

2017

AP[®]

CollegeBoard

AP Research Academic Paper

Sample Student Responses and Scoring Commentary

Inside:

- ☑ Sample B
- ☑ Scoring Guideline
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AP[®] RESEARCH 2017 SCORING GUIDELINES
Performance Task Rubric: Academic Paper

| Content Area | Performance Levels | | |
|--|---|--|---|
| 1 Understand and Analyze Context | The paper identifies a broad topic of inquiry and/or a purpose. 2 | The paper identifies a focused topic of inquiry and describes the purpose. 4 | The paper explains the topic, purpose, and focus of the inquiry and why further investigation of the topic is needed by connecting it to the larger discipline, field, and/or scholarly community. 6 |
| 2 Understand and Analyze Argument | The paper identifies or cites previous scholarly works and/or summarizes a single perspective on the student’s topic of inquiry. 2 | The paper summarizes, individually, previous scholarly works representing multiple perspectives about the student’s topic of inquiry. 4 | The paper explains the relationships among multiple scholarly works representing multiple perspectives, describing the connection to the student’s topic of inquiry. 6 |
| 3 Evaluate Sources and Evidence | The paper uses sources/evidence that are unsubstantiated as relevant and/or credible for the purpose of the inquiry. 2 | The paper uses credible and relevant sources/evidence suited to the purpose of the inquiry. 4 | The paper explains the relevance and significance of the used sources/cited evidence by connecting them to the student’s topic of inquiry. 6 |
| 4 Research Design | The paper presents a summary of the approach, method, or process, but the summary is oversimplified. 3 | The paper describes in detail a replicable approach, method, or process. 5 | The paper provides a logical rationale for the research design by explaining the alignment between the chosen approach, method, or process and the research question/project goal. 7 |
| 5 Establish Argument | The paper presents an understanding, argument, or conclusion, but it is simplistic or inconsistent, and/or it provides unsupported or illogical links between the evidence and the claim(s). 3 | The paper presents a new understanding, argument, or conclusion that the paper justifies by explaining the links between evidence and claims derived from the student’s research. 5 | The paper presents a new understanding, argument, or conclusion that acknowledges and explains the limitations and implications in context. 7 |
| 6 Select and Use Evidence | Evidence is presented, but it is insufficient or sometimes inconsistent in supporting the paper’s conclusion or understanding. 2 | The paper supports its conclusion by compiling relevant and sufficient evidence generated by the student’s research. 4 | The paper demonstrates an effective argument through interpretation and synthesis of the evidence generated by the student’s research, while describing its relevance and significance. 6 |
| 7 Engage Audience | Organizational and design elements are present, but sometimes distract from communication or are superfluous. 1 | Organizational and design elements convey the paper’s message. 2 | Organizational and design elements engage the audience, effectively emphasize the paper’s message and demonstrate the credibility of the writer. 3 |
| 8 Apply Conventions | The paper cites and attributes the work of others, but does so inconsistently and/or incorrectly. 2 | The paper consistently and accurately cites and attributes the work of others. 4 | The paper effectively integrates the knowledge and ideas of others and consistently distinguishes between the student’s voice and that of others. 6 |
| 9 Apply Conventions | The paper’s use of grammar, style and mechanics convey the student’s ideas; however, errors interfere with communication. 1 | The paper’s word choice and syntax adheres to established conventions of grammar, usage and mechanics. There may be some errors, but they do not interfere with the author’s meaning. 2 | The paper’s word choice and syntax enhances communication through variety, emphasis, and precision. 3 |

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Performance Task Rubric: Academic Paper

NOTE: To receive the highest performance level presumes that the student also achieved the preceding performance levels in that row.

ADDITIONAL SCORES: In addition to the scores represented on the rubric, readers can also assign scores of **0** (zero).

- A score of **0** is assigned to a single row of the rubric when the paper displays a below-minimum level of quality as identified in that row of the rubric.

AP[®] RESEARCH 2017 SCORING COMMENTARY

Academic Paper

Overview

This performance task was intended to assess students' ability to conduct scholarly and responsible research and articulate an evidence-based argument that clearly communicates the conclusion, solution, or answer to their stated research question. More specifically, this performance task was intended to assess students' ability to:

- Generate a focused research question that is situated within or connected to a larger scholarly context or community;
- Explore relationships between and among multiple works representing multiple perspectives within the scholarly literature related to the topic of inquiry;
- Articulate what approach, method, or process they have chosen to use to address their research question, why they have chosen that approach to answering their question, and how they employed it;
- Develop and present their own argument, conclusion, or new understanding while acknowledging its limitations and discussing implications;
- Support their conclusion through the compilation, use, and synthesis of relevant and significant evidence generated by their research;
- Use organizational and design elements to effectively convey the paper's message;
- Consistently and accurately cite, attribute, and integrate the knowledge and work of others, while distinguishing between the student's voice and that of others;
- Generate a paper in which word choice and syntax enhance communication by adhering to established conventions of grammar, usage, and mechanics.

Music Chemistry

The Formula of K-Pop

Word Count: 4,314

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I. ABSTRACT:

South Korean pop music, or K-Pop, is a rapidly growing sector of the music industry, and has experienced increased economic success and international exposure over the last few years. Although a variety of possible causes have been postulated for this heightened popularity, this study aims to quantitatively analyze one aspect of K-Pop in particular - the music itself. Utilizing a novel method involving musical correlational analytics, this research will anatomize successful K-Pop songs released between 2014 and 2016 and parse existing databases for records of those songs. These two sets of information will then be compared with each other and evaluated for meaningful correspondence. The results of this evaluation potentially hold revelations of how a K-Pop song's content and commercial success are linked, leading to large-scale implications in terms of how K-Pop music producers choose to develop their songs. Beyond these industry-specific ramifications, however, this study also adopts a methodology that can be applied to analyze other styles of music.

II. INTRODUCTION

Music has traditionally been perceived as a creative art form, delivered through the medium of sound. Its forms and elements vary vastly across societies and cultures, and its origins can be drawn back to prehistoric eras. The development and structure of music is amazingly complex, with different pitches, rhythms, timbres and dynamics all contributing to the effect a musical piece can have on a listener. It is this complexity that has influenced the analysis and study of music, causing researchers to utilize qualitative methods in examining music. This approach, although fairly effective at exploring musical qualities that attract a listener's interest and emotion, inherently introduces an aspect of bias.

Due to advances in technology, however, a new realm of quantitative investigation has been unlocked, and this research plans to use a novel method involving musical correlational analytics. This research seeks to use this method to discover potential relationships and connections between the quantitatively measured aspects of a song and its popularity within an audience, particularly pertaining to the music industry of South Korea. In this study, songs will be anatomized and organized through analytics software that provides measurements for pre-defined values. Existing databases will be parsed for information concerning each song's success, and the two datasets will be compared for correlations between them. Based off of existing trends in the current musical world, it is predicted that the most successful songs will possess higher levels of energy with consistent beat patterns, and that those trends will be present in the datasets when analyzed. This new quantitative analysis presents implications for song producers in South Korea, as well as researchers seeking to investigate other music industries using this easily replicable research methodology.

III. LITERATURE REVIEW

For the purpose of this study, the South Korean pop music industry was selected for analysis due to a variety of attributes it possesses. First of all, Korean pop music, or K-Pop, encompasses a large variety of musical styles. According to Timothy N. Laurie, a researcher of Cultural Studies at the University of Technology Sydney, K-Pop incorporates elements from global hip-hop, smooth R&B, Hi-NRG, Japanese pop, and Cantonese pop.¹ Not only are songs pertaining to these styles present within K-Pop, hybrids and blends between these different styles have developed as well, introducing even more variation. This diversity means that analysis of the Korean music industry, which will be performed within this research, offers insights and conclusions about other musical genres and industries. Additionally, the large variety of styles signifies K-Pop as an independent, comprehensive musical environment, allowing it to serve as a microcosm for other music industries and audiences in general.

Beyond the assortment of different musical styles present in K-Pop, another attribute it possesses makes it extremely attractive as a subject for this research. This attribute is the relative size of the industry as a whole, and the number of songs released every year. Of all the songs released in South Korea every year, approximately 60 songs can be considered to achieve a moderate level of success, both domestically and internationally. These moderately successful songs were selected because of an easily defined and implemented criterion that will be further discussed in the Methodology portion, **Section IV**. Considering the 3 year time span covered in this study, the number of songs to be analyzed is reasonable given the scope and resource limitations of this research. The size of the K-Pop industry was an important consideration when

¹ Laurie, Timothy N. *Toward a Gendered Aesthetics of K-Pop*. Edited by Henry Johnson and Ian Chapman. London & New York: Routledge, 2016.

selecting the focus of this study, as it allows the research to adequately analyze a number of songs over an appropriate time period.

An important contribution to the growing size of this industry can be found in Hallyu, or the Korean wave. Hallyu, a neologism for the ‘flow of Korea,’ refers to “a surge in the international visibility of Korean culture” originating within East Asia during the 1990s, and more recently expanding to the United States, Latin America, the Middle East, and parts of Europe.² Generally, Hallyu is composed of multiple aspects of Korean culture, including fashion, music, television programs, cosmetics, and games. The musical portion, K-Pop, has played a key role in Hallyu’s continuing success, and the relationship between the two has been mutually beneficial.³ One of Hallyu’s premier examples is Gangnam Style, a song released in 2012 by K-Pop artist PSY. Although the song itself is a phenomenon that deserves separate examination, its significance to this study can be found in the interest it generated in the Korean music industry. In the year following the release of the song, views of Korean artists on YouTube tripled, from around 2.2 billion to 7 billion views.⁴ It also holds a variety of accolades, from being the first song to reach 1 billion views on YouTube, to being recognized by the United Nations as an “international sensation.”⁵ Hallyu and K-Pop comprise a feedback loop, with each contributing to the development of the other, and discoveries concerning either one of them presenting

² Ravina, Mark. "Conceptualizing the Korean Wave ." *Southeast Review of Asian Studies* 31 (2009): 3-9. Accessed February 15, 2017.

³ Kim, Sang Yeob. "Investigation on the Management Status of K-Pop Revenue Model and Finding Ways for Improvement." *International Journal of Trade, Economics and Finance*, 2012, 343-46. doi:10.7763/ijtef.2012.v3.224.

⁴ "K-Pop's Profile Expands Exponentially, All Thanks to Psy." Billboard. Accessed February 15, 2017. <http://www.billboard.com/biz/articles/news/digital-and-mobile/1685153/k-pops-profile-expands-exponentially-all-thanks-to-psy>.

⁵ "From Korean Pop music to Skydiving to Earth – Not-your-typical diplomatic meetings for UN Secretary-General." UN News Center. October 24, 2012. Accessed February 15, 2017. http://www.un.org/apps/news/story.asp?NewsID=43373&Cr=secretary-general&Cr1=#.WKSAR_nyvIV.

valuable insights into the expansion of the other. As such, the investigation of K-Pop can lead to additional discoveries about the spread of Hallyu.

Even with K-Pop's rising popularity, certain aspects of the music industry itself limit the rate at which this advancement can occur. The K-Pop industry is extremely structured, and is organized into record labels, music production houses, event management companies, and various merchandise providers. This detailed format involves a trainee system, where potential artists are recruited at a young age and live in a regulated environment, developing their skills in singing and dancing.⁶ This meticulous setup is restrictive towards individuals who wish to create their own music, independent from the industry's companies and established infrastructure, meaning that virtually all artists within the K-Pop scene are affiliated with a label that developed and promoted them. As such, even though Hallyu's rising prominence has increased interest and curiosity towards K-Pop, South Korea's relatively structured music industry limits the proliferation of new music. These two factors, in tandem, have contributed to an industry with a healthy, controlled rate of growth and a promising future, and that has an appropriate size for this study to focus on.

With Hallyu and K-Pop's current reputation, various academic sources have sought to investigate the driving causes behind its appeal, especially internationally. Dal-yong Jin and Woong-jae Ryoo's essay explored the incorporation of English lyrics in K-Pop songs as a form of cultural hybridization that helped develop a transnational appeal. They wished to understand K-Pop as a cultural phenomenon by analyzing the progression of the lyrical content under the context of unfolding globalization.⁷ Their research, although valuable, utilized a more traditional,

⁶ Kim, Yoon-mi. *K-Pop: A New Force in Pop Music*. Seoul: Korean Culture and Information Service, 2011.

⁷ Jin, Dal Yong, and Woong Jae Ryoo. "Critical Interpretation of Hybrid K-Pop: The Global-Local Paradigm of English Mixing in Lyrics." *Popular Music and Society* 37, no. 2 (2012): 113-31. doi:10.1080/03007766.2012.731721.

qualitative approach and served to bolster an understanding of the lyrical foundation found in K-pop. They discussed how the presence of English within the lyrics was vital to K-pop's international expansion, by offering familiar sections in each song to non-Korean listeners.

In another study, by Yew Chee Chew, 5 separate factors were identified as the main causes of K-Pop's popularity. One of them was a production factor, which relates to the incorporation of music and lyrics from imported Western and Japanese music producers. This one was intimately connected with Jin and Ryoo's work, especially the facet of fusing cultural aspects of other countries and how it contributes to driving K-pop's global appeal. The other factors were performance, idol characteristics, training, and Korean culture.⁸ Chew's study weighed each of these factors evenly, whereas Jin and Ryoo focused on the lyrical aspect as the most significant contributors. This study intends to focus on the musical aspect of K-Pop, similar to the production factor identified in Chew's work, but instead of a qualitative analysis of the lyrics and music of K-Pop, this research utilizes a quantitative approach.

This research intends to find a numerical correlation between the musical qualities of songs and their success. Inspiration for this choice of methodology was drawn largely from a data visualization project titled "Visualizing a Hit," performed by Shaun Ellis and Tom Engelhardt.⁹ Within their project, they used the Echo Nest API, a music analytics software, to examine and scrutinize popular American songs released between 1960 and 2010. Echo Nest was recently acquired by Spotify, but its fundamental programs and algorithms remain the same. Essentially, a set of characteristics of the K-Pop industry establish it as a suitable subject for this

⁸ Chew, Yee Chee. "The Five Success Factors of K-pop Music: An Exploratory Study on How The Factors Affect Fans' Satisfaction."

⁹ "Visualizing a Hit - InfoVis Final Project." Google Sites. Accessed February 20, 2017. <https://sites.google.com/site/visualizingahit/home>.

research, which intends to utilize a quantitative method. In the next section, this methodology will be further clarified and defined.

IV. METHODOLOGY

The first step in carrying out the research was to select which songs would be reviewed and examined. Hundreds of songs are released each year in South Korea, and it was not feasible to analyze them all, given the time constraints of this project. As such, songs were chosen if they attained a moderate level of success, defined by if a song managed to win a music show. This definition was selected as it provides the most concise and effective formula for choosing an appropriate number of songs. Music shows are weekly television broadcasts, where artists perform and receive scores based off different factors, as shown below in **Figure 1**.

| Music Show | System Used |
|----------------------|--|
| <i>The Show</i> | Pre-score: Total 70% [Album sales + Digital sales + SNS (Korea) (35%) + Tudou music video views + pay vote items (China) (35%)]. Live voting (<i>for nominees only</i>): Total 30% [Text votes (Korea) (15%) + Tudou votes (China) (15%)] |
| <i>Show Champion</i> | Digital sales (streaming + downloads) (50%), Online voting (MelOn) (15%), Physical sales (Hanteo) (20%), Ranking from professional judges (MBC Music) (15%) ¹⁰ |
| <i>M Countdown</i> | Digital music sales score (50%), Album sales volume score (15%), Social media score (15%), Popularity score (10%), Broadcast score (10%), Live broadcast real time voting score (10%) ¹¹ |

¹⁰ "신동 · 김신영, MBC뮤직 `쇼 챔피언` 진행". Digital Times (in Korean). Accessed March 06, 2017. http://www.dt.co.kr/contents.html?article_no=2012020602019954604007

¹¹ "Weekly KPOP Music Chart & K-POP Star Chart | M COUNTDOWN." Mwave. Accessed March 06, 2017. <http://mwave.interest.me/mcountdown/vote/mcdChart>.

| | |
|-------------------|--|
| <i>Music Bank</i> | Digital music charts (65%), Album sales (5%), Number of times broadcast on KBS TV only (20%), Viewer's choice charts (10%) ¹² |
| <i>Inkigayo</i> | Digital single sales (55%), SNS (YouTube Views) (35%), Album sales (5%), Advance viewer votes (5%) (for 1st place candidates only) ¹³ |

Figure 1: Factors Accounted for in Music Show Scoring

The winners of the 5 largest shows, *The Show*, *Show Champion*, *M Countdown*, *Music Bank*, and *Inkigayo*, between 2014 and 2016 were tabulated, along with their number of wins. This amounted to a total of 192 songs spanning the 3 year period.

For the next step of analysis performed in this study, the Echo Nest/Spotify API was used.¹⁴ **Figure 2** below outlines the values that the API can return, the range of possible values, and their meanings, in terms of the musical qualities they represent.

| Value | Range | Meaning |
|------------------|-----------|---|
| Acousticness | 0.0 ~ 1.0 | Measure of if a song is acoustic (not having electronic amplification). |
| Danceability | 0.0 ~ 1.0 | Measure of how suitable a song is for dancing, based on tempo, rhythm stability, beat strength, and overall regularity. |
| Energy | 0.0 ~ 1.0 | Measure of intensity and activity, based on dynamic range, perceived loudness, timbre, onset rate, and general entropy. |
| Instrumentalness | 0.0 ~ 1.0 | Measure of if a song is instrumental (sound generated solely by instruments without vocals). |
| Key | 0 ~ 11 | The key the track is in |

¹² "[Oh!쎌 초점] '뮤직뱅크' 해외 팬만 중요? 시청자 의견에 귀 달았나". Chosun (in Korean). Accessed March 06, 2017. http://news.chosun.com/site/data/html_dir/2015/04/10/2015041003723.html

¹³ 인기가요 차트 공지사항 [Inkigayo Methodology] (in Korean). Seoul Broadcasting System. Accessed March 06, 2017.

http://program.sbs.co.kr/builder/verticalEndpage.do?pgm_id=00000010182&pgm_mnu_id=22962&pgm_build_id=48&pageIdx=1&bbsCd=ct_gayo3&searchCondition=title&searchKeyword=&contNo=90000010

¹⁴ "Get Audio Features for a Track." Spotify Developer. Accessed March 06, 2017.

<https://developer.spotify.com/web-api/get-audio-features/>.

| | | |
|-------------|-------------|---|
| Liveness | 0.0 ~ 1.0 | Measure of if a song was performed live. |
| Loudness | -60 ~ 0 | Measure of the overall loudness of a song in decibels, averaged across the whole song. Loudness represents the primary psychological correlate of a song's amplitude. |
| Mode | 0 ~ 1 | Measure of if a track is major or minor. |
| Speechiness | 0.0 ~ 1.0 | Measure of presence of spoken words in the song. |
| Tempo | 0.0 ~ 250.0 | Overall estimated tempo of a song in beats per minute. |
| Valence | 0.0 ~ 1.0 | Measure of the musical positiveness conveyed by a song. |

Figure 2: Spotify API Values and Meanings¹⁵

Simply from examining the meaning column of **Figure 2**, a few values can be eliminated from the method's analysis. The first one is instrumentality, as there are no pertaining K-Pop songs that are purely instrumental, so the value would result in 0.0 or close to 0.0 for most songs. Additionally, liveness is an unnecessary value, as once again, each K-Pop song was recorded in a studio, instead of being a live performance, leading to 0.0 or near 0.0 outcomes. From there, each of the songs was input into the Spotify API engine. Unfortunately, 23 of the songs were not available on the Spotify database as of the time of this study, meaning that it was impossible to perform analysis on them with the API. This cut the number of usable songs down to 169.

After each of the remaining songs was analyzed, the values returned by the API were recorded in a spreadsheet and then transferred into a local database using the PostgreSQL relational database management system. This placement would permit convenient analysis and comparison in the future.

In addition to the values and qualities of the songs themselves, additional information about each song's success was recorded. The number of music show wins, music video views,

¹⁵ Ibid.

digital downloads, and streams were recorded for each song from the Gaon Music Chart, a chart that tabulates the popularity of songs and is compiled by the Korea Music Content Industry Association.¹⁶ Unfortunately, data could not be recovered for some of the songs in terms of both downloads and streams. For downloads, there were still enough songs to perform legitimate analysis on them, but the amount of streaming data was far too miniscule, and therefore streaming was excluded as a measurement of a song's success. However, since the data on the number of music show wins and music video views was more comprehensive, those two factors were considered to be more representative of the overall patterns.

Once the data compilation was completed and transferred into the database, the next step was to compare and analyze the resulting information. Each of the song qualities taken from the Spotify API was plotted against each of the measures of success on a simple scatter graph. PostgreSQL's inner join and grouping functions proved invaluable in this aspect, allowing for data to be taken from different tables and compared with each other. Excel spreadsheet software was then used to create parabolic trend lines that fit the graphs, and those lines were then used to deduct patterns and general sequences that could be seen in the data. These graphs allowed for viable comparisons between the different quantities the API measured for each song and how successful each song was, which were further analyzed for additional conclusions and implications. In essence, the methodology performed in this study compared the fundamental qualities of songs with their success within the market, which, as described in **Section III**, provides an effective quantitative analysis of music.

¹⁶ "국내 대표 음악 차트 가온차트!" Chart. Accessed March 08, 2017. <http://gaonchart.co.kr/>.

V. RESULTS/DATA ANALYSIS

As stated in the methodology section, **Section IV**, constraints of the Spotify API limited the number of songs analyzed to 169. Even so, the quantity of data is too large to reasonably display within this section. As such, the data will be included at the end of this paper. **Appendix A** contains information about the songs' music show wins, **Appendix B** contains data on the number of music video views and downloads, **Appendix C** contains the results of the API analysis, and **Appendix D** is a list of the songs that were excluded due to their lack of availability in the Spotify database.

The first results presented are of the mode and key from the API, as both of them had well-defined, whole number ranges for the values. The mode represents if a song is in a major or minor key, with 1 representing major and 0 representing minor. **Figure 3** shows the average success of songs within each mode.

| Mode: | Average MV Views (Million) | Average Music Show Wins |
|--------------|-----------------------------------|--------------------------------|
| Major (1) | 23.7 | 3.13 |
| Minor (0) | 36.3 | 3.61 |

Figure 3: Average Success based on Mode

As seen in **Figure 3**, songs with minor keys enjoyed more success than major songs, with, on average, 12.6 million more music video views, and 0.48 more music show wins.

The musical keys and the statistics are represented in **Figure 4**.

| Key: | Average MV Views (Million) | Average Music Show Wins |
|-----------------|-----------------------------------|--------------------------------|
| C (0) | 41.0 | 3.55 |
| C#/D ♭ (1) | 26.7 | 2.38 |
| D (2) | 32.6 | 2.44 |
| D#/E ♭ (3) | 6.3 | 1.57 |
| E (4) | 21.9 | 3.71 |
| F (5) | 22.9 | 3.94 |
| F#/G ♭ (6) | 64.7 | 4.23 |
| G (7) | 21.5 | 3.89 |
| G#/A ♭ (8) | 16.1 | 4.08 |
| A (9) | 11.6 | 2.58 |
| A#/B ♭ (10) | 35.6 | 3.00 |
| B (11) | 34.2 | 3.62 |
| Average: | 27.9 | 3.25 |

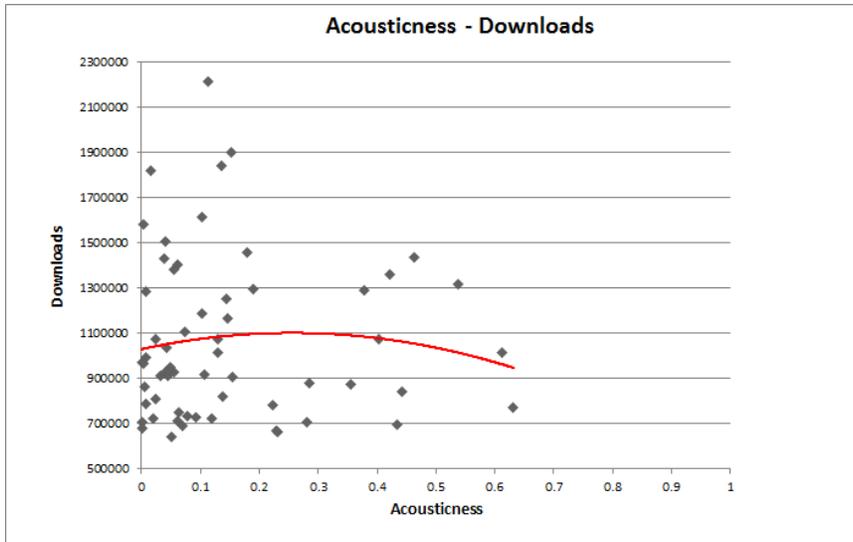
Figure 4: Average Success based on Key

Most of the keys enjoyed moderate success, with a few notable differences. In particular, the keys of C and F#/G ♭ enjoyed a larger number of music views, with 13.1 and 36.8 million more than the average, respectively. F#/G ♭ had similar success on music shows, averaging 0.98 more wins on average. D#/E ♭ performed exceptionally poorly in terms of both MV views and wins, having 21.6 million less views and 1.68 less wins than the average. The keys D, E, F, G, G#/A ♭, and A#/B ♭ had internally varying results, simultaneously performing both above and below average in the two categories. This can most likely be attributed to the low value of wins D#/E ♭ songs had, which significantly dropped the overall average number of show wins.

Different musical keys inherently instigate varying reactions, and this information describes which keys generate higher levels of popularity.

Beyond the Mode and Key that the API returned, data concerning all of the other values was also graphed. **Figures 5 to 12** are the other graphs of the values and measures of success. One important observation that needs to be discussed prior to the analysis of the graphs and data is the existence of a R^2 value for each trend line. This R^2 value is a statistical measure of how close the data fits the trend line. As will be seen from most of the graphs, the association between the data points and the trend lines is not very exact, meaning that the R^2 values are fairly small and precise predictions can not be made about the data values. This is expected, due to the large variability of values within the songs, which leads to a larger prediction interval for each value. However, lower R^2 values are not inherently bad, and important conclusions can still be drawn from this information, and are discussed in this section.¹⁷

¹⁷ Frost, Jim. "Regression Analysis: How Do I Interpret R-squared and Assess the Goodness-of-Fit?" Minitab. May 30, 1970. Accessed March 13, 2017. <http://blog.minitab.com/blog/adventures-in-statistics-2/regression-analysis-how-do-i-interpret-r-squared-and-assess-the-goodness-of-fit>.



The data points are shown in dark grey, and the line represents the trend line of best fit that matches the data.

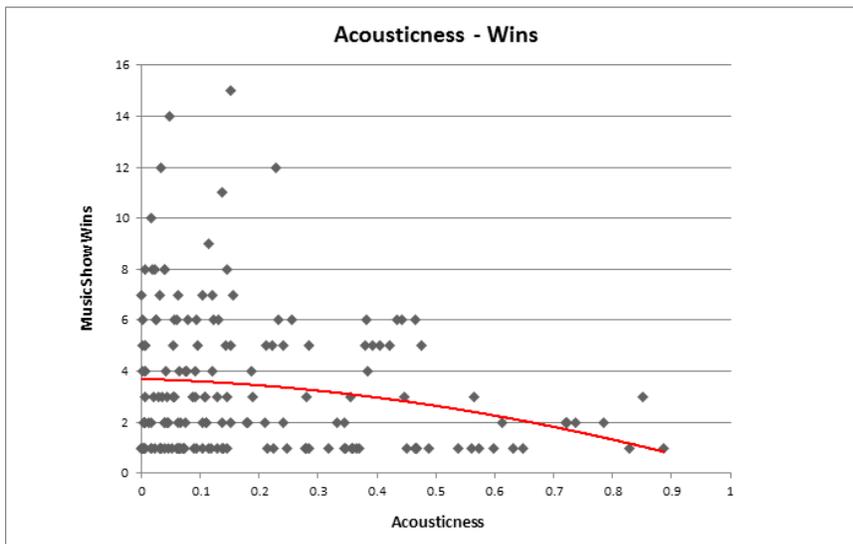
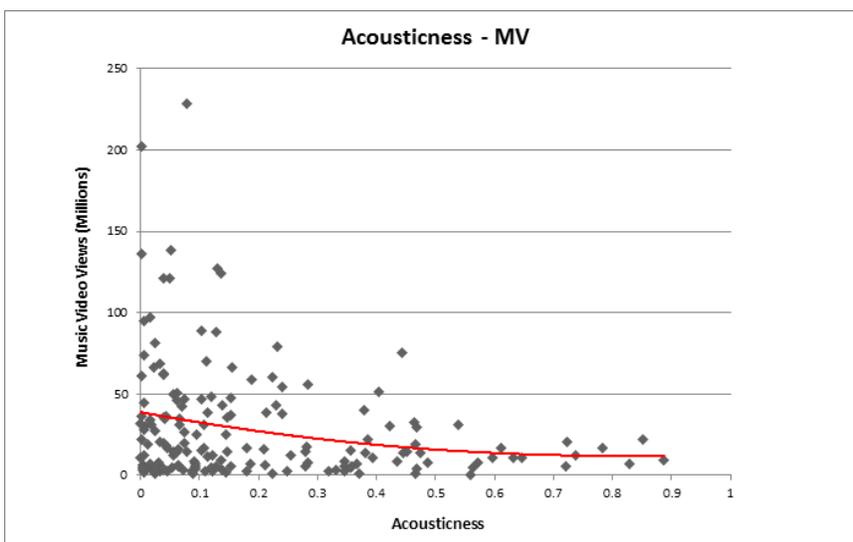


Figure 5: Acousticness Graphs



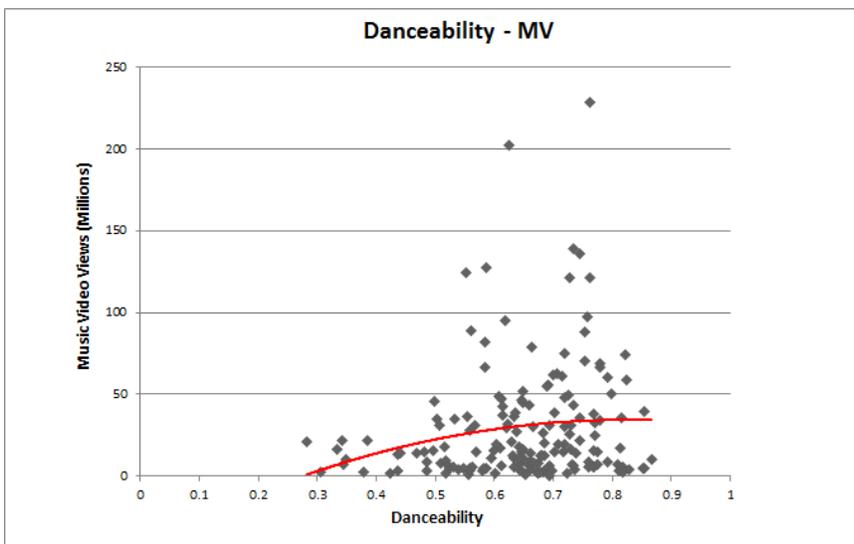
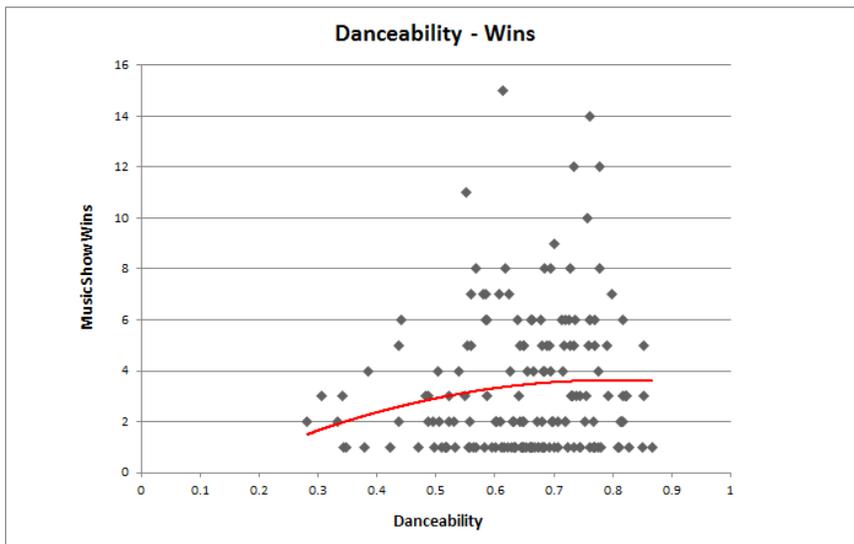
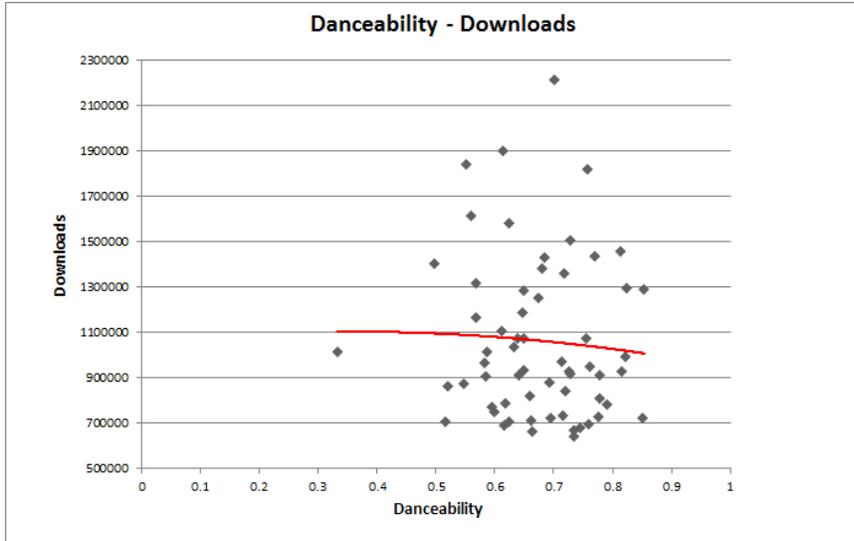


Figure 6: Danceability Graphs

For the graphs of the acousticness data in **Figure 5**, it appears that the songs with lower acousticness perform better, with a song's success in terms of all three categories (Downloads, MV Views, Show Wins) being inversely proportional with the acousticness. Recall that acousticness measures the absence of electronic amplification, and this trend can likely be explained by a general rise in the presence of electronic and EDM (Electronic Dance Music) influences in K-Pop. Although there are a few acoustic songs that are moderately successful, as they needed to have won a music show to qualify in the data set, acoustic songs generally do not achieve the same levels of success as electronic sound oriented songs. As such, it should be noted that lower levels of acousticness are generally conducive to better financial and popular performance.

For danceability, the graphs in **Figure 6** of MV Views and Show Wins show an upward trend that plateaus after a value of around 0.6. Danceability measures how suitable a song is for dancing, based on tempo, rhythm stability, beat strength, and overall regularity, and a pattern like this can most likely be attributed to a shift of interest towards faster-paced and dance-oriented songs, drawing again on the influence of EDM in K-Pop. The Download graph's fairly straight line is probably due to some outliers, because of the previously mentioned smaller amount of data for that particular comparison. As these regular, constant songs enjoy additional success, it can also be noted that the marginal benefit of higher danceability values decreases, and that the difference in success between songs with values of 0.65 and 0.85 is minimal. As such, songs should generally try to adhere to higher levels of danceability, with a stable rhythm, and regular, strong beats.

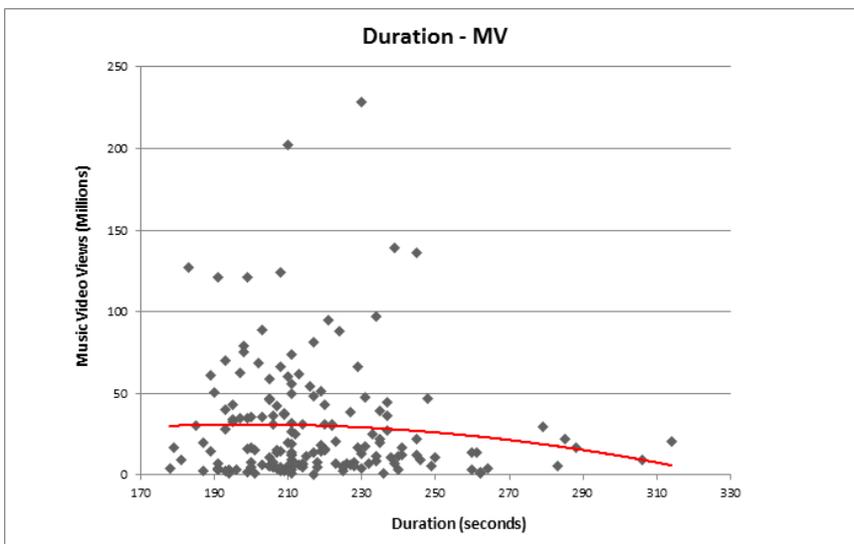
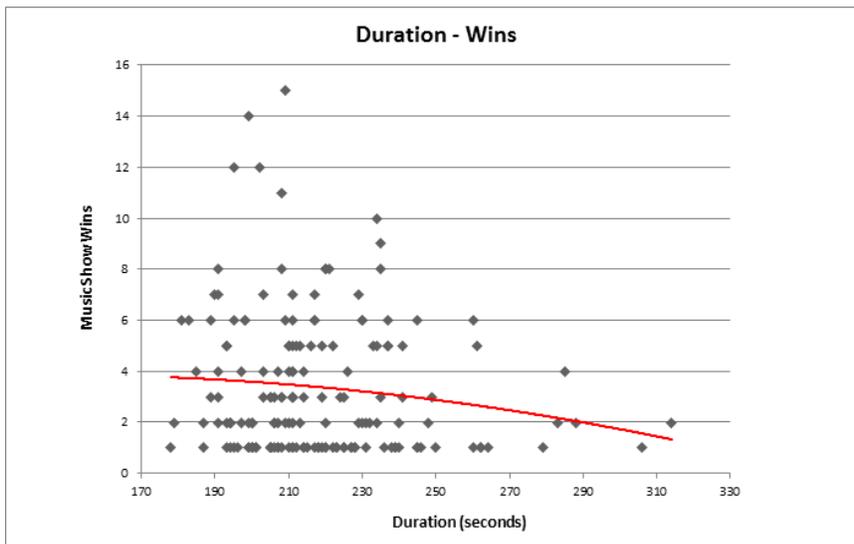
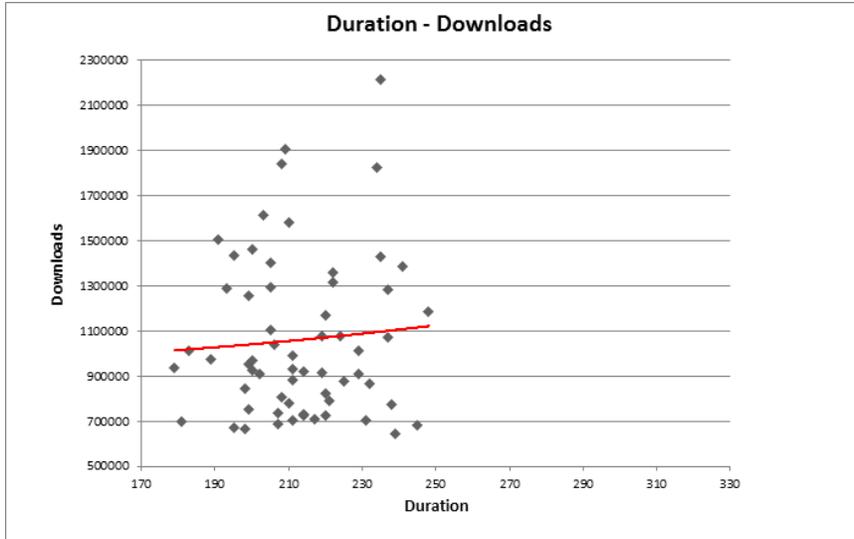


Figure 7: Duration Graphs

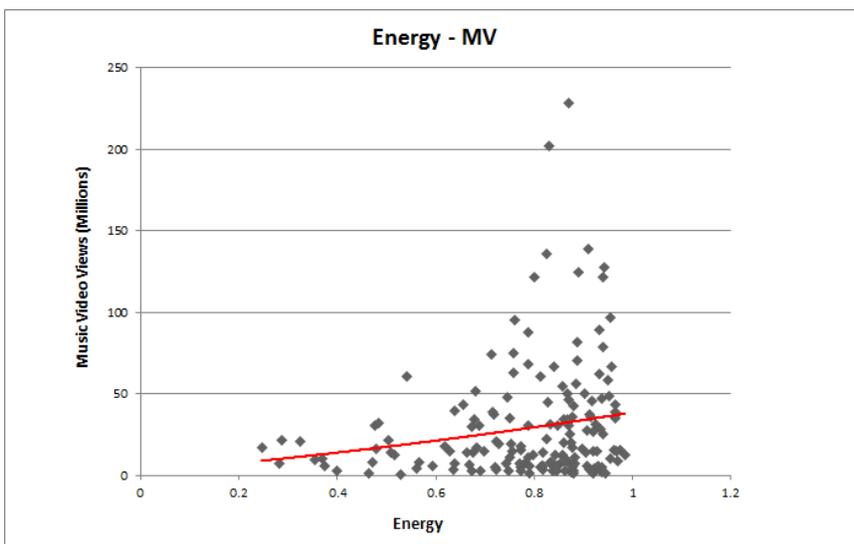
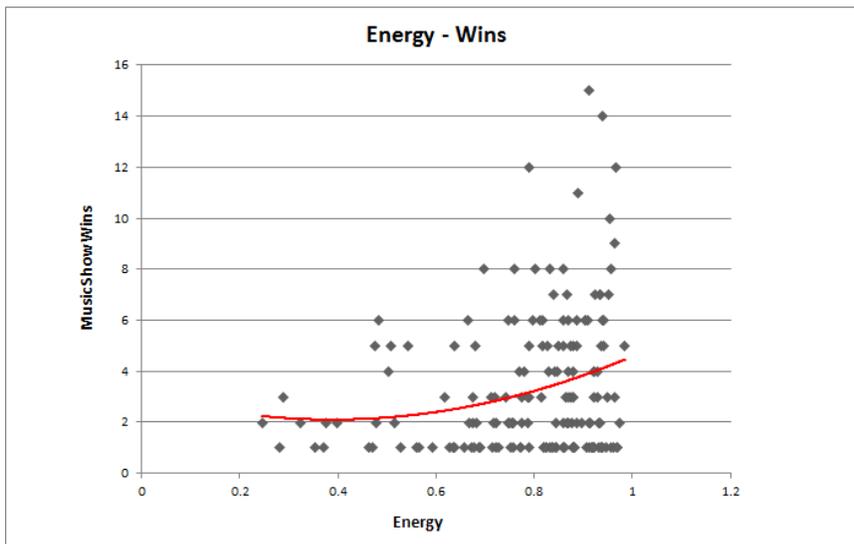
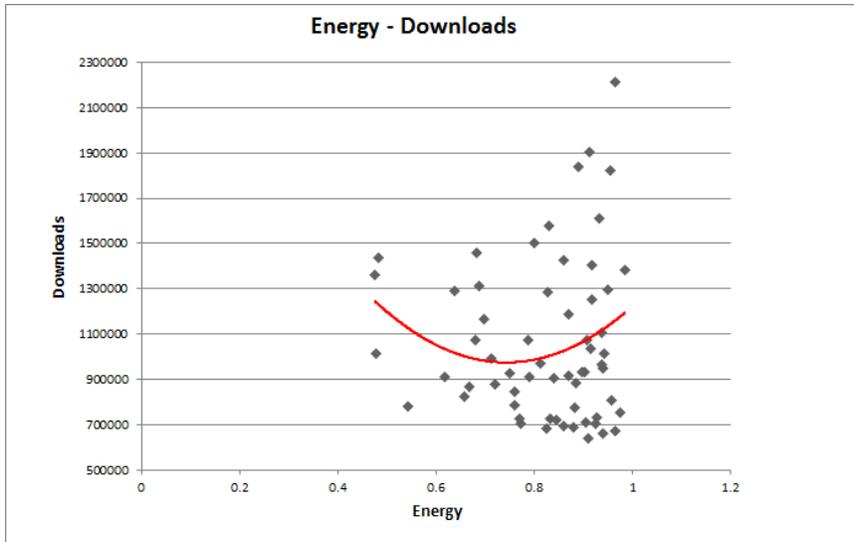


Figure 8: Energy Graphs

A similar contrast can be found between the Download graph and the MV Views/Show Wins graphs in **Figure 7**, which represents the duration of songs. For this analysis, the results taken from the MV Views/Show Wins will be used, due to the more consistent and reliable amount of data. The trend line for both of these graphs are concave downward and inversely proportional to the length of the songs, meaning that as the length of a song increases, its success decreases exponentially. This hints at an audience that favors shorter songs with a length below 240 seconds, or 4 minutes.

For energy, there exists a nearly linear direct relationship between the value of energy and success in the MV graph. Recall that energy is a measure of intensity and activity in a song, based on dynamic range, perceived loudness, timbre, onset rate, and general entropy. In **Figure 8**, the Download graph shows a higher value of success for lower energy songs as well, but, once again, this may be attributed to variation in the smaller dataset. In the other two graphs, the positive trend is easy to observe, and more energetic songs generally perform better. This relationship reveals another facet of the music's audience, and their preference for more intense and energetic songs.

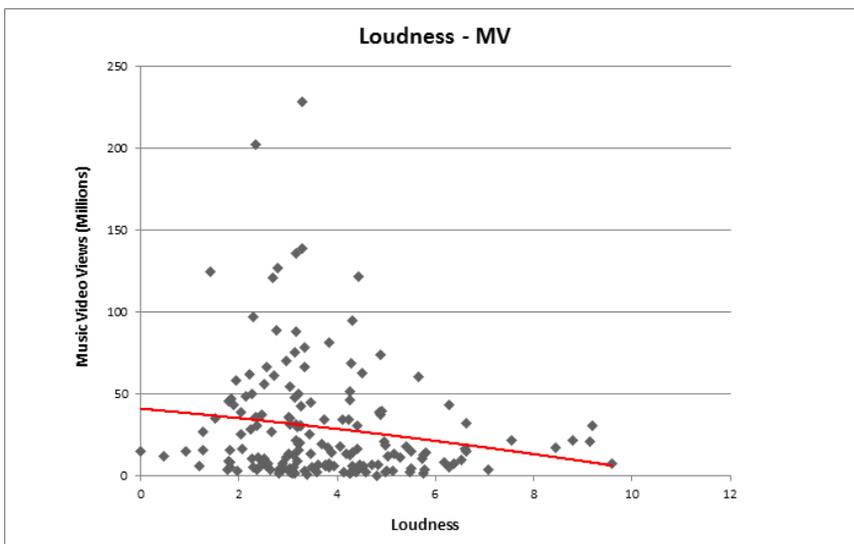
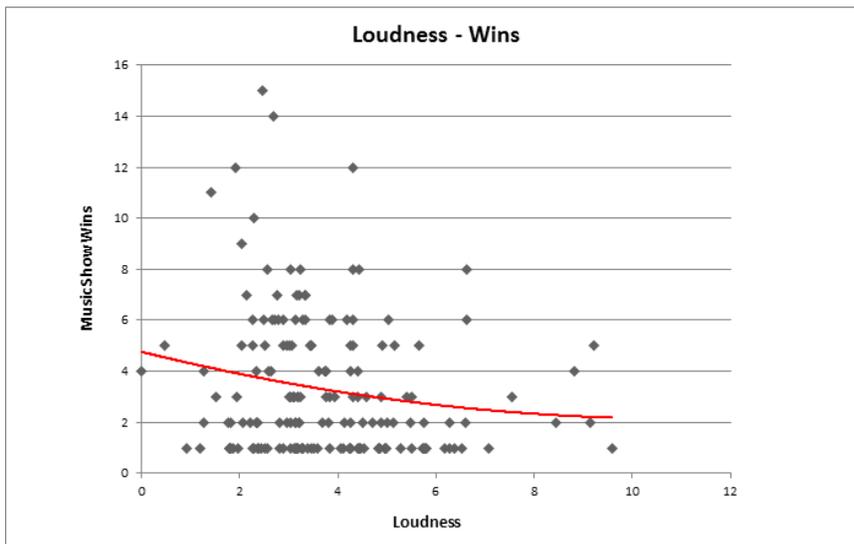
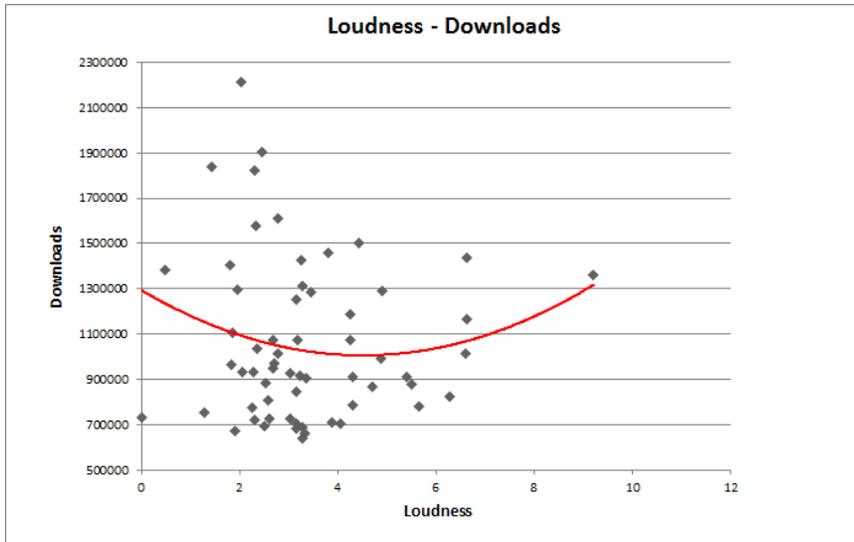


Figure 9: Loudness Graphs

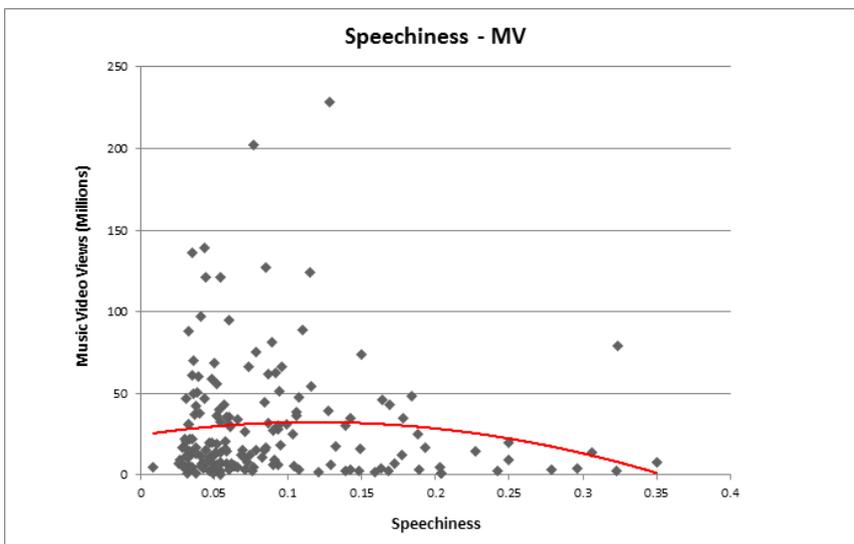
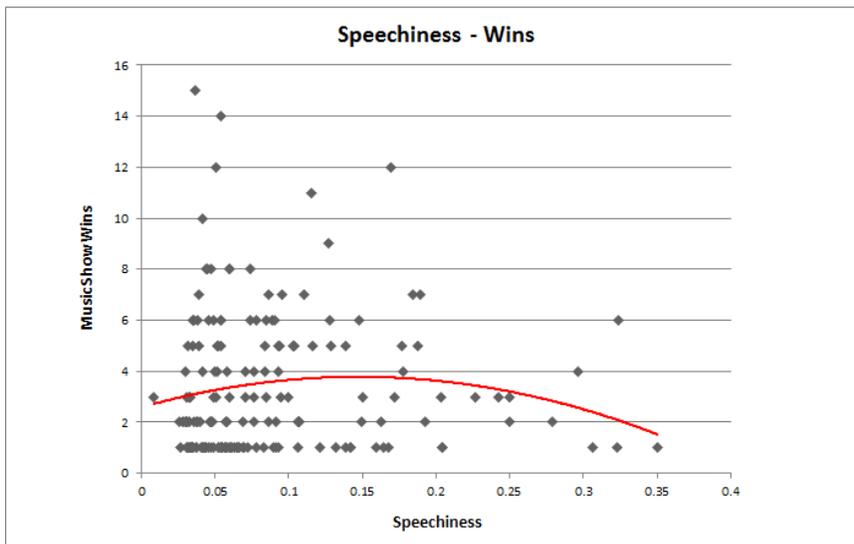
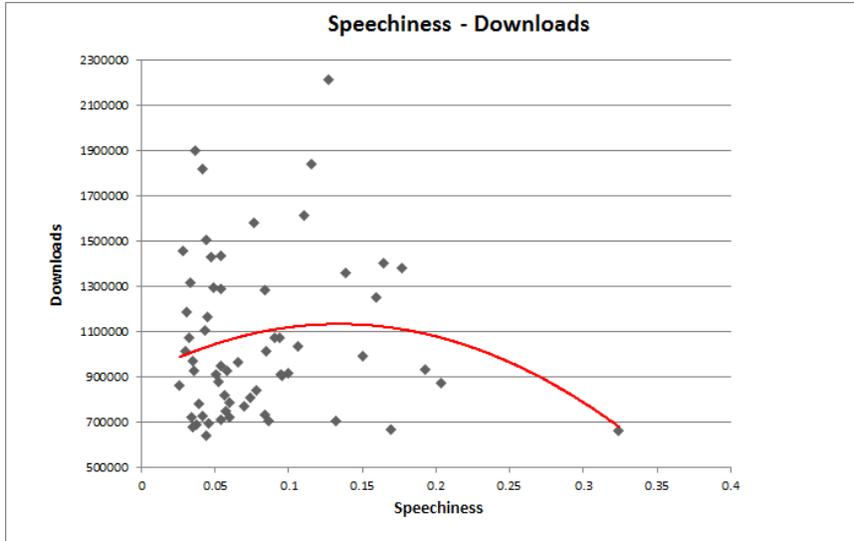


Figure 10: Speechiness Graphs

In the scales for the loudness graphs in **Figure 9**, the absolute value of the loudness values was taken for ease of comprehension. The Download chart most likely shows contrasting results for aforementioned reasons, but the MV Views and Show Wins diagrams show a negatively sloped line for the data. Due to the absolute value performed on the data, the smaller magnitude values represent louder songs, while larger values represent quieter songs. As expected, louder songs performed better generally, and this can be correlated with the results from the energy graphs, of consumers preferring more intense, dynamic songs.

All of the graphs in the speechiness section, **Figure 10**, show a similar pattern of a concave-downward parabola with a maximum value found around 0.15. This occurrence, of a maximum found in the center of the data set, demonstrate that the two extremes of high or low speechiness do not perform as well as a more moderate level of speechiness, which measured the presence of spoken words in the song. In turn, this demonstrates the appeal of songs with a balance between spoken words and musical aspects, where a proportional amount of each is required to achieve optimal levels of performance and success.

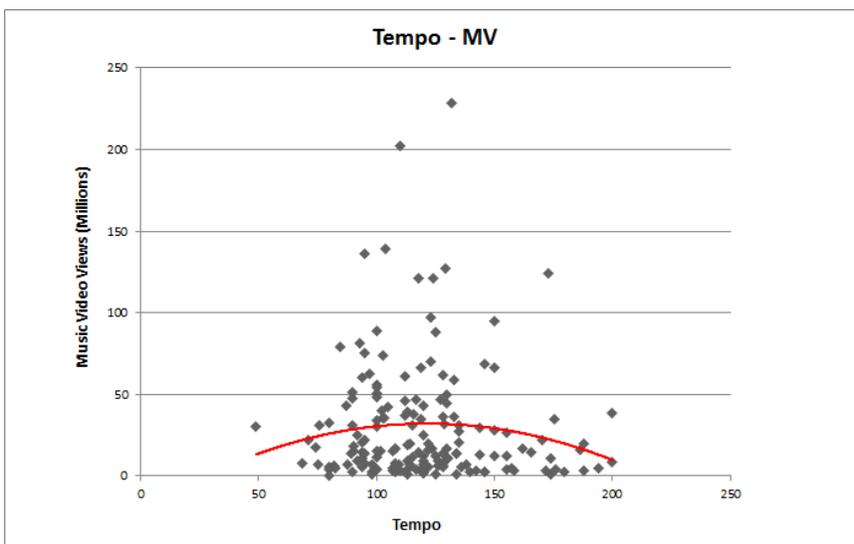
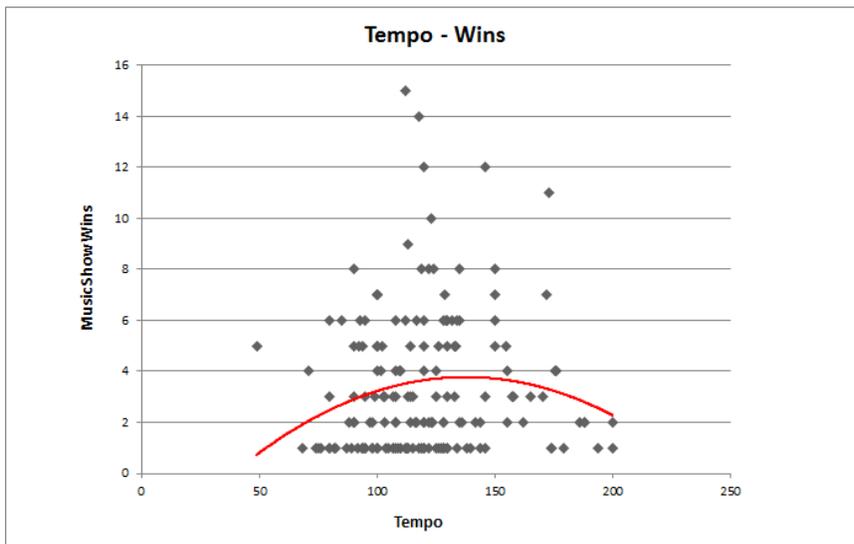
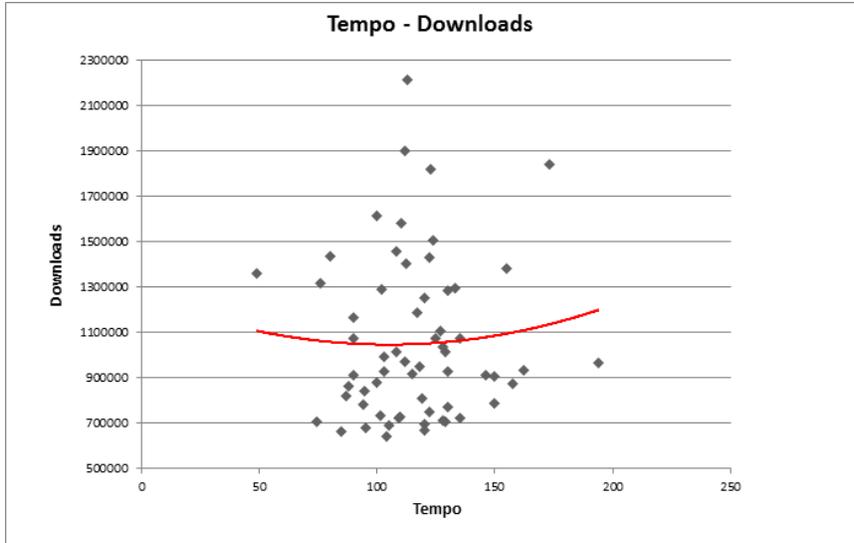


Figure 11: Tempo Graphs

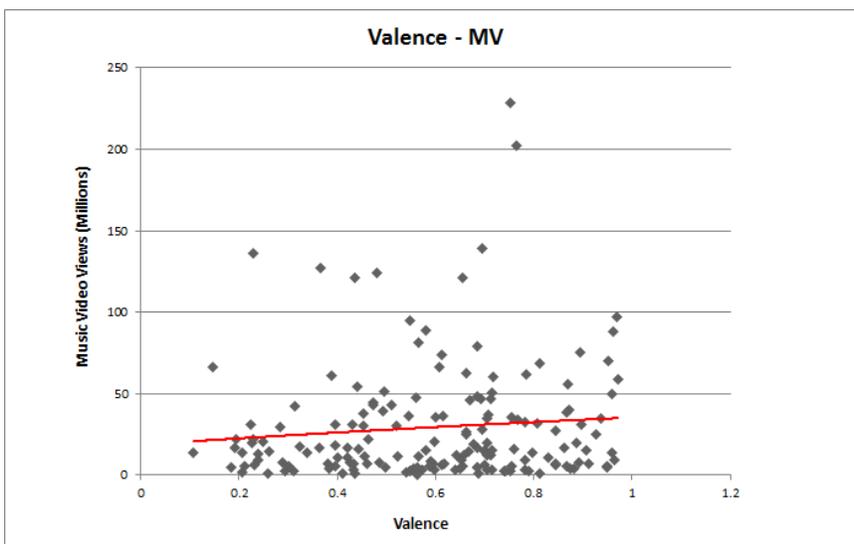
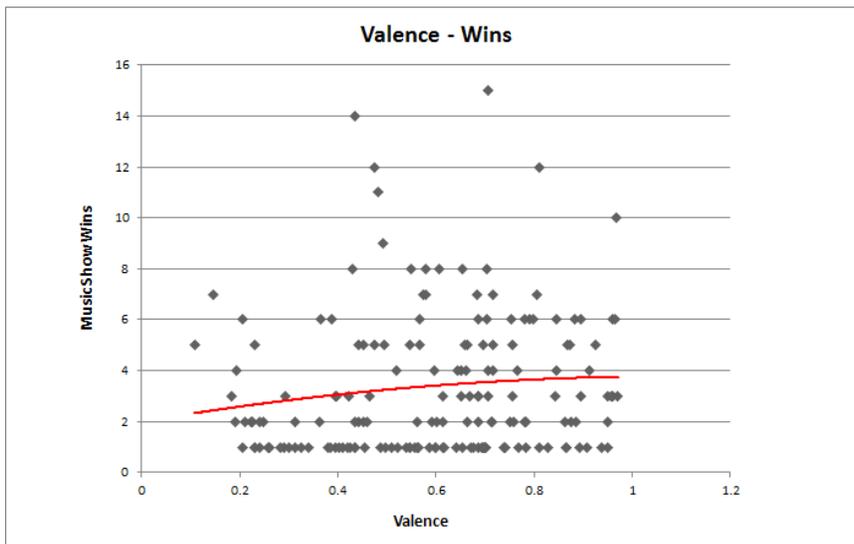
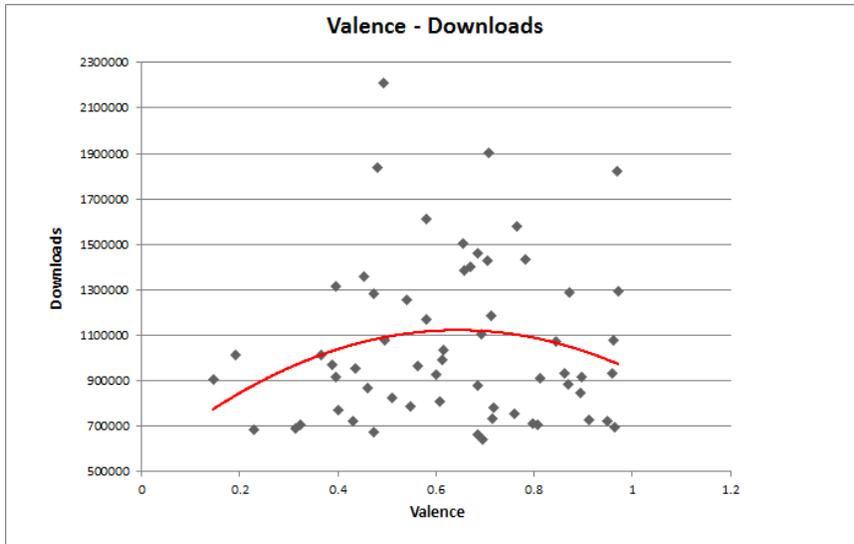


Figure 12: Valence Graphs

With the exception of the first graph in **Figure 11**, the Tempo-Downloads graph, the other tempo charts display a similar trend as can be seen in speechiness. The parabola in this case has a maximum around 125 beats per minute, effectively illustrating the appeal of intermediate speeds in songs. Songs that exceed or fall below this mark significantly enjoy a similarly poorer reception, having less music video views and winning less music show wins. This value highlights a preference for songs for moderate tempos.

Finally, the valence graphs, which display the general positivity of songs, show a positive correlation between the API values and measures of success. Even the Downloads graph, with its exceptions and less-reliable dataset, possesses an upward-trending line. This pattern perhaps hints at an underlying inclination of the audience towards more upbeat, optimistic sounds, and can be clearly identified in the sequences in **Figure 12**.

VI. CONCLUSION

To summarize, the data shows that in general, successful K-Pop songs are in minor keys, not in $D\#/E\flat$, less acoustic, more danceable, shorter than 4 minutes, highly energetic, loud, intense, and positive, with moderate tempos and an even balance between the use of vocals and music. This conclusion closely matches the initial predictions made prior to performing the methodology, with additional detail, especially pertaining to the durations and tempos of the songs. The potential implications and consequences of this derived conclusion will be discussed in the following section.

VII. DISCUSSION

This section aims to primarily discuss this research's limitations and implications, as well as potential future directions. The most apparent issue arose with the analysis' dependence on the Spotify API and database. As elaborated in **Section IV**, the segment on the methodology, 23 of the songs were not available on the database and were unable to be examined, cutting down the number of songs available for use. Furthermore, the data storage mechanism of the Gaon chart downloads and streams database meant that data could not be gathered on a large portion of the songs in the desired dataset. As such, outliers had an immense impact on the diagrams involving the number of downloads, skewing the lines that tried to fit the data as a whole. The amount of data on streaming was far too small to be considered significant, and was not even utilized as a part of the analysis. The incompleteness of information concerning the song qualities and the measures of the songs' success presented a substantial limitation in the analysis of the K-Pop genre.

There also exist certain limitations with the K-Pop industry's applicability to specific genres of music. Although K-Pop possesses qualities attractive to this research, as established in **Section III**, the literature review, it is still fundamentally based on pop music. It draws on a variety of aforementioned musical styles, such as hip-hop, R&B, EDM and jazz, but fundamentally, all of these genres share tremendous similarities with popular music around the world, from Europe to the Americas. The results from this research can perhaps be related to those similar markets, but for more niche musical styles, like metal with its own myriad subcategories, to folk and punk, additional research would be necessary in order to generate findings for those respective categories.

The methodology utilized in the study holds its own potential. As was seen with the R^2 values in **Section VI**, precise predictions can not be made about individual songs due to the large spectrum of values that different tracks can have. However, broader patterns and trends can be discovered, and those still hold value for potential songwriters and producers. As such, this method of quantitative music analysis can be further implemented for other markets and genres, even if they share similarities with K-Pop. This is mainly because even though the music may seem similar, the audience's tastes in music could differ, so region- and market-specific analysis is still recommended for optimal results.

Ultimately, although this study's use of software to gather and organize data offered a promising method for quantitatively analyzing music, it is still a fairly novel development and requires supplementary improvement. The author invites individuals well-versed in statistical analysis and data manipulation to further implement and expand the presented methodology. However, this research suggests that the use of this type of quantitative analysis can provide useful insights into a variety of music markets and industries. The specific findings offered in this paper hold promise for the K-Pop industry in terms of crafting successful songs, but additional analysis is still recommended to be performed for other music markets and audiences.

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IX. APPENDIX A

Music Show Wins:

| Song Name | Artist | Number of Wins |
|---------------------|-----------------|----------------|
| Lonely Night | Gary | 1 |
| Dream | Suzy & Baekhyun | 5 |
| Rough | GFriend | 15 |
| Rain | Taeyeon | 1 |
| You're The Best | Mamamoo | 8 |
| Breathe | Lee Hi | 2 |
| One of These Nights | Red Velvet | 5 |
| A Few Years Later | Block B | 1 |
| What the Spring?? | 10cm | 1 |
| Toy | Block B | 3 |
| Hopefully Sky | Jung Eun-ji | 2 |
| Cheer Up | Twice | 11 |
| L.I.E. | EXID | 4 |
| Monster | EXO | 8 |
| Why | Taeyeon | 1 |
| Whistle | Blackpink | 3 |
| Lotto | EXO | 7 |
| Russian Roulette | Red Velvet | 6 |

| | | |
|------------------------------------|---------------|---|
| Hard Carry | Got7 | 4 |
| 1 of 1 | SHINee | 4 |
| Blood Sweat and Tears | BTS | 6 |
| Very Very Very | I.O.I. | 3 |
| Playing With Fire | Blackpink | 2 |
| Bermuda Triangle | Zico | 1 |
| Star | Heize | 1 |
| Fxxk It | Big Bang | 2 |
| Sing For You | EXO | 3 |
| Run | BTS | 5 |
| Warning Sign | Teen Top | 2 |
| Press Your Number | Taemin | 4 |
| Remember That | BTOB | 3 |
| You're So Fine | CNBlue | 6 |
| Dynamite | VIXX | 5 |
| Starlight | Taeyeon | 1 |
| Ribbon | Beast | 2 |
| Whatta Man | I.O.I. | 5 |
| Making a New Ending for This Story | Han Dong-geun | 1 |
| A Lie | B1A4 | 3 |
| Boom Boom | Seventeen | 3 |
| Last Dance | Big Bang | 1 |
| For Life | EXO | 1 |
| Daddy | Psy | 6 |
| Dumb & Dumber | iKon | 3 |
| Sentimental | Winner | 1 |
| Don't Forget | Crush | 1 |
| Pretty U | Seventeen | 2 |
| I Just Wanna Dance | Tiffany | 2 |
| Good Luck | AOA | 2 |
| She Is | Jonghyun | 2 |
| Fantasy | VIXX | 3 |
| Flower Way | Kim Se-jeong | 1 |
| Pain | SS301 | 1 |
| Feel So Good | B.A.P. | 1 |
| Take Me Now | FTIsland | 1 |

| | | |
|------------------------|--------------------|----|
| The Closer | VIXX | 1 |
| Hey Mama! | EXO-CBX | 1 |
| Skydive | B.A.P. | 1 |
| Decalcomanie | Mamamoo | 1 |
| Good Boy | G-Dragon & Taeyang | 1 |
| Up & Down | EXID | 6 |
| Deja-Boo | Jonghyun | 6 |
| Fire | Mad Clown | 3 |
| One Fine Day | Jung Yong-hwa | 3 |
| Pretty | Infinite H | 4 |
| Crazy | 4Minute | 6 |
| Sniper | Shinhwa | 7 |
| Ice Cream Cake | Red Velvet | 5 |
| Call Me Baby | EXO | 14 |
| Ah Yeah | EXID | 5 |
| Loser | Big Bang | 8 |
| View | SHINee | 8 |
| Bang Bang Bang | Big Bang | 4 |
| Love Me Right | EXO | 8 |
| Shake It | Sistar | 5 |
| Sober | Big Bang | 2 |
| Party | SNSD | 6 |
| Gotta Go To Work | Beast | 1 |
| YeY | Beast | 4 |
| Let's Not Fall In Love | Big Bang | 3 |
| Lion Heart | SNSD | 12 |
| Dumb Dumb | Red Velvet | 5 |
| My Type | iKon | 2 |
| I | Taeyeon | 10 |
| Twenty Three | IU | 2 |
| Boys and Girls | Zico | 1 |
| Apology | iKon | 1 |
| Hot Pink | EXID | 2 |
| Lovekiller | Niel | 1 |
| Growing Pains | Super Junior D & E | 1 |
| Pray | FTIsland | 3 |

| | | |
|------------------------|-------------------------|---|
| I Need U | BTS | 5 |
| Bad | Infinite | 5 |
| Remember | Apink | 3 |
| Married to the Music | SHINee | 2 |
| Cinderella | CNBlue | 5 |
| 4 Walls | f(x) | 5 |
| Chained Up | VIXX | 3 |
| Young Wild and Free | B.A.P. | 2 |
| Insensible | Lee Hong-gi | 2 |
| Zutter | G-Dragon & T.O.P. | 1 |
| Lean on Me | Soyou & Kwon Jeong-yeol | 1 |
| Rhythm Ta | iKon | 1 |
| Jam | Dynamic Duo | 2 |
| I Am a Woman Too | Minah | 1 |
| Heart Attack | AOA | 2 |
| Sweet Girl | B1A4 | 1 |
| Mind Your Own Business | Ailee | 1 |
| Way Back Home | BTOB | 1 |
| Playground | U-Kiss | 1 |
| Bounce | Boyfriend | 1 |
| The Answer | Kim Sung-kyu | 1 |
| EOEO | Uniq | 1 |
| Cupid | Kara | 1 |
| Ah-Ah | Teen Top | 1 |
| Beautiful Liar | VIXX LR | 1 |
| I'm Fine | Kim Dong-wan | 1 |
| Friday | IU | 2 |
| Something | Girl's Day | 5 |
| Something | TVXQ | 6 |
| Lonely | B1A4 | 6 |
| Miniskirt | AOA | 1 |
| 1004 (Angel) | B.A.P. | 3 |
| Some | Soyou & Junggigo | 9 |
| Mr. Mr. | SNSD | 7 |
| Come Back Home | 2NE1 | 3 |
| Whatcha Doin' Today | 4Minute | 2 |

| | | |
|------------------------------------|----------------------|---|
| Playground | U-Kiss | 1 |
| Bounce | Boyfriend | 1 |
| The Answer | Kim Sung-kyu | 1 |
| EOEO | Uniq | 1 |
| Cupid | Kara | 1 |
| Ah-Ah | Teen Top | 1 |
| Beautiful Liar | VIXX LR | 1 |
| I'm Fine | Kim Dong-wan | 1 |
| Friday | IU | 2 |
| Something | Girl's Day | 5 |
| Something | TVXQ | 6 |
| Lonely | B1A4 | 6 |
| Miniskirt | AOA | 1 |
| 1004 (Angel) | B.A.P. | 3 |
| Some | Soyou & Junggigo | 9 |
| Mr. Mr. | SNSD | 7 |
| Come Back Home | 2NE1 | 3 |
| Whatcha Doin' Today | 4Minute | 2 |
| Wild Flower | Park Hyo-shin | 1 |
| Mr. Chu | Apink | 5 |
| | 200% Akdong Musician | 6 |
| Not Spring Love or Cherry Blossoms | HIGH4 & IU | 1 |
| Overdose | EXO | 6 |
| Eternity | VIXX | 2 |
| Eyes Nose Lips | Taeyang | 7 |
| Good Luck | Beast | 7 |
| Red Light | f(x) | 4 |
| Darling | Girl's Day | 2 |
| Touch My Body | Sistar | 8 |
| Empty | Winner | 6 |
| I Swear | Sistar | 4 |
| Mamacita | Super Junior | 7 |
| Holler | SNSD - TTS | 4 |
| How I Am | Kim Dong-ryul | 2 |
| Sogyeokdong | IU | 1 |
| Error | VIXX | 5 |

| | | | |
|--------------------|-------|--------------------|----|
| | 12:30 | Beast | 6 |
| Miss Me or Diss Me | | MC Mong | 1 |
| I'm Different | | Hi Suhyun | 1 |
| LUV | | Apink | 12 |
| La Song | | Rain | 1 |
| Can't Stop | | CNBlue | 2 |
| Last Romeo | | Infinite | 6 |
| You You You | | Fly to the Sky | 1 |
| Solo Day | | B1A4 | 3 |
| Danger | | Taemin | 1 |
| Missing | | Teen Top | 2 |
| At Gwanghwamun | | Kyuhyun | 4 |
| 30 Sexy | | Rain | 1 |
| Day 1 | | K. Will | 2 |
| H.E.R | | Block B | 2 |
| Home | | Roy Kim | 1 |
| No Make Up | | Gaeko | 1 |
| Happen Ending | | Epik High | 3 |
| Without You | | Mad Clown & Hyolyn | 1 |
| Red | | Hyuna | 2 |
| Mamma Mia | | KARA | 1 |
| Like a Cat | | AOA | 1 |
| Witch | | Boyfriend | 1 |
| Rewind | | Zhou Mi | 1 |
| Erase | | Hyolyn & Jooyoung | 1 |

X. APPENDIX B

Music Video Views and Downloads:

| Song Name | Artist | Views (Million) | Downloads |
|-----------------------|-----------------|-----------------|-----------|
| Lonely Night | Gary | 12.5 | 1009082 |
| Dream | Suzy & Baekhyun | 30.4 | 1360267 |
| Rough | GFriend | 37.3 | 1903126 |
| Rain | Taeyeon | 30.8 | 1315393 |
| You're The Best | Mamamoo | 20 | 1428938 |
| Breathe | Lee Hi | 17 | |
| One of These Nights | Red Velvet | 13.7 | |
| A Few Years Later | Block B | 8 | |
| What the Spring?? | 10cm | 10.6 | |
| Toy | Block B | 18.1 | 913927 |
| Hopefully Sky | Jung Eun-ji | 15.8 | |
| Cheer Up | Twice | 124.5 | 1839566 |
| L.I.E. | EXID | 26.8 | |
| Monster | EXO | 95.2 | 789078 |
| Why | Taeyeon | 42.6 | 689209 |
| Whistle | Blackpink | 74 | 991628 |
| Lotto | EXO | 50.3 | |
| Russian Roulette | Red Velvet | 49.9 | 930907 |
| Hard Carry | Got7 | 30.6 | |
| 1 of 1 | SHINee | 6.4 | |
| Blood Sweat and Tears | BTS | 81.6 | |
| Very Very Very | I.O.I. | 35.3 | |
| Playing With Fire | Blackpink | 62.9 | |
| Bermuda Triangle | Zico | 13.9 | |
| Star | Heize | 7.7 | |
| Fxxk It | Big Bang | 47.9 | |
| Sing For You | EXO | 21.8 | |
| Run | BTS | 36.2 | |
| Warning Sign | Teen Top | 2.7 | |
| Press Your Number | Taemin | 7 | |
| Remember That | BTOB | 5.2 | |
| You're So Fine | CNBlue | 3.8 | |
| Dynamite | VIXX | 5.5 | |
| Starlight | Taeyeon | 20.8 | |
| Ribbon | Beast | 8.4 | |
| Whatta Man | I.O.I. | 28.3 | |

| | | | |
|------------------------------------|--------------------|-------|---------|
| Making a New Ending for This Story | Han Dong-geun | 1.3 | |
| A Lie | B1A4 | 2.3 | |
| Boom Boom | Seventeen | 4.8 | |
| Last Dance | Big Bang | 29.7 | |
| For Life | EXO | 9.5 | |
| Daddy | Psy | 228.6 | |
| Dumb & Dumber | iKon | 16.7 | |
| Sentimental | Winner | 14.7 | |
| Don't Forget | Crush | 14.5 | |
| Pretty U | Seventeen | 4.2 | |
| I Just Wanna Dance | Tiffany | 19.5 | |
| Good Luck | AOA | 19.7 | |
| She Is | Jonghyun | 3.2 | |
| Fantasy | VIXX | 5 | |
| Flower Way | Kim Se-jeong | 7.3 | |
| Pain | SS301 | 1.4 | |
| Feel So Good | B.A.P. | 3 | |
| Take Me Now | FTIsland | 1.7 | |
| The Closer | VIXX | 2.6 | |
| Hey Mama! | EXO-CBX | 34.6 | |
| Skydive | B.A.P. | 1.4 | |
| Decalcomanie | Mamamoo | 11.3 | |
| Good Boy | G-Dragon & Taeyang | 136 | |
| Up & Down | EXID | 61 | 971632 |
| Deja-Boo | Jonghyun | 2.5 | |
| Fire | Mad Clown | 9 | |
| One Fine Day | Jung Yong-hwa | 5.9 | |
| Pretty | Infinite H | 4.1 | |
| Crazy | 4Minute | 78.9 | 664249 |
| Sniper | Shinhwa | 3.1 | |
| Ice Cream Cake | Red Velvet | 56.1 | 881597 |
| Call Me Baby | EXO | 121.2 | 951930 |
| Ah Yeah | EXID | 51.6 | 1076447 |
| Loser | Big Bang | 121.5 | 1505163 |
| View | SHINee | 31.1 | 724659 |
| Bang Bang Bang | Big Bang | 202.2 | 1581284 |

| | | | |
|------------------------|-------------------------|------|---------|
| Love Me Right | EXO | 66.4 | 808257 |
| Shake It | Sistar | 44.8 | 1283400 |
| Sober | Big Bang | 70.3 | |
| Party | SNSD | 75.2 | 843843 |
| Gotta Go To Work | Beast | 6 | |
| YeY | Beast | 12.6 | |
| Let's Not Fall In Love | Big Bang | 88.1 | 1076447 |
| Lion Heart | SNSD | 68.5 | 911721 |
| Dumb Dumb | Red Velvet | 60.4 | 780846 |
| My Type | iKon | 30.9 | |
| I | Taeyeon | 97 | 1822590 |
| Twenty Three | IU | 35.4 | 926631 |
| Boys and Girls | Zico | 17.9 | 705567 |
| Apology | iKon | 15.6 | |
| Hot Pink | EXID | 37.7 | |
| Lovekiller | Niel | 1.4 | |
| Growing Pains | Super Junior D & E | 10.6 | |
| Pray | FTIsland | 3 | |
| I Need U | BTS | 54.7 | |
| Bad | Infinite | 25.2 | |
| Remember | Apink | 30.9 | 918259 |
| Married to the Music | SHINee | 12.6 | |
| Cinderella | CNBlue | 6.3 | |
| 4 Walls | f(x) | 25.3 | |
| Chained Up | VIXX | 14.6 | |
| Young Wild and Free | B.A.P. | 3.1 | |
| Insensible | Lee Hong-gi | 2.5 | |
| Zutter | G-Dragon & T.O.P. | 43.1 | 823317 |
| Lean on Me | Soyou & Kwon Jeong-yeon | 6 | |
| Rhythm Ta | iKon | 34.1 | |
| Jam | Dynamic Duo | 3.5 | |
| I Am a Woman Too | Minah | 9.1 | |
| Heart Attack | AOA | 46.6 | 1187652 |
| Sweet Girl | B1A4 | 3.5 | |
| Mind Your Own Business | Ailee | 11.2 | |
| Way Back Home | BTOB | 2.6 | |

| | | | |
|------------------------------------|----------------------|-------|---------|
| Playground | U-Kiss | 1.2 | |
| Bounce | Boyfriend | 4.9 | |
| The Answer | Kim Sung-kyu | 2.5 | |
| EOEO | Uniq | 5.9 | |
| Cupid | Kara | 7.7 | |
| Ah-Ah | Teen Top | 7 | |
| Beautiful Liar | VIXX LR | 4.2 | |
| I'm Fine | Kim Dong-wan | 0.2 | |
| Friday | IU | 17.1 | 1460219 |
| Something | Girl's Day | 12.2 | 1383961 |
| Something | TVXQ | 12.4 | |
| Lonely | B1A4 | 9 | 695394 |
| Miniskirt | AOA | 47.1 | 1104681 |
| 1004 (Angel) | B.A.P. | 13.8 | |
| Some | Soyou & Junggigo | 39 | 2212895 |
| Mr. Mr. | SNSD | 66.5 | 906962 |
| Come Back Home | 2NE1 | 58.6 | 1294905 |
| Whatcha Doin' Today | 4Minute | 20.9 | |
| Wild Flower | Park Hyo-shin | 5.5 | |
| Mr. Chu | Apink | 39.8 | 1290794 |
| | 200% Akdong Musician | 32.3 | 1436302 |
| Not Spring Love or Cherry Blossoms | HIGH4 & IU | 45.8 | 1403026 |
| Overdose | EXO | 127.3 | 1014053 |
| Eternity | VIXX | 12.7 | |
| Eyes Nose Lips | Taeyang | 89 | 1613109 |
| Good Luck | Beast | 31.7 | 705909 |
| Red Light | f(x) | 34.6 | |
| Darling | Girl's Day | 36.2 | 1036598 |
| Touch My Body | Sistar | 15 | 1168060 |
| Empty | Winner | 27.3 | 1073498 |
| I Swear | Sistar | 15 | 733268 |
| Mamacita | Super Junior | 48.5 | |
| Holler | SNSD - TTS | 21.9 | |
| How I Am | Kim Dong-ryul | 6.7 | 866782 |
| Sogyeokdong | IU | 5.8 | |
| Error | VIXX | 11.2 | |

| | | | | |
|--------------------|-------|--------------------|------|---------|
| | 12:30 | Beast | 14 | 711240 |
| Miss Me or Diss Me | | MC Mong | 5.1 | 723795 |
| I'm Different | | Hi Suhyun | 22.1 | 682157 |
| LUV | | Apink | 43.3 | 672195 |
| La Song | | Rain | 10.7 | 773111 |
| Can't Stop | | CNBlue | 15.8 | 753113 |
| Last Romeo | | Infinite | 13.8 | |
| You You You | | Fly to the Sky | 1.8 | 1254451 |
| Solo Day | | B1A4 | 6.9 | |
| Danger | | Taemin | 19.1 | |
| Missing | | Teen Top | 5.5 | |
| At Gwanghwamun | | Kyuhyun | 7.4 | 728086 |
| 30 Sexy | | Rain | 7.9 | |
| Day 1 | | K.Will | 16.6 | 933619 |
| H.E.R | | Block B | 16.6 | 1013651 |
| Home | | Roy Kim | 2.5 | |
| No Make Up | | Gaeko | 3.8 | |
| Happen Ending | | Epik High | 4.8 | 876983 |
| Without You | | Mad Clown & Hyolyn | 5 | 967646 |
| Red | | Hyuna | 61.9 | |
| Mamma Mia | | KARA | 15.1 | |
| Like a Cat | | AOA | 38.6 | |
| Witch | | Boyfriend | 7 | |
| Rewind | | Zhou Mi | 5.9 | |
| Erase | | Hyolyn & Jooyoung | 7.5 | |

XI. APPENDIX C

API Results:

| Song Name | Artist | Danceability | Energy | Key | Loudness | Mode | Speechiness | Acousticness | Valence | Tempo | Duration |
|---------------------------|-----------------|--------------|--------|-----|----------|------|-------------|--------------|---------|---------|----------|
| Lonely Night | Gary | 0.559 | 0.743 | 10 | -6.741 | 1 | 0.0695 | 0.171 | 0.506 | 149.63 | 217 |
| Dream | Suzy & Baekhyun | 0.718 | 0.476 | 4 | -9.205 | 1 | 0.139 | 0.422 | 0.453 | 48.973 | 222 |
| Rough | GFriend | 0.613 | 0.912 | 8 | -2.464 | 1 | 0.0366 | 0.152 | 0.707 | 112.005 | 209 |
| Rain | Taeyeon | 0.567 | 0.687 | 8 | -3.269 | 1 | 0.0329 | 0.538 | 0.396 | 76.024 | 222 |
| You're The Best | Mamamoo | 0.684 | 0.86 | 5 | -3.243 | 0 | 0.0471 | 0.0395 | 0.704 | 122.03 | 235 |
| Breathe | Lee Hi | 0.609 | 0.246 | 8 | -8.449 | 1 | 0.0376 | 0.784 | 0.364 | 123.773 | 288 |
| One of These Nights | Red Velvet | 0.436 | 0.509 | 6 | -5.161 | 0 | 0.0345 | 0.475 | 0.108 | 133.653 | 261 |
| A Few Years Later | Block B | 0.644 | 0.565 | 10 | -6.174 | 1 | 0.35 | 0.487 | 0.487 | 95.024 | 228 |
| What the Spring?? | 10cm | 0.866 | 0.37 | 1 | -5.739 | 1 | 0.0327 | 0.597 | 0.829 | 94.018 | 205 |
| Toy | Block B | 0.641 | 0.618 | 7 | -5.397 | 1 | 0.0949 | 0.0441 | 0.396 | 90.107 | 219 |
| Hopefully Sky | Jung Eun-ji | 0.495 | 0.774 | 0 | -3.214 | 0 | 0.149 | 0.209 | 0.443 | 186.165 | 220 |
| Cheer Up | Twice | 0.552 | 0.89 | 6 | -1.425 | 1 | 0.115 | 0.136 | 0.481 | 172.97 | 208 |
| L.I.E. | EXID | 0.682 | 0.921 | 1 | -1.261 | 1 | 0.0707 | 0.0742 | 0.662 | 155.054 | 211 |
| Monster | EXO | 0.618 | 0.76 | 6 | -4.312 | 1 | 0.0596 | 0.0066 | 0.549 | 150 | 221 |
| Why | Taeyeon | 0.615 | 0.879 | 6 | -3.275 | 0 | 0.0377 | 0.0702 | 0.313 | 105.026 | 207 |
| Whistle | Blackpink | 0.822 | 0.712 | 11 | -4.877 | 1 | 0.15 | 0.00682 | 0.614 | 102.874 | 211 |
| Lotto | EXO | 0.798 | 0.867 | 11 | -3.207 | 0 | 0.0386 | 0.0618 | 0.715 | 99.996 | 190 |
| Russian Roulette | Red Velvet | 0.726 | 0.903 | 7 | -2.277 | 0 | 0.0357 | 0.055 | 0.96 | 129.986 | 211 |
| Hard Carry | Got7 | 0.666 | 0.847 | 1 | -4.412 | 1 | 0.0929 | 0.00685 | 0.52 | 99.999 | 185 |
| 1 of 1 | SHINee | 0.694 | 0.879 | 5 | -3.765 | 0 | 0.0515 | 0.0635 | 0.845 | 108.045 | 203 |
| Blood Sweat and Tears | BTS | 0.585 | 0.887 | 0 | -3.825 | 0 | 0.089 | 0.0244 | 0.566 | 92.971 | 217 |
| Very Very Very | I.O.I | 0.745 | 0.965 | 7 | -1.517 | 1 | 0.06 | 0.146 | 0.755 | 102.994 | 203 |
| Playing With Fire | Blackpink | 0.707 | 0.758 | 4 | -4.511 | 0 | 0.0917 | 0.0399 | 0.663 | 97.037 | 197 |
| Bermuda Triangle | Zico | 0.469 | 0.819 | 3 | -3.469 | 0 | 0.306 | 0.0592 | 0.34 | 89.013 | 207 |
| Star | Heize | 0.509 | 0.471 | 11 | -6.374 | 0 | 0.0721 | 0.572 | 0.29 | 68.426 | 218 |
| Fxxk It | Big Bang | 0.72 | 0.746 | 0 | -3.143 | 0 | 0.107 | 0.152 | 0.561 | 90.026 | 231 |
| Sing For You | EXO | 0.341 | 0.288 | 8 | -7.544 | 1 | 0.0335 | 0.852 | 0.464 | 170.202 | 235 |
| Run | BTS | 0.554 | 0.878 | 11 | -3.02 | 0 | 0.0513 | 0.00146 | 0.546 | 132.889 | 237 |
| Warning Sign | Teen Top | 0.672 | 0.845 | 3 | -4.14 | 0 | 0.0463 | 0.18 | 0.752 | 98.043 | 194 |
| Press Your Number | Taemin | 0.656 | 0.78 | 10 | -3.609 | 0 | 0.058 | 0.186 | 0.596 | 120.021 | 226 |
| Remember That | BTOB | 0.523 | 0.774 | 3 | -3.831 | 1 | 0.0304 | 0.564 | 0.397 | 79.961 | 249 |
| You're So Fine | CNBlue | 0.737 | 0.818 | 8 | -2.892 | 1 | 0.0492 | 0.0936 | 0.883 | 116.93 | 230 |
| Dynamite | VIXX | 0.759 | 0.816 | 6 | -2.898 | 0 | 0.104 | 0.152 | 0.756 | 113.953 | 210 |
| Starlight | Taeyeon | 0.628 | 0.723 | 1 | -4.962 | 0 | 0.0571 | 0.0329 | 0.599 | 93.958 | 223 |
| Ribbon | Beast | 0.486 | 0.867 | 0 | -1.818 | 1 | 0.0475 | 0.345 | 0.591 | 199.982 | 234 |
| Whatta Man | I.O.I | 0.559 | 0.936 | 6 | -2.254 | 0 | 0.0931 | 0.0063 | 0.696 | 150.065 | 193 |
| Making a New Ending for T | Han Dong-geun | 0.556 | 0.464 | 3 | -5.751 | 1 | 0.0374 | 0.37 | 0.259 | 134.1 | 262 |
| A Lie | B1A4 | 0.305 | 0.875 | 7 | -4.583 | 1 | 0.242 | 0.0862 | 0.293 | 145.973 | 208 |
| Boom Boom | Seventeen | 0.853 | 0.814 | 8 | -3.047 | 1 | 0.0766 | 0.0347 | 0.686 | 108.111 | 206 |
| Last Dance | Big Bang | 0.621 | 0.673 | 1 | -3.194 | 0 | 0.0606 | 0.467 | 0.283 | 143.889 | 279 |
| For Life | EXO | 0.517 | 0.353 | 3 | -6.522 | 1 | 0.0268 | 0.887 | 0.24 | 91.736 | 246 |
| Daddy | Psy | 0.762 | 0.87 | 6 | -3.287 | 0 | 0.128 | 0.0788 | 0.753 | 132.049 | 230 |
| Dumb & Dumber | iKon | 0.729 | 0.878 | 1 | -4.402 | 1 | 0.085 | 0.108 | 0.422 | 129.96 | 241 |
| Sentimental | Winner | 0.775 | 0.756 | 7 | -5.513 | 1 | 0.058 | 0.279 | 0.7 | 118.019 | 208 |
| Don't Forget | Crush | 0.646 | 0.628 | 5 | -5.81 | 1 | 0.0337 | 0.451 | 0.262 | 93.897 | 219 |

| | | | | | | | | | | | |
|------------------------|--------------------|-------|-------|----|--------|---|---------|----------|-------|---------|-----|
| Pretty U | Seventeen | 0.642 | 0.931 | 8 | -2.82 | 1 | 0.163 | 0.0173 | 0.875 | 155.088 | 207 |
| I Just Wanna Dance | Tiffany | 0.72 | 0.754 | 5 | -3.675 | 1 | 0.0481 | 0.0128 | 0.227 | 114.054 | 210 |
| Good Luck | AOA | 0.603 | 0.876 | 5 | -3.217 | 0 | 0.25 | 0.0745 | 0.886 | 187.936 | 187 |
| She Is | Jonghyun | 0.697 | 0.723 | 0 | -5.134 | 1 | 0.107 | 0.00353 | 0.781 | 119.966 | 191 |
| Fantasy | VIXX | 0.586 | 0.929 | 7 | -3.107 | 0 | 0.00847 | 0.0533 | 0.184 | 106.938 | 208 |
| Flower Way | Kim Se-jeong | 0.344 | 0.281 | 1 | -9.59 | 1 | 0.0545 | 0.828 | 0.381 | 74.998 | 239 |
| Pain | SS301 | 0.724 | 0.79 | 5 | -3.101 | 0 | 0.0314 | 0.465 | 0.687 | 124.975 | 211 |
| Feel So Good | B.A.P. | 0.811 | 0.845 | 10 | -1.964 | 0 | 0.06 | 0.0458 | 0.641 | 110.031 | 196 |
| Take Me Now | FTIsland | 0.518 | 0.937 | 9 | -4.268 | 0 | 0.121 | 0.00504 | 0.206 | 119.852 | 262 |
| The Closer | VIXX | 0.648 | 0.837 | 11 | -3.598 | 0 | 0.139 | 0.0337 | 0.548 | 139.82 | 225 |
| Hey Mama! | EXO-CBX | 0.532 | 0.859 | 1 | -4.106 | 1 | 0.142 | 0.0662 | 0.937 | 118.919 | 199 |
| Skydive | B.A.P. | 0.423 | 0.921 | 11 | -2.816 | 0 | 0.204 | 0.0236 | 0.435 | 174.031 | 236 |
| Decalcomanie | Mamamoo | 0.648 | 0.859 | 10 | -2.384 | 1 | 0.0472 | 0.114 | 0.523 | 115.436 | 215 |
| Good Boy | G-Dragon & Taeyang | 0.745 | 0.825 | 1 | -3.162 | 0 | 0.0352 | 0.000875 | 0.23 | 95.001 | 245 |
| Up & Down | EXID | 0.714 | 0.812 | 7 | -2.703 | 1 | 0.0351 | 0.00189 | 0.388 | 112.018 | 189 |
| Deja-Boo | Jonghyun | 0.818 | 0.748 | 5 | -4.296 | 1 | 0.148 | 0.122 | 0.79 | 108.117 | 209 |
| Fire | Mad Clown | 0.792 | 0.864 | 9 | -3.19 | 1 | 0.25 | 0.0914 | 0.652 | 113.061 | 211 |
| Pretty | Infinite H | 0.818 | 0.79 | 4 | -3.931 | 0 | 0.0325 | 0.28 | 0.95 | 98.994 | 205 |
| Crazy | 4Minute | 0.539 | 0.922 | 7 | -2.643 | 1 | 0.296 | 0.00691 | 0.651 | 176.079 | 191 |
| Sniper | Shinhwa | 0.663 | 0.94 | 10 | -3.337 | 0 | 0.324 | 0.232 | 0.685 | 84.851 | 198 |
| Ice Cream Cake | Red Velvet | 0.58 | 0.935 | 9 | -3.348 | 1 | 0.189 | 0.0318 | 0.574 | 172.023 | 191 |
| Call Me Baby | EXO | 0.692 | 0.886 | 1 | -2.519 | 1 | 0.0519 | 0.284 | 0.869 | 100.03 | 211 |
| Ah Yeah | EXID | 0.762 | 0.939 | 11 | -2.688 | 0 | 0.054 | 0.0483 | 0.435 | 117.986 | 199 |
| Loser | Big Bang | 0.648 | 0.681 | 0 | -4.251 | 0 | 0.0937 | 0.404 | 0.495 | 89.947 | 219 |
| View | SHINee | 0.728 | 0.801 | 6 | -4.428 | 0 | 0.0439 | 0.04 | 0.655 | 123.953 | 191 |
| Bang Bang Bang | Big Bang | 0.694 | 0.832 | 5 | -3.038 | 0 | 0.0598 | 0.0192 | 0.431 | 135.011 | 220 |
| Love Me Right | EXO | 0.625 | 0.83 | 0 | -2.33 | 1 | 0.0764 | 0.00266 | 0.766 | 110.04 | 210 |
| Shake It | Sistar | 0.778 | 0.957 | 11 | -2.57 | 0 | 0.0735 | 0.0234 | 0.607 | 118.997 | 208 |
| Sober | Big Bang | 0.649 | 0.827 | 5 | -3.465 | 1 | 0.0838 | 0.00676 | 0.474 | 129.963 | 237 |
| Party | SNSD | 0.753 | 0.887 | 10 | -2.975 | 0 | 0.0359 | 0.111 | 0.951 | 122.981 | 193 |
| Gotta Go To Work | Beast | 0.719 | 0.759 | 2 | -3.144 | 1 | 0.0781 | 0.443 | 0.895 | 94.93 | 198 |
| YeY | Beast | 0.611 | 0.907 | 2 | -1.189 | 0 | 0.0929 | 0.345 | 0.701 | 127.961 | 214 |
| Let's Not Fall In Love | Big Bang | 0.685 | 0.843 | 0 | -4.258 | 1 | 0.0499 | 0.121 | 0.643 | 125.029 | 211 |
| Lion Heart | SNSD | 0.754 | 0.788 | 2 | -3.175 | 1 | 0.0322 | 0.129 | 0.961 | 124.992 | 224 |
| Dumb Dumb | Red Velvet | 0.778 | 0.789 | 7 | -4.297 | 0 | 0.0503 | 0.0334 | 0.811 | 145.99 | 202 |
| My Type | iKon | 0.791 | 0.542 | 5 | -5.659 | 0 | 0.0388 | 0.223 | 0.717 | 93.98 | 210 |
| I | Taeyeon | 0.506 | 0.788 | 9 | -2.372 | 1 | 0.0324 | 0.0666 | 0.224 | 89.993 | 206 |
| Twenty Three | IU | 0.757 | 0.955 | 5 | -2.299 | 0 | 0.0412 | 0.0168 | 0.968 | 122.952 | 234 |
| Boys and Girls | Zico | 0.815 | 0.75 | 1 | -3.029 | 1 | 0.0581 | 0.0399 | 0.601 | 103.037 | 200 |
| Apology | iKon | 0.515 | 0.773 | 6 | -4.066 | 1 | 0.132 | 0.281 | 0.325 | 74.146 | 231 |

| | | | | | | | | | | | |
|------------------------|--------------------|-------|-------|----|--------|---|--------|----------|-------|---------|-----|
| Hot Pink | EXID | 0.769 | 0.962 | 1 | -1.812 | 1 | 0.0691 | 0.357 | 0.699 | 107.008 | 201 |
| Lovekiller | Niel | 0.768 | 0.718 | 2 | -4.892 | 1 | 0.0402 | 0.241 | 0.453 | 115.979 | 209 |
| Growing Pains | Super Junior D & E | 0.601 | 0.879 | 6 | -4.256 | 1 | 0.0491 | 0.224 | 0.41 | 112.972 | 201 |
| Pray | FTIsland | 0.348 | 0.956 | 9 | -2.511 | 1 | 0.0826 | 0.000271 | 0.42 | 173.786 | 250 |
| I Need U | BTS | 0.486 | 0.88 | 5 | -3.097 | 0 | 0.0706 | 0.0215 | 0.705 | 158.043 | 211 |
| Bad | Infinite | 0.689 | 0.858 | 0 | -3.051 | 1 | 0.116 | 0.24 | 0.442 | 99.994 | 216 |
| Remember | Apink | 0.77 | 0.873 | 1 | -3.444 | 1 | 0.103 | 0.144 | 0.663 | 120.007 | 233 |
| Married to the Music | SHINee | 0.729 | 0.869 | 10 | -3.24 | 0 | 0.0994 | 0.107 | 0.896 | 114.995 | 214 |
| Cinderella | CNBlue | 0.68 | 0.858 | 0 | -3.126 | 1 | 0.0686 | 0.00635 | 0.713 | 119.985 | 211 |
| 4 Walls | f(x) | 0.735 | 0.849 | 4 | -4.308 | 0 | 0.129 | 0.212 | 0.231 | 125.972 | 213 |
| Chained Up | VIXX | 0.728 | 0.941 | 9 | -2.044 | 0 | 0.188 | 0.0955 | 0.926 | 92.073 | 212 |
| Young Wild and Free | B.A.P. | 0.482 | 0.921 | 11 | -4.31 | 1 | 0.227 | 0.056 | 0.668 | 165.401 | 189 |
| Insensible | Lee Hong-gi | 0.437 | 0.674 | 7 | -4.995 | 1 | 0.032 | 0.138 | 0.434 | 141.955 | 240 |
| Zutter | G-Dragon & T.O.P. | 0.817 | 0.399 | 10 | -5.482 | 0 | 0.076 | 0.11 | 0.312 | 90.015 | 194 |
| Lean on Me | Soyou & Kwon Jeon | 0.659 | 0.657 | 10 | -6.266 | 1 | 0.0568 | 0.139 | 0.51 | 87 | 220 |
| Rhythm Ta | iKon | 0.762 | 0.819 | 7 | -4.459 | 1 | 0.0897 | 0.129 | 0.613 | 81.981 | 227 |
| Jam | Dynamic Duo | 0.779 | 0.677 | 10 | -4.242 | 0 | 0.066 | 0.0156 | 0.768 | 99.967 | 195 |
| I Am a Woman Too | Minah | 0.558 | 0.912 | 1 | -1.758 | 0 | 0.279 | 0.332 | 0.714 | 187.979 | 194 |
| Heart Attack | AOA | 0.661 | 0.97 | 0 | -1.802 | 1 | 0.091 | 0.137 | 0.782 | 125.993 | 306 |
| Sweet Girl | B1A4 | 0.647 | 0.87 | 0 | -4.249 | 1 | 0.0305 | 0.103 | 0.713 | 116.969 | 248 |
| Mind Your Own Business | Ailee | 0.685 | 0.921 | 8 | -2.357 | 0 | 0.142 | 0.073 | 0.598 | 106.95 | 260 |
| Way Back Home | BTOB | 0.633 | 0.751 | 7 | -5.272 | 1 | 0.0411 | 0.647 | 0.455 | 129.885 | 240 |
| Playground | U-Kiss | 0.683 | 0.69 | 9 | -4.396 | 0 | 0.0543 | 0.318 | 0.739 | 111.949 | 210 |
| Bounce | Boyfriend | 0.652 | 0.946 | 4 | -3.385 | 0 | 0.204 | 0.0893 | 0.811 | 98.003 | 194 |
| The Answer | Kim Sung-kyu | 0.558 | 0.878 | 0 | -4.427 | 1 | 0.0351 | 0.00452 | 0.497 | 82.48 | 218 |
| EOEO | Uniq | 0.679 | 0.862 | 9 | -3.037 | 0 | 0.168 | 0.248 | 0.742 | 145.966 | 187 |
| Cupid | Kara | 0.768 | 0.845 | 6 | -2.567 | 0 | 0.0644 | 0.00532 | 0.866 | 122.003 | 205 |
| Ah-Ah | Teen Top | 0.674 | 0.833 | 11 | -3.824 | 1 | 0.0543 | 0.0314 | 0.426 | 128.031 | 200 |
| Beautiful Liar | VIXX LR | 0.664 | 0.882 | 7 | -4.449 | 1 | 0.0544 | 0.366 | 0.434 | 137.972 | 223 |
| I'm Fine | Kim Dong-wan | 0.662 | 0.56 | 5 | -7.076 | 1 | 0.0306 | 0.467 | 0.384 | 80.018 | 178 |
| Friday | IU | 0.693 | 0.529 | 9 | -4.819 | 1 | 0.0539 | 0.56 | 0.563 | 80.026 | 217 |
| Something | Girl's Day | 0.813 | 0.683 | 6 | -3.813 | 0 | 0.0285 | 0.179 | 0.685 | 107.95 | 200 |
| Something | TVXQ | 0.68 | 0.985 | 2 | -0.47 | 0 | 0.177 | 0.0546 | 0.658 | 154.942 | 241 |
| Lonely | B1A4 | 0.678 | 0.798 | 9 | -5.04 | 1 | 0.074 | 0.255 | 0.704 | 150.037 | 245 |
| Miniskirt | AOA | 0.76 | 0.859 | 5 | -2.501 | 1 | 0.046 | 0.434 | 0.964 | 119.987 | 181 |

| | | | | | | | | | | | |
|---------------------------|--------------------|-------|-------|----|--------|---|--------|----------|-------|---------|-----|
| 1004 (Angel) | B.A.P. | 0.612 | 0.937 | 2 | -1.855 | 1 | 0.0435 | 0.0733 | 0.693 | 126.983 | 205 |
| Some | Soyou & Junggigo | 0.738 | 0.676 | 11 | -3.025 | 0 | 0.0507 | 0.446 | 0.958 | 95.04 | 211 |
| Mr. Mr. | SNSD | 0.701 | 0.964 | 4 | -2.037 | 0 | 0.127 | 0.114 | 0.492 | 113.058 | 235 |
| Come Back Home | 2NE1 | 0.585 | 0.84 | 0 | -3.349 | 0 | 0.0957 | 0.155 | 0.147 | 149.855 | 229 |
| Whatcha Doin' Today | 4Minute | 0.823 | 0.949 | 11 | -1.954 | 0 | 0.0487 | 0.189 | 0.971 | 133.025 | 205 |
| Wild Flower | Park Hyo-shin | 0.281 | 0.323 | 8 | -9.145 | 1 | 0.031 | 0.722 | 0.249 | 134.824 | 314 |
| Mr. Chu | Apink | 0.769 | 0.837 | 2 | -3.499 | 1 | 0.0631 | 0.359 | 0.587 | 120.005 | 205 |
| 200% | Akdong Musician | 0.853 | 0.638 | 1 | -4.911 | 1 | 0.0536 | 0.379 | 0.873 | 102.06 | 193 |
| Not Spring Love or Cherry | HIGH4 & IU | 0.77 | 0.484 | 7 | -6.626 | 1 | 0.0538 | 0.464 | 0.781 | 79.988 | 195 |
| Overdose | EXO | 0.498 | 0.917 | 5 | -1.797 | 0 | 0.164 | 0.0615 | 0.671 | 112.357 | 205 |
| Eternity | VIXX | 0.586 | 0.942 | 0 | -2.791 | 0 | 0.0848 | 0.13 | 0.366 | 129.088 | 183 |
| Eyes Nose Lips | Taeyang | 0.631 | 0.516 | 0 | -5.759 | 1 | 0.0378 | 0.738 | 0.24 | 143.777 | 230 |
| Good Luck | Beast | 0.56 | 0.933 | 10 | -2.776 | 0 | 0.11 | 0.103 | 0.58 | 99.966 | 203 |
| Red Light | f(x) | 0.623 | 0.924 | 7 | -3.162 | 1 | 0.0862 | 0.000457 | 0.806 | 128.947 | 211 |
| Darling | Girl's Day | 0.503 | 0.868 | 11 | -3.727 | 0 | 0.178 | 0.0414 | 0.705 | 175.62 | 197 |
| Touch My Body | Sistar | 0.633 | 0.915 | 9 | -2.347 | 1 | 0.106 | 0.0437 | 0.615 | 128.033 | 206 |
| Empty | Winner | 0.568 | 0.698 | 0 | -6.618 | 1 | 0.0445 | 0.146 | 0.58 | 90.119 | 220 |
| I Swear | Sistar | 0.638 | 0.908 | 8 | -2.67 | 1 | 0.0902 | 0.0242 | 0.845 | 134.955 | 237 |
| Mamacita | Super Junior | 0.716 | 0.928 | 7 | -0.005 | 1 | 0.084 | 0.0777 | 0.715 | 101.564 | 207 |
| Holler | SNSD - TTS | 0.608 | 0.952 | 10 | -2.144 | 0 | 0.184 | 0.12 | 0.684 | 100.025 | 217 |
| How I Am | Kim Dong-ryul | 0.385 | 0.504 | 7 | -8.806 | 0 | 0.03 | 0.385 | 0.194 | 71.006 | 285 |
| Sogyeokdong | IU | 0.521 | 0.668 | 1 | -4.714 | 1 | 0.0258 | 0.00465 | 0.461 | 87.919 | 232 |
| Error | VIXX | 0.563 | 0.931 | 5 | -2.436 | 0 | 0.052 | 0.0636 | 0.301 | 128.019 | 225 |
| 12:30 | Beast | 0.642 | 0.789 | 1 | -2.959 | 1 | 0.0312 | 0.393 | 0.566 | 100.007 | 234 |
| Miss Me or Diss Me | MC Mong | 0.662 | 0.904 | 8 | -3.877 | 0 | 0.0539 | 0.0606 | 0.797 | 127.953 | 217 |
| I'm Different | Hi Suhyun | 0.851 | 0.845 | 2 | -2.293 | 0 | 0.0342 | 0.119 | 0.949 | 108.998 | 214 |
| Good Boy | G-Dragon x Taeyang | 0.745 | 0.825 | 1 | -3.162 | 0 | 0.0352 | 0.000875 | 0.23 | 95.001 | 245 |
| LUV | Apink | 0.735 | 0.911 | 6 | -3.282 | 0 | 0.0437 | 0.0511 | 0.696 | 103.978 | 239 |
| La Song | Rain | 0.734 | 0.966 | 0 | -1.905 | 1 | 0.169 | 0.229 | 0.474 | 119.975 | 195 |
| Can't Stop | CNBlue | 0.595 | 0.882 | 1 | -2.256 | 1 | 0.0697 | 0.631 | 0.402 | 130.02 | 238 |
| Last Romeo | Infinite | 0.6 | 0.974 | 11 | -1.277 | 0 | 0.0575 | 0.0632 | 0.759 | 122.057 | 199 |
| You You You | Fly to the Sky | 0.441 | 0.664 | 7 | -4.178 | 1 | 0.0379 | 0.381 | 0.206 | 133.822 | 260 |
| Solo Day | BIA4 | 0.674 | 0.918 | 0 | -3.144 | 1 | 0.159 | 0.145 | 0.54 | 119.977 | 199 |
| Danger | Taemin | 0.732 | 0.743 | 1 | -3.765 | 1 | 0.172 | 0.0295 | 0.844 | 114.051 | 191 |
| Missing | Teen Top | 0.708 | 0.728 | 0 | -4.974 | 0 | 0.052 | 0.465 | 0.677 | 112.97 | 211 |
| At Gwanghwamun | Kyuhyun | 0.53 | 0.375 | 3 | -6.268 | 1 | 0.0285 | 0.72 | 0.211 | 135.821 | 283 |
| 30 Sexy | Rain | 0.775 | 0.77 | 8 | -2.594 | 1 | 0.0413 | 0.0919 | 0.912 | 109.522 | 214 |
| Day 1 | K.Will | 0.667 | 0.836 | 4 | -2.894 | 1 | 0.0454 | 0.284 | 0.893 | 107.984 | 206 |
| H.E.R | Block B | 0.648 | 0.897 | 8 | -2.057 | 1 | 0.193 | 0.0453 | 0.863 | 162.014 | 179 |
| Home | Roy Kim | 0.333 | 0.479 | 2 | -6.592 | 1 | 0.0299 | 0.612 | 0.191 | 107.953 | 229 |
| No Make Up | Gaeko | 0.379 | 0.773 | 0 | -4.992 | 1 | 0.323 | 0.346 | 0.547 | 179.334 | 193 |
| Happen Ending | Epik High | 0.828 | 0.636 | 11 | -5.78 | 0 | 0.0427 | 0.0397 | 0.556 | 100.006 | 264 |
| Without You | Mad Clown & Hyoly | 0.548 | 0.72 | 5 | -5.5 | 1 | 0.203 | 0.356 | 0.686 | 157.467 | 225 |
| Red | Hyuna | 0.582 | 0.938 | 9 | -1.829 | 1 | 0.0658 | 0.00287 | 0.564 | 193.91 | 200 |
| Mamma Mia | KARA | 0.699 | 0.933 | 0 | -2.21 | 1 | 0.0864 | 0.0398 | 0.784 | 128.108 | 213 |
| Like a Cat | AOA | 0.701 | 0.968 | 1 | -0.913 | 1 | 0.078 | 0.103 | 0.908 | 100.009 | 220 |
| Witch | Boyfriend | 0.635 | 0.715 | 11 | -4.848 | 0 | 0.106 | 0.213 | 0.866 | 199.971 | 227 |
| Rewind | Zhou Mi | 0.808 | 0.638 | 7 | -4.834 | 1 | 0.0614 | 0.0164 | 0.617 | 97.942 | 212 |
| Erase | Hyolyn & Jooyoung | 0.634 | 0.593 | 3 | -4.522 | 0 | 0.0406 | 0.0936 | 0.655 | 94.091 | 228 |

XII. APPENDIX D

Songs not included:

| | |
|------------------------|----------------|
| Fly | Got7 |
| Fire | BTS |
| So-So | Baek A-yeon |
| I Like That | Sistar |
| Why So Lonely | Wonder Girls |
| Navillera | GFriend |
| How's This? | Hyuna |
| The Eye | Infinite |
| TT | Twice |
| You From The Same Time | Naul |
| One Fine Day | Jung Yong-hwa |
| Love Equation | VIXX |
| Love Again | Im Chang-jung |
| Cry Again | Davichi |
| Shouldn't Have | Baek A-yeon |
| Just | Zion.T & Crush |
| My House | 2 P M |
| If You Do | Got7 |
| Full Moon | Sunmi |
| Don't Touch Me | Ailee |
| Three of Us | Toy |
| Singing Got Better | Ailee |
| Night and Day | Wheesung |

AP[®] RESEARCH 2017 SCORING COMMENTARY

Academic Paper

Sample: B

- 1 Understand and Analyze Context Score:** 6
- 2 Understand and Analyze Argument Score:** 6
- 3 Evaluate Sources and Evidence Score:** 6
- 4 Research Design Score:** 7
- 5 Establish Argument Score:** 7
- 6 Select and Use Evidence Score:** 6
- 7 Engage Audience Score:** 3
- 8 Apply Conventions Score:** 6
- 9 Apply Conventions Score:** 3

HIGH SAMPLE RESPONSE

Music Chemistry

Content Area: Understand and Analyze Context — Row 1

The response earned 6 points for this row because the paper identifies a focused topic on page 4, paragraph 2: "This research seeks to use this method to discover potential relationships and connections between the quantitatively measured aspects of a song and its popularity within an audience, particularly pertaining to the music industry of South Korea". It also makes a connection to the larger field on page 8, paragraph 1: "This study intends to focus on the musical aspect of K-Pop, similar to the production factor identified in Chew's work, but instead of a qualitative analysis of the lyrics and music of K-Pop, this research utilizes a quantitative approach". This statement also serves as a useful transition to the paper's subsequent statement of method.

Content Area: Understand and Analyze Argument — Row 2

The response earned 6 points for this row because the paper presents multiple perspectives throughout the Literature Review section. These perspectives include the variety of musical styles within K-Pop, the size and importance of the South Korean music industry (and its relation to the international visibility of Korean culture), the highly structured nature of the Korean music industry, and the international appeal of K-pop songs. The relationship of the sources can be found on page 8, paragraph 2: "Chew's study weighed each of these factors evenly, whereas Jin and Ryoo focused on the lyrical aspect as the most significant contributors". This in turn opens up an avenue of original research by the student, who "...intends to find a numerical correlation between the musical qualities of songs and their success" (page 8, paragraph 2).

Content Area: Evaluate Sources and Evidence — Row 3

The response earned 6 points for this row because the paper explains how sources are relevant and credible on pages 7 and 8, noting that the research by Dal-yong Jin and Woong-jae Ryoo, "...although valuable, utilized a more traditional, qualitative approach and served to bolster an understanding of the lyrical foundation found in K-Pop". The paper connects the literature review sources to the student's topic of inquiry, explicitly on page 8, paragraph 1: "This study intends to focus on the musical aspect of K-Pop, similar to the production factor identified in Chew's work, but instead of a qualitative analysis of the lyrics and music of K-Pop, this research utilizes a quantitative approach".

AP[®] RESEARCH 2017 SCORING COMMENTARY

Academic Paper

Content Area: Research Design — Row 4

The response earned 7 points for this row because the paper carefully lays out its method, adapting an existing "...data visualization project titled 'Visualizing a Hit', performed by Shaun Ellis and Tom Engelhardt" (page 8, paragraph 3) and utilizing Echo Nest API, a program since acquired by Spotify. Pages 9 to 12 of the paper carefully outline specific steps in the method while defending method choices throughout.

Content Area: Establish Argument — Row 5

The response earned 7 points for this row because the paper mounts a complex, logical argument carefully linking evidence derived from its original research. The paper's conclusion on page 27, paragraph 3 states that "...the data shows that in general, successful K-Pop songs are in minor keys,...less acoustic, more danceable, shorter than 4 minutes, highly energetic, loud, intense, and positive, with moderate tempos and an even balance between the use of vocals and music. This conclusion closely matches the initial predictions made prior to performing the methodology..." In addition the student usefully discusses both implications and limitations of the inquiry on pages 28 to 29. For example, it is suggested that this research might "...hold value for potential songwriters and producers" if "...broader patterns and trends" (page 29, paragraph 1) can be discerned from the data and used to produce original music.

Content Area: Select and Use Evidence — Row 6

The response earned 6 points for this row because the paper does an exceptional job of laying out its extensive original forms of evidence. These include indications of popularity of individual songs and the television programs which help to popularize them, the visualized musical characteristics of songs within the sample selection, and the number of downloads of music videos of K-Pop tunes. These are found in the paper's appendices and in the twelve separate figures included within the body of the text. This evidence is carefully interpreted within the body of the argument, and its relevance is consistently tied to both method and new understanding.

Content Area: Engage Audience — Row 7

The response earned 3 points for this row because the paper's organizational and design elements are of superior quality, consistently engaging the reader and underlining the student's credibility. The paper itself is organized carefully and divided into labeled sections which confidently lead the reader from the introduction and background literature through method and the various stages of argumentation. In addition, the paper's extensive use of visual materials, including tables, graphs, and charts, both in the body of the text and appendices, greatly enhance the impact of the argument, as these materials are well-labeled and carefully referenced.

Content Area: Apply Conventions — Row 8

The response earned 6 points for this row because there are no evident citation errors within the paper and the bibliography adheres to proper format. In addition, the student is able to use extensive data without surrendering authorial voice, as on page 21, paragraph 2: "In Figure 8, the Download graph shows a higher value of success for lower energy songs as well, but, once again, this may be attributed to variation in the smaller dataset. In the other two graphs, the positive trend is easy to observe, and more energetic songs generally perform better. This relationship reveals another facet of the music's audience, and their preference for more intense and energetic songs".

**AP[®] RESEARCH
2017 SCORING COMMENTARY**

Academic Paper

Content Area: Apply Conventions — Row 9

The response earned 3 points for this row because the paper is well written and uniformly strong throughout, and does an especially good job of setting its inquiry within a larger context, rationalizing its method, mounting a complex argument, and explaining its data to the non-expert reader.