Brooklyn Connections: Analysis of 2012-13 to 2018-19 Data

Looking Back to Plan Ahead

February 3, 2020
John Voiklis, Elizabeth Attaway, Rebecca Joy Norlander, & Nezam Ardalan
Executive Summary

Brooklyn Connections, a program of the Brooklyn Public Library, aims to raise academic achievement in K-12 classrooms by teaching a culturally responsive curriculum with trusted primary sources. In 2020, Brooklyn Connections partnered with Knology to review and analyze previous data, and to refine evaluation strategies for the future. As a first step of this project, Knology analyzed data from Brooklyn Connections evaluations from the 2012-13 academic year to the 2018-19 academic year. This report presents our analyses with the purpose of sparking conversation and planning in an upcoming workshop for the teams from Brooklyn Connections and Knology.

Building on the Brooklyn Connections’ team’s current understanding of the data, our analysis demonstrated additional insights into program impacts. We found that both student and teacher ratings are consistent from year to year. Students’ ratings related to their experiences and skills reliably predicted the probability of their ratings on two outcomes: changes in attitudes towards history and the valence of their overall experience with Brooklyn Connections. Here, students who reported better experiences and learning new skills also indicated increasingly better attitudes about history and social studies. Likewise, reporting better experiences and learning new skills reduced the likelihood of reporting a negative overall experience.

The findings from this new analysis indicate that teachers and students’ high levels of satisfaction have remained stable over the past seven years, and several variables can predict these outcomes. Given this consistent pattern, there is ample opportunity to enrich Brooklyn Connections’ evaluative strategy.
Table of Contents

Executive Summary  
Introduction 1
This Report 1
Methods & Results 2
The Structure of Student Success 2
Teacher Surveys 6
Text Responses from Students & Teachers 6
Implications & Opportunities 9
Foundational Findings 9
New Findings 9
Opportunities for Future Evaluation 9
References  

List of Tables

Table 1. Variables (by type) shared across student exit surveys from the 2012-13 academic year through the 2018-19 academic year. 2
Table 2. Results of ordinal logistic regression of changes of opinion about History/Social Studies modeled on Experience and Skills PCA scores. 5
Table 3. Results of Poisson logistic regression of negative overall experience modeled on Experience and Skills PCA scores. 5

List of Figures

Figure 1. Distribution of Responses to program experiences. 3
Figure 2. Distribution of responses to Self-assessed skills learning. 3
Figure 3. Distribution of responses to self-assessed program outcomes. 3
Figure 4. Relationship (loadings) of predictor variables to principal components. 4
Figure 5. Locating student and teacher affect scores in the three-dimensional space created by the dimensions of affect. 7
Introduction

Brooklyn Connections aims to raise academic achievement in K-12 classrooms by teaching a culturally responsive curriculum with trusted primary sources. Brooklyn Connections is based out of the Brooklyn Collection, the Brooklyn Public Library’s local archive, and uses Brooklyn history as a focus to introduce students to archival research and inquiry-based learning.

Brooklyn Connections conducts evaluation of its program using both formal and informal tools to collect information to adapt, improve, and develop new programming. Specifically, Brooklyn Connections uses an anonymous exit survey completed at the end of the school year by both partner educators and students, to measure the success and impact of the program.

Brooklyn Connections has partnered with Knology to assess previous evaluation data, and design and deploy a broader variety of impact assessments. These assessments aim to tell a more complete story of Brooklyn Connections and the difference it makes in empowering educators to effectively teach research methods, while also helping their students learning about their local history and build a sense of connection to their neighborhoods.

This Report

As a first step, Knology conducted analysis of data previously collected by Brooklyn Connections from the 2012-13 academic year to the 2018-19 academic year, to understand the impact of the Brooklyn Connections program to date. To that end, Knology has aggregated the exit survey data from the last several years of the program—seven years of student surveys and nine years of teacher surveys—and conducted a series of analyses. The student surveys included responses from $N = 4,874$ students and $N = 733$ teachers (note that a subset of the teachers repeated the program). While previous analyses have shown that both teachers and students are highly satisfied with the program and its learning outcomes, the following aggregate analysis is intended to extract some of the nuances of that satisfaction. Knology designed this report to inform planning discussions at a workshop for the Brooklyn Connections and Knology teams on February 5, 2020.
Methods & Results

The Structure of Student Success

The student exit surveys shared 10 items across the program years (between 2012-13 and 2018-19). As shown in Table 1, these variables can be organized into three categories: Responses to program experiences, Self-assessed skills learning, and Self-assessed program outcomes. Arguably, the former two categories (experiences and skills) capture components of the program that should predict how the students felt about their outcomes. These we define as independent variables (predictors), while the latter (program outcomes) we define as dependent variables. Essentially, this means that as ratings on items related to experiences (e.g., seeing historic documents) and/or skills (e.g., feeling prepared for future projects) increase or decrease, then one would expect to see a comparable increase or decrease in the ratings to outcomes (e.g., attitudes towards the topic of history). The analyses we performed test this hypothesized relationship.

Table 1. Variables (by type) shared across student exit surveys from the 2012-13 academic year through the 2018-19 academic year.

<table>
<thead>
<tr>
<th>Variable Types</th>
<th>Responses to program experiences</th>
<th>Self-assessed skills learning</th>
<th>Self-assessed program outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visiting the Brooklyn Collection</td>
<td>Visiting the Brooklyn Collection</td>
<td>Visiting the Brooklyn Collection</td>
<td>Visiting the Brooklyn Collection</td>
</tr>
<tr>
<td>Seeing Historic Documents</td>
<td>Seeing Historic Documents</td>
<td>Seeing Historic Documents</td>
<td>Seeing Historic Documents</td>
</tr>
<tr>
<td>Studying a Brooklyn Topic</td>
<td>Studying a Brooklyn Topic</td>
<td>Studying a Brooklyn Topic</td>
<td>Studying a Brooklyn Topic</td>
</tr>
<tr>
<td>Working with Library Staff</td>
<td>Working with Library Staff</td>
<td>Working with Library Staff</td>
<td>Working with Library Staff</td>
</tr>
<tr>
<td>Working on a Research Project</td>
<td>Working on a Research Project</td>
<td>Working on a Research Project</td>
<td>Working on a Research Project</td>
</tr>
</tbody>
</table>

To confirm whether this logical structure underlies how the students felt about their outcomes, Knology researchers used principal components analysis (PCA). Statistically speaking, PCA reveals (orthogonal) latent variables that explain the pattern of covariation in the data. Psychologically speaking, PCA reveals the underlying conceptual dimensions along which one could organize data, uniting different variables that represent the same concept.

Before analyzing the covariations in the data, Knology researchers needed to first observe whether the data exhibited enough variability. The distributions (and consequently variability) for all variables are presented below in Figures 1, 2, and 3. The width of the violin plots indicates the mass of students who indicated each particular rating level.
Looking Back to Plan Ahead

As apparent in Figures 1-3 student responses were nearly the same across all available years, skewing towards positive responses. Therefore, we do not use year as a predictive factor. Responses to program experiences (Figure 1) exhibited the greatest variability (mean skewness=-0.63). Ratings for self-assessed skills learning are extremely skewed towards “yes”...
responses (mean skewness = -1.65), but were not unanimous and therefore would not violate statistical assumptions for predictors. Skewness values less than -1 or greater than 1 are considered extreme and difficult to analyze on their own, and must therefore be combined and transformed in statistical analysis.

The two Self-assessed program outcomes were also nearly the same across all available years (Figure 3). Attitudes towards the program’s target topics—History in the later years and Social Studies in earlier years—remained mostly the same, skewing slightly towards “liking” the topic more than before the program (skewness=-0.06). Student were near unanimous on their positive overall experience with the program (skewness=-3.7). To avoid violating statistical assumptions about dependent variables, Knology researchers used a probability distribution for rare events to model the extent to which specific experiences and skill learning predicted the probability of answering “Negative.” This inversion of the analysis allows one to reveal the characteristics of students who did not report positive experiences.

Extracting the Structure of Student Responses

Parallel analysis, a simulation technique for estimating the number of components in the data (e.g., Horn, 1965), suggested that two components would explain the bulk of the variance in the predictor data (ratings on specific experiences and skills learning). As apparent in Figure 4, the two-component solution to the PCA matches the two logical categories—unifying the specific experiences on PC1 and skills learning on PC2.

![Figure 4](image)

**Figure 4.** Relationship (loadings) of predictor variables to principal components.

*Note.* Loadings ≥ 0.5 signal a strong relationship.
Predicting Student Success

Among its results, the PCA provides scores for each participant indicating their positions on the Experiences dimension and the Skills dimension\(^1\). For example, the maximum score on the Skills dimension (1.66) corresponded to ratings of all “yes” on the three skills; a zero score corresponded to “yes, yes, no”; and the minimum score (-3.58) corresponded to all “no” responses.

Knology researchers used the PCA scores as predictors in two models: an ordinal logistic regression of changes in opinion about History/Social Studies, and a Poisson logistic regression of the probability of reporting a “Negative” overall experience.

As apparent from the “probability of change” and the probability of chance occurrence (p) in the regression summaries in Tables 2 and 3, the scores on the Experiences and Skills dimensions were highly reliable predictors of each of the two outcome ratings—changes of opinion about History/Social Studies and overall experience.

Table 2. Results of ordinal logistic regression of changes of opinion about History/Social Studies modeled on Experience and Skills PCA scores.

<table>
<thead>
<tr>
<th>Probability of Change</th>
<th>Log Odds</th>
<th>Std. Error</th>
<th>z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiences</td>
<td>209</td>
<td>1.13</td>
<td>0.04</td>
<td>29.16</td>
</tr>
<tr>
<td>Skills</td>
<td>78</td>
<td>0.57</td>
<td>0.04</td>
<td>16.08</td>
</tr>
</tbody>
</table>

Table 2 shows that with every unit increase in position on the Experiences dimension, students were more than twice as likely (209\%) to report a more positive rating on their attitude towards History/Social Studies (z=29.16, p<.001). Likewise, with every unit increase in position on the Skills dimension, students were 78\% more likely to report a more positive rating on their attitude towards History/Social Studies (z=16.08, p<.001).

Table 3. Results of Poisson logistic regression of negative overall experience modeled on Experience and Skills PCA scores.

<table>
<thead>
<tr>
<th>Probability of Change</th>
<th>Log Odds</th>
<th>Std. Error</th>
<th>z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Intercept)</td>
<td>-97</td>
<td>-3.59</td>
<td>0.09</td>
<td>-37.85</td>
</tr>
<tr>
<td>Experiences</td>
<td>-57</td>
<td>-0.85</td>
<td>0.04</td>
<td>-19.52</td>
</tr>
<tr>
<td>Skills</td>
<td>-45</td>
<td>-0.60</td>
<td>0.05</td>
<td>-12.43</td>
</tr>
</tbody>
</table>

Looking at the probability of reporting a negative overall experience, the predictions go in the opposite direction. Table 3 shows that with every unit increase in position on the Experiences dimension, students were 57\% less likely to report a negative overall experience (z=-19.52, p<.001). Likewise, with every unit increase in position on the Skills dimension, students were 45\% less likely to report a negative overall experience (z=-19.52, p<.001).

\(^1\)PCA scores have a mean value of approximately 0 and a standard deviation of 1.
Teacher Surveys

Teachers responses to the survey items were nearly unanimous in their positive ratings, lacking sufficient variability to analyze covariation. Instead, we analyze their text responses, looking to characterize their underlying affect and compare the results to student text responses below.

Text Responses from Students & Teachers

Thus far, the data, even those that were not amenable to analysis, provide evidence that both students and teachers over several years have consistently reported an overwhelmingly positive experience with the Brooklyn Connections program. To expand our analysis beyond indicators of positive impact, we draw upon dimensional models of core affect (first proposed by Mehrabian & Russell, 1974), which have provided robust predictions in the study of affect (momentary feelings towards a target), emotion (persistent feelings with cognitive appraisals of their target), and mood (long-term, free-floating feelings). All versions of the model decompose affect into three dimensions:

- Valence/Pleasure (the pleasantness of a stimulus)
- Arousal/Energy (the intensity of feeling provoked by a stimulus)
- Dominance/Effectance (the feeling of control prompted by a stimulus)

Research on the affective meanings of words has revealed that people can attribute feelings to isolated words and provide consensus ratings for those words on the aforementioned three-dimensional model of affect (Warriner, Kuperman, Brysbaert (2013). Warriner, et al. (2013) created normed affect scores for approximately 14,000 English words using ratings data (on a scale of 1-9) from 1,827 individuals who represented a broad range of demographic categories. We used the normed affect scores to analyze the affective undertones of student and teacher text responses.

The surveys did not directly query whether program participants were left feeling energized or in control—the latter dimensions of affect. Here we attempt to indirectly capture all three aspects of how participants felt about the program by performing a text analysis of their word choices in their text responses. Specifically, Knology researchers assembled two text corpora—a student corpus and a teacher corpus—from the responses to the most frequently completed text-response items on each of the surveys.

For students, the corpus was assembled from the item that asked In one or two sentences, tell us what you enjoyed most about Brooklyn Connections. This question appeared across all years in the available data and was answered by 3,469 of the 4,874 students (71%) who completed the exit surveys. The resulting corpus included unique 1,493 words, each occurring from 1 to 612 times in the corpus. These words yielded 1,153 lemmas (uninflected word forms), of which 831 (72%) had normed scores in the Warriner et al. list. These included lemmas such as “enjoy” (frequency = 653 and affect ratings of Pleasure = 7.67, Energy = 5, Effectance = 7.28), and “learn” (frequency = 653 and affect ratings of Pleasure = 7.67, Energy = 5,
Effectance = 7.28). Overall, the lemmas in the student corpus ranged from 1.67-8.37 for Pleasure, 1.67-7.19 for Energy, and 2.41-7.74 for Effectance.

For teachers, the corpus was assembled from the item that asked *In one or two sentences, tell us what you enjoyed most about Brooklyn Connections.* This prompt appeared across all years in the available data and was answered by 114 of the 168 teachers (68%) who completed the teacher surveys. The resulting corpus included 672 unique words, each occurring from 1 to 213 times in the corpus. These words yielded 567 lemmas, of which 387 (68%) had normed scores in the Warriner et al. list. These included lemmas such as “easy” (frequency = 24 and affect ratings of Pleasure = 7.47, Energy = 3.82, Effectance = 6.79), and “help” (frequency = 23 and affect ratings of Pleasure = 6.95, Energy = 4.29, Effectance = 6.89). Overall, the lemmas in the teacher corpus ranged from 2.23 -8.37 for Pleasure, 1.75-6.81 for Energy, and 3.27-7.86 for Effectance.

This research showed that the affective undertones of student and teacher text responses by calculating the weighted means of each of the three affect scores for the lemmas in the corpus (i.e., the affect scores for each lemma were weighted by their relative frequency in the corpus before calculating the arithmetic mean of the scores). The resulting scores for students were Pleasure = 6.17, Energy = 3.97, Effectance = 5.97; for teachers the resulting scores were Pleasure = 6.03, Energy = 3.93, Effectance = 6.08. Both students and teachers convey an undertone of above middling pleasure and effectance, but below middling energy. In other words, they were both feeling good and ready for action, even if a little depleted.

![Figure 5](image)

**Figure 5.** Locating student and teacher affect scores in the three-dimensional space created by the dimensions of affect.
Figure 5 locates the students and teachers in the three-dimensional space created by the dimensions of affect. The points represent the scores for the individual lemmas that appeared in each corpus. The labeled bars represent the weighted mean for each group of participants. Serving as touchstones, the figure also plots the scores for the so-called “basic” emotion terms (Ekman, 1999).
Implications & Opportunities

Foundational Findings

Prior to this study, the Brooklyn Connections team understood the following outcomes:

- Students and teachers report positive ratings for the Brooklyn Connections program.
- Overall, they like the various elements of the program and the program.
- Teachers are nearly unanimous favorable ratings.
- Students lean positive but exhibit some variability.

New Findings

The new aggregation and statistical analyses revealed new insights:

- Student and teacher ratings are consistent from year to year.
- As expected, a PCA revealed two underlying statistical and conceptual dimensions in the data: items related to specific experiences during the program and items related to skills learning during the program.
- The location of students on the experiences and skills dimensions reliably predicted the probability of their ratings on two outcomes: changes in attitudes towards history and the valence of their overall experience with Brooklyn Connections.
  - Students who reported better experiences and learning new skills showed increasingly better attitudes about history and social studies.
  - Likewise, reporting better experiences and learning new skills reduced the likelihood of reporting a negative overall experience.
- These results should increase confidence that, despite the high likelihood of social desirability bias influencing responses, the existing impact measures reliably capture satisfaction with the program and its elements.

Opportunities for Future Evaluation

To move forward we recommend creating more specific instruments and questions. We propose that the team considers the questions that are not being answered: what does the Brooklyn Connections team still want to know? Since we have found satisfaction with the program is stable, we can expand our horizons. Here are several ideas:

- Explore how archival education programs work best, and how other libraries might be able to use the findings and the program model.
- Consider ways of measuring the actual skills participants are learning.
  - How are teachers using the Brooklyn Connections materials, and how do they supplement those materials?
  - To what extent does the Brooklyn Connections approach affect educators’ other teaching practices?
  - How do students interpret program materials: How do they judge the credibility of those materials relative to other historic sources to contemporary sources? What criteria do they use in making those judgements?
- To what extent do they recognize the transferability of research practices and the criteria of historical credibility to judgements of everyday credibility in things like the news, memes, and testimony?

- Learn about the unique opportunities, affordances, and benefits, the evaluation should elicit specific examples in participant responses.

- Explore the extent to which teachers and students come to think of Brooklyn Public Library and the Archive as "their space"—a place where they are welcome and belong, like an extension of the classroom or even the living room?

- Consider other methods options beyond surveys to get a more accurate and in-depth understanding.

- Explore other data collection approaches, which can also inform the design of a deeper-diving survey. For example, a survey based on an interview model, which funnels down (or triangulates) into greater detail about the topic under investigation.
References


