayPart: Descriptive label for the time of day (e.g., Morning, Afternoon).
- HourRange: The hourly interval associated with each part.

## **4. VideoResolution Table**

The VideoResolution table provides additional details about the visual content, including:

- videoKey: Identifier linking back to the FactTable.
- videoResolution: The resolution of the video (e.g., Standard Definition, High Definition).
- Description: Summary of the resolution's characteristics.



## **Insights from Data**

### **1. Engagement Patterns:**

- The FactTable offers a granular view of reel performance, with metrics like comments, views, and plays.
- Temporal keys enable analysis of trends by day or time of day (e.g., peak engagement periods).

### **2. Content Analysis:**

- The inclusion of hashtags, mentions, and audio details allows exploration of factors influencing engagement.
- Video resolution and duration can be correlated with metrics to determine optimal production strategies.

### **3. Relational Structure:**

- FactTable acts as the central hub, with links to the WeekDay, DayPart, and VideoResolution tables. This structure is ideal for visualization and analysis in tools like Tableau.

## Data Analytical Techniques

We aimed to uncover insights about Instagram Reels performance using engagement metrics, time-of-post factors, and content characteristics. The goal is to help identify the drivers of engagement, develop actionable metrics, and suggest strategies for enhancing customer interaction on the account. We performed a series of data analysis techniques to uncover recommendations using these steps:

### 1. Data Collection and Management:

- The first step in our analysis is to ensure that the dataset is clean, consistent, and properly formatted. This involves checking for missing values and filling or removing them, verifying data types (e.g., ensuring that the postDate is a date and commentsCount is numeric), and handling duplicates to ensure each record is unique based on reelID.

Additionally, the data is stored across four interrelated tables:

- FactTable: Contains reel-level data, including engagement metrics (comments, views, plays), post date/time, caption data (hashtags, mentions), and music usage.
- WeekDay Table: Defines the day of the week for each reel post.
- DayPart Table: Describes the time of day (e.g., morning, afternoon) when the post was shared.
- VideoResolution Table: Contains details on video resolution, which may impact engagement.
- The tables are joined based on the following relationships:
  - FactTable[DayPartKey] → DayPart[DayPartKey], FactTable[DayKey] → WeekDay[DayKey]
  - FactTable[videoKey] → VideoResolution[videoKey]

## 2. Descriptive Analysis in Tableau:

- In Tableau, we designed dashboards that include key engagement metrics such as total comments, views, and plays for the entire dataset. By computing the average values of comments, views, and plays per reel, the analysis will help identify typical user responses to content. We made the dashboards dynamic, allowing us to filter the data by year, day of the week, or hourly intervals to uncover trends.
- We also created custom calculations to enrich the analysis. For example, the MonthReel calculation will extract the month from the postDate to analyze seasonal trends. The LengthCaption metric calculated the length of each caption to explore its relationship with engagement metrics. The HourlyIntervalReel calculation categorized timestamps into hourly intervals, which helped us analyze trends in engagement throughout the day.

## 3. Temporal Analysis:

- In this phase, our focus was on analyzing how engagement varies by time of day and day of the week. We created a custom engagement metric, which incorporated counts of comments, views, and plays in a weighted manner, making it more reliable. Using this custom metric, we created a heat map to visualize engagement across different day parts and days of the week.
- The heat map allows our client to visually identify patterns in user engagement, such as which day parts and days of the week tend to drive the most interaction. This insight will be valuable for developing strategies aimed at posting during optimal times to increase engagement.

## 4. Video Content Analysis:

- In this phase, the analysis will explore how video duration impacts engagement. We categorized video durations into specific intervals (e.g., 0-30 seconds, 31-60 seconds, 61-90 seconds) and assessed how these categories influence comments, views, and plays. We created a dynamic dashboard that had filters by video duration to observe the impact on engagement metrics. The results from this analysis helped identify the optimal video length for driving the highest engagement.

#### 5. Engagement Flow Analysis with Sankey Diagram:

- We created a Sankey diagram to visualize how engagement metrics flow across different categories such as days of the week, dayparts, and music usage. This visualization helped analyze the relationship between these factors and identify key drivers of engagement. Filters sliced the data by video duration, providing a more granular understanding of how engagement changes with video length. The diagram provided actionable insights into which combinations of time, day, and music usage result in higher engagement, enabling us to recommend optimal posting strategies based on these findings.

#### 6. Correlational Analysis in Excel:

- Using Excel, we conducted correlation matrices to explore relationships between engagement metrics and various factors such as video duration, music usage, and time of day. We assessed how video duration influences engagement (comments, views, plays) and examined the role of original music in driving interaction. Additionally, we created dummy variables for day parts (morning, afternoon, evening) and days of the week (Monday, Tuesday, etc.) to explore how these factors correlate with engagement metrics.

#### 7. Multiple Regression Analysis:

The multiple regression analysis identified predictors of engagement metrics such as comments, video views, and video plays. We ran separate regression models for each dependent variable (comments, views, and plays), analyzing independent variables such as video duration, day part, video resolution, music usage, and the number of hashtags. Each model provided insights into which factors are statistically significant predictors of engagement.

By comparing the results across these models, we identified common predictors and focused on those factors when making recommendations for content optimization. This analysis helped us better understand which elements of Holly's posts drive engagement, allowing for more data-driven decision-making.

## Exploratory Analysis

Table 1: Descriptive Statistics

	commentsCount		videoViewCount		videoPlayCount		videoDuration		HashtagsCount		MentionsCount
Mean	1.990825688	Mean	115.3211009	Mean	285.2256881	Mean	30.36580367	Mean	16.3706422	Mean	1.84587156
Standard Error	0.162251035	Standard Error	10.98523988	Standard Error	23.36229542	Standard Error	1.801159583	Standard Error	0.346466291	Standard Error	0.128072772
Median	1	Median	64	Median	165	Median	22.533	Median	16	Median	1
Mode	0	Mode	0	Mode	0	Mode	29.933	Mode	10	Mode	1
Standard Deviation	3.787788556	Standard Deviation	256.4530071	Standard Deviation	545.398278	Standard Deviation	42.04849384	Standard Deviation	8.088336996	Standard Deviation	2.989888969
Sample Variance	14.34734215	Sample Variance	65768.14487	Sample Variance	297459.2817	Sample Variance	1768.075834	Sample Variance	65.42119536	Sample Variance	8.93943605
Kurtosis	171.7337157	Kurtosis	83.93881912	Kurtosis	68.72428674	Kurtosis	60.58017037	Kurtosis	-1.09558031	Kurtosis	97.25571034
Skewness	10.61013547	Skewness	8.522017427	Skewness	7.350482472	Skewness	7.013507439	Skewness	-0.041011957	Skewness	8.384185155
Range	68	Range	3119	Range	6824	Range	508.7	Range	30	Range	44
Minimum	0	Minimum	0	Minimum	0	Minimum	2.833	Minimum	0	Minimum	0
Maximum	68	Maximum	3119	Maximum	6824	Maximum	511.533	Maximum	30	Maximum	44
Sum	1085	Sum	62850	Sum	155448	Sum	16549.363	Sum	8922	Sum	1006
Count	545	Count	545	Count	545	Count	545	Count	545	Count	545

Table 2: Correlation Matrix of Video Metrics

	commentsCount	videoViewCount	videoPlayCount	videoDuration
commentsCount	1			
videoViewCount	0.259020197	1		
videoPlayCount	0.239576824	0.956050351	1	
videoDuration	0.154111493	0.021728657	0.087320908	1

Table 3: Correlation Matrix of Video Metrics and Music Usage

	Uses Original Music	commentsCount	videoViewCount	videoPlayCount
Uses Original Music	1			
commentsCount	0.052989942	1		
videoViewCount	0.093723931	0.259020197	1	
videoPlayCount	0.014179229	0.239576824	0.956050351	1

### Step-by-step Description of Data Analytical Techniques:

#### 1. Data preparation and cleaning

- Organized raw data into relational tables (FactTable, WeekDay, DayPart, VideoResolution).
- Ensured data integrity by cleaning missing or inconsistent values.
- Created calculated columns in Tableau for trends analysis, such as:

- MonthReel for seasonal patterns.
- LengthCaption to study caption length and engagement.
- HourlyIntervalReel for hourly trend analysis.

## **2. Descriptive Analytics**

- Summarized key engagement metrics (total comments, video views, video plays) to understand overall performance.
- Calculated averages for engagement metrics across reels to identify baseline performance levels.

## **3. Correlation Analysis**

- Conducted correlation matrices in Excel to identify relationships between variables (e.g., video duration, engagement metrics, music usage, and temporal variables).
- Visualized correlations using heat maps for better interpretation.

## **4. Regression Analysis**

- Built multiple regression models to identify key predictors for engagement metrics:
  - Comments, video views, and video plays as dependent variables.
  - Predictors included video duration, day part, video resolution, music usage, and hashtags.

## **5. Dashboard Development**

- Designed interactive dashboards in Tableau for real-time data exploration:
  - Basic Engagement Overview Dashboard to dynamically filter key metrics by time and date.
  - Temporal Analysis Dashboard using heat maps for engagement trends by day parts and weekdays.
  - Video Content Analysis Dashboard to explore video duration's effect on engagement.
  - Engagement Flow Analysis Dashboard with Sankey diagrams for visualizing engagement flows.

## **6. Custom Metric Development**

- Created a unique engagement metric combining comments, views, and plays into a weighted index to provide actionable insights.

## **7. Visualization Techniques**

- Used Tableau's visualization tools (heat maps, Sankey diagrams, bar charts, etc.) to present findings clearly and interactively.
- Employed conditional formatting in Excel for easier pattern recognition in correlation matrices.

#### **8. Predictive and Prescriptive Analytics**

- Used regression outputs to forecast potential engagement outcomes for specific scenarios (e.g., posting at different times, using original music).
- Provided actionable recommendations based on insights from models and dashboards.

#### **9. KPI Development and Tracking**

- Defined key performance indicators (KPIs) for engagement (e.g., average views per reel, peak posting times).
- Tracked these KPIs to evaluate the impact of recommendations on engagement performance.

#### **10. Documentation and Presentation**

- Consolidated findings and techniques into a detailed report, including visual demonstrations from Tableau.
- Presented key insights, recommendations, and limitations to stakeholders in a formal business presentation format.



## Results

The following dashboard summaries were created in Tableau and yielded the following information regarding various engagement metrics. The purpose of these dashboards was to dynamically display engagement metrics that could provide insight into how Makeup by Holly LLC should implement promotional or change strategies.

### Dashboard 1:

- Prime days: Monday and Tuesday show the highest user engagement.
  - Monday:
    - Highest total Comments (249)
    - High views (12,650) and plays (28,151)
  - Tuesday:
    - Highest total plays (31,119)
    - High Views (12,582)
- Peak Engagement Times:
  - 12-1 PM: Highest comment activity (82 comments over all days)
  - 2-3 PM: Highest Views (9,521) and highest plays (20,498)

### Dashboard 2:

- Engagment Metric Forumla:
  - The engagement metric is calculated using the following formula:  $(0.5 \times \text{Comments Count}) + (0.25 \times \text{Video View Count}) + (0.25 \times \text{Video Play Count})$ .  
This formula prioritizes comments as the most meaningful indicator of

engagement, assigning them a 50% weight. Video views and plays are equally weighted at 25%, balancing audience reach with active participation.

- High Engagement Periods:
  - Monday afternoons: The highest engagement, driven by comments and views.
  - Tuesday afternoons and evenings: strong engagement, particularly in plays.
  - Thursday afternoons: high interaction, supported by comments and views.
- Low Engagement Periods:
  - Sunday (all day): Consistently low engagement across all metrics.
  - Thursday Mornings: Minimal audience activity.
  - Saturday Mornings: Limited interaction and content consumption.

### **Dashboard 3:**

- Video length and engagement:
  - The data reveals a significant drop in engagement for videos longer than 30 seconds. Key metrics illustrate this pattern:  
Videos less than 30 seconds:
    - 634 comments, 43,082 views, and 104,469 plays
 Videos 30 seconds or longer:
    - Engagement drops to 286 comments, 14,514 views, and 36,677 plays
  - The stark contrast highlights that shorter videos consistently outperform longer ones in all engagement metrics. Beyond 30 seconds, the engagement continues to dwindle.

### **Dashboard 4:**

1. Comments:
  - Peak activity occurs on Monday and Tuesday.

- These periods are optimal for fostering user interaction.

2. Video Views:

- Most frequent on Tuesday and Thursday, with high engagement during the afternoon and evening.

3. Video Plays:

- Highest on Monday and Tuesday, with a significant majority occurring in the afternoon and evening.

4. Original Audio:

- Content using original audio achieves consistently higher engagement across all metrics, emphasizing the value of unique, personalized content.

5. Anomalies:

- A slight disparity exists between video views and plays, suggesting possible issues with content resonance, audience preferences, or delivery.

A series of correlation matrices were also run in Excel to determine the relationship between the various engagement variables. For example, the first correlational matrix included video duration, comments, video views, and video plays. Focusing on Video Duration, it's effect on engagement metrics is relatively negligible. The highest correlation it has among all engagement metrics is with the comments count, which has a 15% correlation with video duration. As it relates to how often the video is played or viewed, the length of the video has less than a 10% correlation. In conclusion, video duration and the number of comments, the number of people who view videos, and the number of people who play videos have very weak

correlations with each other. They should not be used as a reliable metric to explain engagement metrics.

The second correlation matrix included the use of original music, comments, video views, and video plays as the engagement variables. Focusing on how original music impacts engagement metrics, it doesn't show strong correlations with any other engagement variables, therefore music does not greatly affect engagement metrics.

The last correlation matrix used the time of day, day of the week, comments, video plays, and video views as the engagement variables. The correlations between days of the week (Monday to Sunday) and engagement metrics (commentsCount, videoViewCount, videoPlayCount) are mostly weak or slightly negative, which suggests that there is no significant difference between days regarding engagement. However, even though the correlations are not strong, Monday shows all positive correlations among comments, views, and plays, indicating users may engage more at the start of the week compared to other days. Tuesday and Thursday also have mostly positive correlations, with only the comment correlation being negative for those two days.

The afternoon has slightly positive correlations in all engagement metrics, while both morning and evening have negative correlations, suggesting that the afternoon is the best time to post reels.

Based on the correlation analysis, the best time to post Instagram Reels is Monday afternoon, as it shows consistent positive correlations across comments, views, and plays, indicating higher engagement at the start of the week. Tuesday and Thursday afternoons are good secondary options, with positive correlations for views and plays. In general, posting during the

afternoon (12 PM - 4 PM) is best, as it gives better engagement compared to mornings or evenings, which both show negative correlations.

Multiple Regression analyses were also run in Excel, where the first regression predicted comments, the second predicted video views, and the last predicted video plays. In this Regression analysis, we used the number of comments as the dependent variable. The independent variables are the video duration, day part, video resolution, the uses of original music, and the number of hashtags. Video duration had a very low p-value (0.0003) meaning that video duration is a statistically significant predictor of the number of comments. The use of original music had a p-value of 0.0526 resulting in a borderline of statistical significance. The use of original music may have a slight positive effect on the number of comments, but it's not strong enough to be considered statistically significant at 0.05. Video Resolution had a p-value is less than 0.05 (0.0254) indicating that video resolution is statistically significant in predicting the number of comments. Higher-resolution videos are likely to generate more comments, and this result is robust enough to be considered a reliable finding.

The independent variables in regression analysis two are the video duration, day part, video resolution, the uses of original music, and the number of hashtags. After running the regression analysis, the P-value was greater than .05, so we cannot reject the null hypothesis.

The independent variables are the video duration, day part, video resolution, the uses of original music, and the number of hashtags. The p-value was 0.43, meaning it was too high to reject the null hypothesis.

## Conclusions and Recommendations

Makeup by Holly LLC has a strong social media presence but can enhance engagement and content performance. Our analysis highlights key opportunities and practical strategies.

Mondays and Tuesdays show the highest user interaction, with peak times at 12-1 PM for comments and 2-3 PM for views and plays. Short videos under 30 seconds outperform longer ones, emphasizing concise content. Original audio and visually compelling reels further boost engagement. Low engagement times, like Sunday mornings, are best for routine content.

### Recommendations

1. **Content Posting Schedule:** Focus on Mondays and Tuesdays. Post at 12-1 PM to encourage comments and 2-3 PM for views and plays. Use Tuesday evenings and Thursday afternoons for additional high-value posts.
2. **Content Strategy:**
  - **12-1 PM:** Post interactive content (e.g. Q&A, polls) and respond to comments quickly.
  - **2-3 PM:** Share visually appealing reels (e.g., transformations, behind-the-scenes) to capture attention.
  - Use original audio for authenticity and higher engagement.
3. **Video Length:** Keep videos under 30 seconds. Split longer topics into multiple parts and include engaging hooks with clear calls-to-action.
4. **Engagement Tools:** Use captions to prompt interaction (e.g., “Tag a friend”). Optimize thumbnails and titles for better alignment with audience expectations.
5. **Low Engagement Times:** Post routine content during low-activity periods like Sunday mornings to maintain consistency without using high-value material.

## **Limitations**

The analysis of social media data for Makeup by Holly LLC provides useful insights, but there are limitations that could affect the validity and generalizability of the findings.

One limitation is the timeframe of the data, which spans 2018 to 2024. Over these years, Instagram has added new features and changed its algorithms, making it hard to compare data across years. For example, the introduction of reels and stories significantly changed how users interact with posts. As a result, differences in engagement may reflect platform changes rather than content effectiveness.

Another issue is repeat viewers, which can boost engagement metrics like views and plays. If a single person watches a reel multiple times, it may falsely suggest broader reach. More precise metrics that distinguish unique from repeat interactions could address this threat to validity.

Trends in beauty and social media are also fast-paced and unpredictable. What works one month may lose relevance in the next month. This makes it hard to use past data to create long-term strategies, limiting the possibility for trend-based recommendations.

Finally, the data lacks information about the audience, such as demographics or interests. This limits the depth of insights and makes it harder to fully understand engagement patterns.

## **Potential Future Research**

Future research could include audience data like age, location, and interests to provide deeper insights and improve validity. Addressing repeat viewers in metrics would also make engagement measures more accurate. Studying the effects of new Instagram features and tracking trends in real time could help build more adaptive strategies.

## **Appendix**

Move all extraneous analysis, tables, reports, project management documents to the append



