An Assessment on the Impact of Aikido Training on Academic, Behavioral, and Attendance Scores at Courthouse Academy

Sara Armor, Alexandra Bergner, Kenneth Chisholm, Emma Ferraiuolo, Matthew Floyd, Sarah Karwowski, Maddy Spear, Amy Wells

Applied Statistics and Research DCSI 259: 03

Dr. Christopher Garcia

University of Mary Washington

The College of Business

Table of Contents

I. Executive Summary

The UMW research team was presented with point sheet data (of 2014- 2016 school years), from Courthouse Academy to assess the relationship between cumulative amounts of Aikido and increased behavior and attendance scores. These records contain behavioral scores for every student, the attendance of all students, and an academic score for each student. This data was transferred from an excel spreadsheet, organized, and cleaned in preparation for analysis. Python programs were written to scan through the raw data in order to compile the information into a semi-analyzable format. Analysis of the data was done using the statistical program "R". The "R" code was written by the research team, which ran a trend analysis over the time span of all the available data. This examined the effects of varying amounts of Aikido training on students' behavior, academic, and attendance. Using the point sheet data, the research team conducted several types of graphical analysis. Firstly, the research team compared the condition type of students and grade levels to behavioral scores. The "R" program was also used to analyze the point-sheet data showing the day/before, day/of, and day/after score distributions. Lastly, Aikido's effect on tardiness, absences, and suspensions was assessed using the "R" program.

At the conclusion of the study, the research team found that there was, in fact, a significant correlation between the amount of Aikido training and participation to the scores received on a student's behavioral and academic record. In order to be more consistent with data collection, advice was given to Courthouse Academy to use a

database management system to allow easier data entry as well as create a uniform point of entry. It would also be advisable to analyze a larger sample size, in reference to students who reached the highest levels of Aikido. This will help to better determine if an increase in cumulative Aikido is correlated to an increase in academic and behavior scores.

II. Introduction

For the last several years, Aikido in Fredericksburg (a 501c3 educational corporation) has delivered a weekly class for students enrolled at Courthouse Academy. The Aikido class focuses on physical fitness, social skills development, safe emotional expression, and self-defense. Participation provides students with an opportunity for physical, emotional, and social growth, while reducing fear and other behavioral challenges. Importantly, the practice of Aikido develops and reinforces many character qualities and habits of mind which are essential for success in both academic and social contexts. These include respect, courage, kindness, dedication, success, honesty, fairness, and self-discipline. Accordingly, it is hypothesized that participation in the Aikido program will lead to improved academic, behavioral, and attendance outcomes for students enrolled at Courthouse Academy.

The purpose of this document is to report the results of the collaborative study involving Courthouse Academy and a team of students from the University of Mary Washington (UMW). The study focuses on evaluating the impact of the Aikido program on student academic, behavioral, and attendance outcomes at Courthouse Academy. The study did *not* utilize any human subjects, experiments, surveys, or observations. Rather, the methodological nature of the study consisted of a statistical analysis of four existing

data sources which have been collected and curated by Courthouse Academy: 1) student point-sheet data consisting of periodic academic and behavioral evaluations made by the students' teachers, 2) student attendance records, 3) student Aikido attendance records, and 4) student information. The UMW team was supervised by Dr. Christopher Garcia, Assistant Professor of Quantitative Methods. Additionally, each team member was required to sign and abide by an ethics and confidentiality agreement prior to beginning the project.

III. General Background Information

Courthouse Academy of Spotsylvania, Virginia is an institution recognized for their work with emotionally disabled youth. Courthouse Academy's mission is to support students, families and schools by creating a safe, structured, and therapeutic environment that maximizes their students' ability to achieve individualized goals. Many of their students come from the Spotsylvania public school system. If individuals struggle in public school, not academically but emotionally and socially, Courthouse Academy is an alternative education option that is capable of handling each individual's' specialized needs. It is a secondary school which enrolls students who are in 6th through 12th grade.

Aikido in Fredericksburg, a 501c3 educational corporation, teaches the "effective, yet non-violent, traditional Japanese martial art" of Aikido to students enrolled in Courthouse Academy. The corporation delivers weekly classes to the students that focus on physical fitness, social skills development, safe emotional expression, and self-defense. The goals of Aikido in Fredericksburg are to provide a social opportunity for

emotionally disabled students, to provide a tool for improving academic and behavioral performance, and create a community that supports conflict resolution.

IV. Research Design Outline

I. Study Design Concept

The purpose of this research study is to evaluate the impact of Aikido training on students in attendance at the Courthouse Academy. The study was completed using statistical analyses of the raw data provided to the research team by Courthouse Academy and Aikido of Fredericksburg. Under the supervision of Dr. Christopher Garcia, Assistant Professor of Quantitative Methods, the research team's goal was to provide valuable information for both Courthouse Academy and Aikido of Fredericksburg. Initially, raw data in the form of point sheet data on Google Docs were presented to the research team by Courthouse Academy. Four elements completed our data set: point-sheet data, attendance sheet data, Aikido attendance data, and student information data. The point-sheets are rubrics for teachers at Courthouse Academy to evaluate the academic and behavior performance on a daily basis (See Appendix "Point-Sheet Data"). Teachers evaluate each student and score their performance on the scale of 1-5. These scores are then added up to complete the Behavioral and Academic scores for each student, each day, with a maximum score of 50 points. Student Information data consisted of a condition identification, a coded identifier for the condition of the student established by Courthouse Academy. It is important to note that at the time of analysis, the research team did not know the specific conditions of students, only the condition codes A, B, C, and D. With access to the data, data preparation was needed to prepare the data for proper analysis.

The first steps of the data preparation stages began by converting the four primary raw data sources into two analyzable data sets: 1) behavioral data, which is primarily derived from point sheet data and is analyzed at the daily level, and 2) attendance data, which is primarily derived from the Courthouse Academy attendance data and is analyzed at the monthly level. Two programs were written in the Python language to go through all the point sheets, attendance sheets, Aikido attendance data, and student data and extract the information into semi-analyzable data sets. A separate program in the "R" programming language was written to turn these semi-analyzable data sets into the final behavioral and attendance datasets used for analysis. The research team then cleaned these two data sets prior to analysis and performed quality assurance, ensuring that the information was accurate compared to the original point-sheets on the Google Drive.

Once all data was in an analyzable format, the research team used the statistical program "R" in order to complete several varying analyses of the data. During the "R" analysis of the behavior and academic scores on the point sheet data, the research team found that the correlation between academic scores and behavior scores is 0.9831874. This is nearly a perfect correlation: It establishes that the two scores are essentially the same thing. We can understand either the behavior or academic score by understanding the other. Knowing this, the research team decided that the point sheet data will be evaluated using only behavior scores.

The analyzable data was used to complete numerous analyses for Courthouse Academy. First, the research team did background analyses on how the conditions of students at Courthouse Academy and grade levels compared to overall behavioral scores, which was displayed using a box and whisker statistical plot. Secondly, the research team

ran a trend analysis over the time span of the data, from October 2014 until April 2016. This longitudinal analysis examined the effects of varying amounts of Aikido training on students' behavior and attendance scores. Third, the research team analyzed the point-sheet data detailing the day/before, day/of, and day/after behavioral score distributions. Lastly, the effect of Aikido training on student tardiness, absences, and suspensions was assessed.

i. Dependent Variables

The dependent variables are dependent on cumulative amounts of Aikido exposure.

1) Daily Behavior Score: Behavioral score taken from point sheet data for each student. Analyzed at the daily level.
2) Monthly Attendance Metrics: Monthly incidence counts taken from Attendance sheet data over the course of each month for each student: Analyzed at the monthly level.
    - Total monthly absences
    - Total monthly tardies
    - Total monthly suspensions

ii. Independent Variables

1) Cumulative Aikido Training: The total number of training sessions a student has attended by any given date.
2) Grade level in each semester.
3) Condition Identification: A coded identifier for the condition of the student established by Courthouse Academy.

iii. Research Questions

1) What is the impact of Cumulative Aikido training on the daily Behavior point scores?
2) What is the impact of Cumulative Aikido training on monthly Tardies, Absences and Suspensions?

iv. Hypotheses

1) Higher amounts of Aikido training are related to increased daily behavior, and lower monthly absences, tardiness, and suspensions.
2) Student behavior scores and academic scores are higher the day after Aikido training, than the day before or day of Aikido training.

V. Research Methods

i. Data Generation and Collection Methods

The research team did not supplement the research with any primary data generation in the form of surveys, focus groups, or experiments. Essentially, the collection methods included data organization, data mining, cleaning, and analyzing. The research team was given secondary information and data from Courthouse Academy records. All records were from the 2014-2016 school years. With access to Courthouse Academy's student records, each research member was required to sign a confidentiality agreement in order to protect the privacy of those individuals. Due to the confidentiality agreements, the research team was limited to using media approved by Courthouse Academy for sharing data, which was Excel, Google Docs. After the confidentiality agreement was authorized, approval from parents of the individuals was needed to access the data. The end product of the data organization and cleaning efforts resulted in clean data that analyzed the attendance records, point-sheet data detailing student day-to-day behavioral scores, and records of which students participated in Aikido training.

The two proposed research questions are as follows: “What is the impact of Cumulative Aikido training on the daily Behavior point scores?” and “What is the impact of Cumulative Aikido training on monthly Tardies, Absences and Suspensions?”. From these research questions two hypotheses were formulated. Our first hypothesis proposes

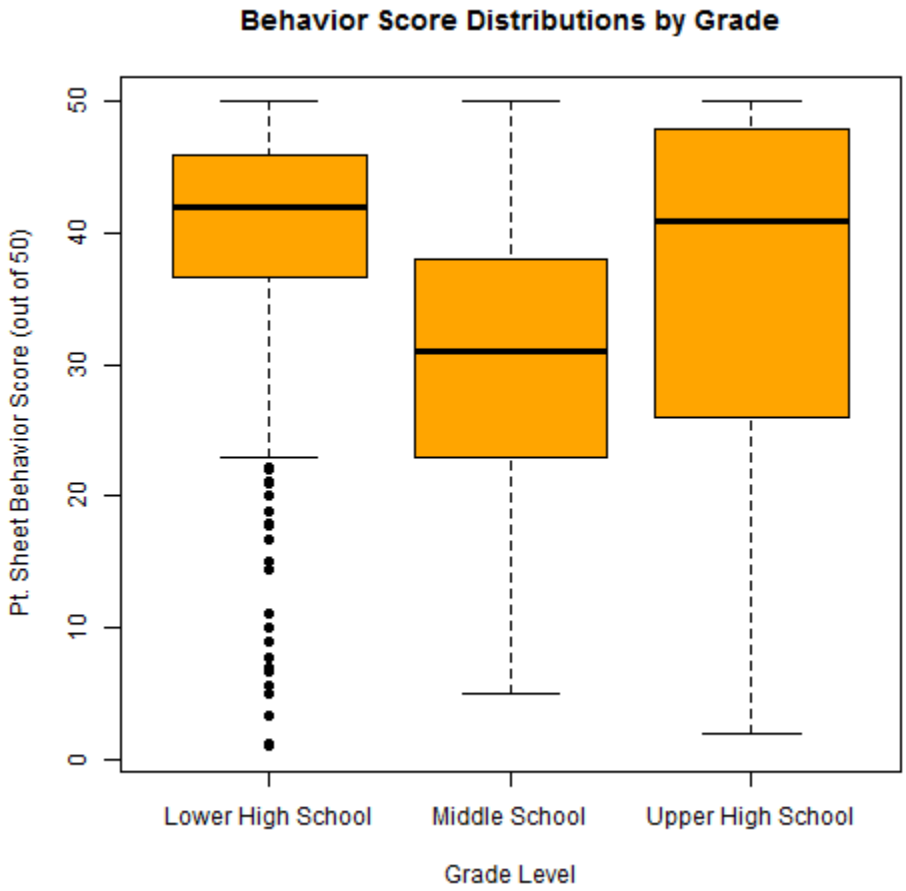
that higher amounts of Aikido training are related to increased daily behavior, and lower monthly absences, tardiness, and suspensions. Our second hypothesis proposes that student's behavior and academic scores are higher the day after Aikido training, than the day before or day of Aikido training

ii. Analytical Methods

The main goal of our project was to determine if there was a correlation between a student's level of cumulative of Aikido training to their behavioral and academic scores. All analyses examined the effect of differing amounts of the cumulative Aikido training on behavior and attendance. The research team used "R" to run multiple types of analyses on the data. First, the research team did background comparisons evaluating behavior scores by grade level and by conditions (A, B, C, D). Second, the team examined Aikido training related to behavior score overall. Third, the research team did a trend analysis over time of the data collected. This examined how differing amounts of Aikido training impacted behavior and attendance scores over time. Furthermore, score distributions by day/after, day/before, and day/of were analyzed. Finally, the team assessed how Aikido training affects monthly tardiness, absences and suspension.

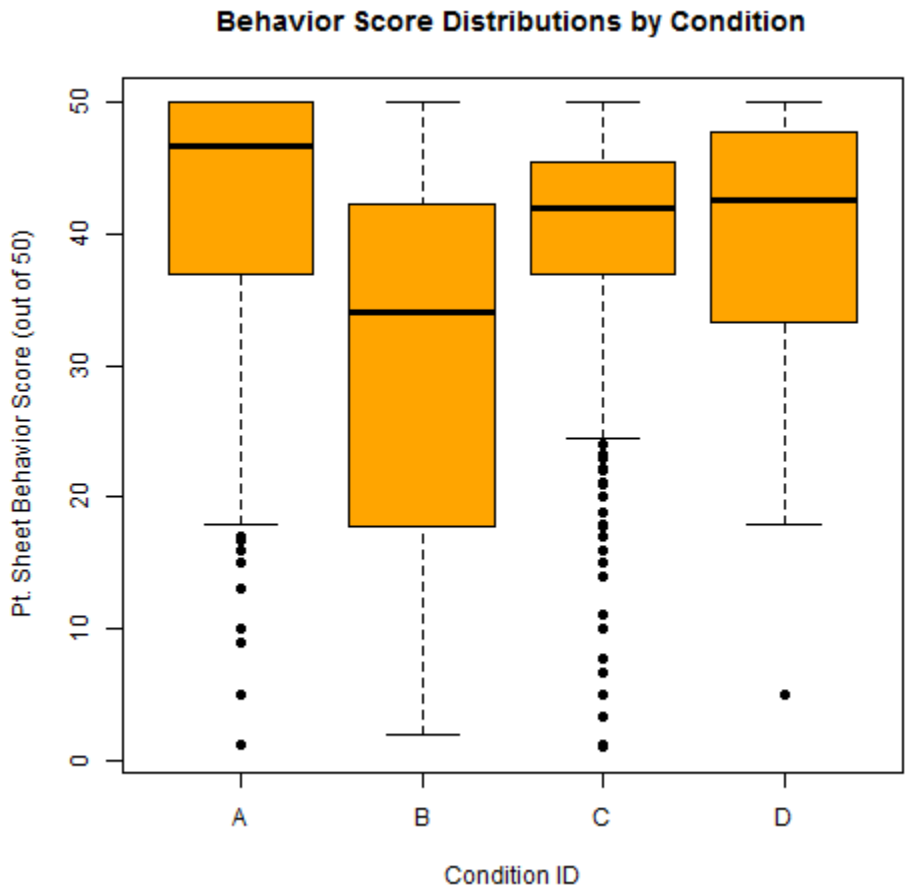
iii. Analysis and Results

A. Impact of Grade and Condition Type on Behavior Score



Interpretation: The boxplot displays the behavior score distributions by grade. The behavior scores differ significantly by grade level. The lower high school has a higher average median score than both the middle school and upper high school. The lower high school has the smallest variance in scores while the upper high school has the largest variance in scores. There were a disproportionate number of middle school observations when compared to the high school data.

Note: See Appendix: A for “R” Code and Table of Means.

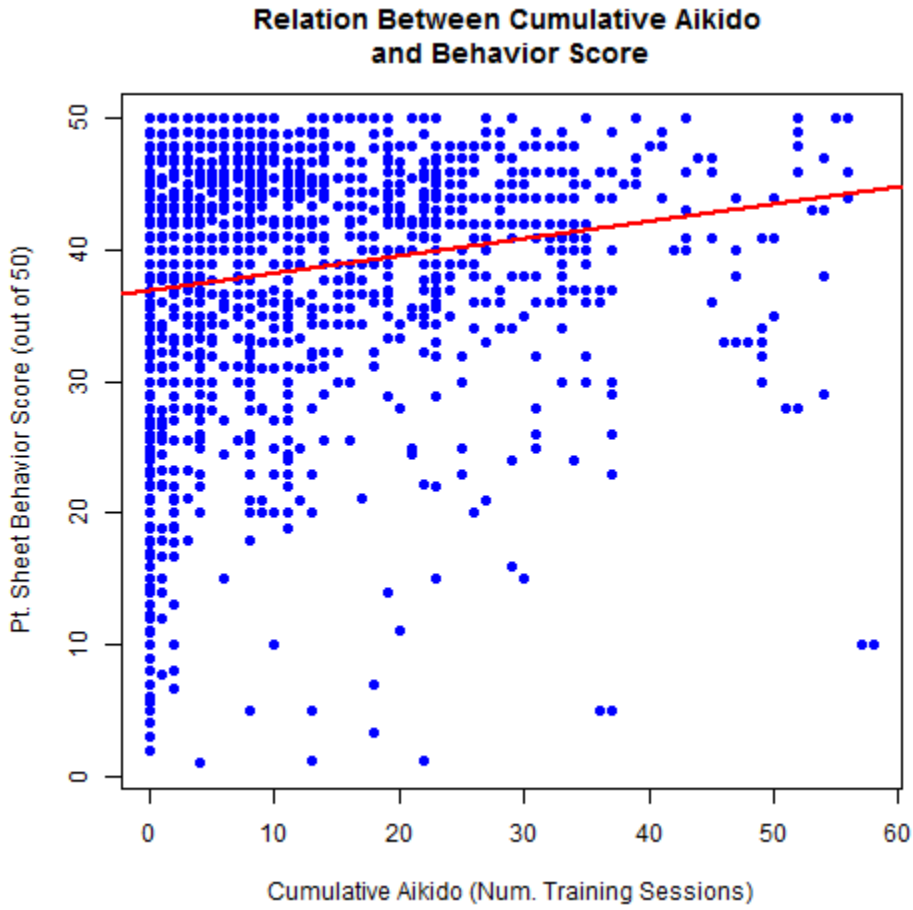


Interpretation: The boxplot displays the behavior score distributions by condition type. The behavior scores differ significantly by condition. The condition types, A, B, C, and D were coded by Courthouse Academy during the data analysis to view the data objectively. As displayed by the boxplot, behavior scores differ significantly by condition type. Condition A is associated with the highest average behavior scores. Condition B is associated with the lowest average behavior scores and also the greatest variance between the scores. After analysis, the conditions were revealed. A: Autism Spectrum Disorder, B: Angry/Aggressive, C: Functional Skills Deficits, D: Psychoses. Due to the small nature of the sample sizes for each condition, the research team was unable to make any

conclusions about the relationships between condition type and the impact of Aikido exposure on behavior score.

Note: See Appendix: A for “R” Code and Table of Means.

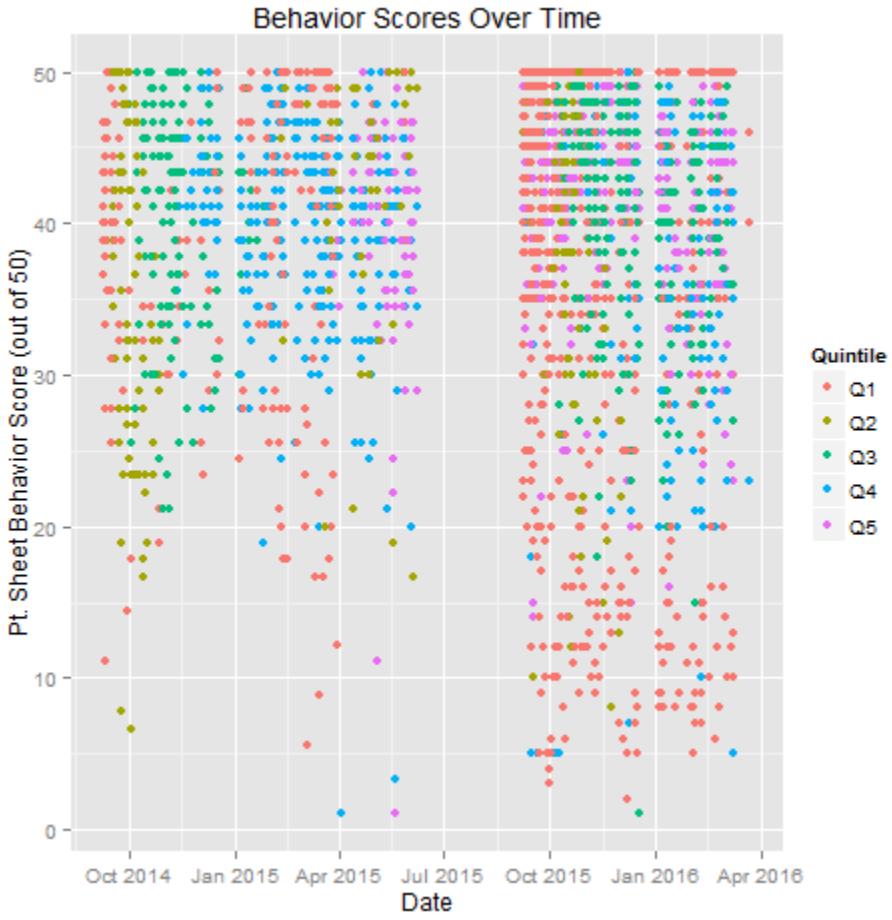
B. Aikido Training Related to Behavior Score Overall



Interpretation: The scatter plot displays the relationship between cumulative Aikido and behavior score. Each point on the scatter plot is a student with a particular behavior score and a particular level of Aikido on a given day. As shown by the regression line on the scatter plot, there is a general correlation between cumulative Aikido training and behavior score. Here, the points located at zero, or students with no Aikido exposure

work as the control group for the analysis. Students with increasing amounts of cumulative Aikido training tend to cluster towards the upper right portion of the graph. Overall, there is **a** modest but evident increase in behavior score associated with higher levels of Aikido training.

C. Relationship Between Aikido Training and Behavior Over Time

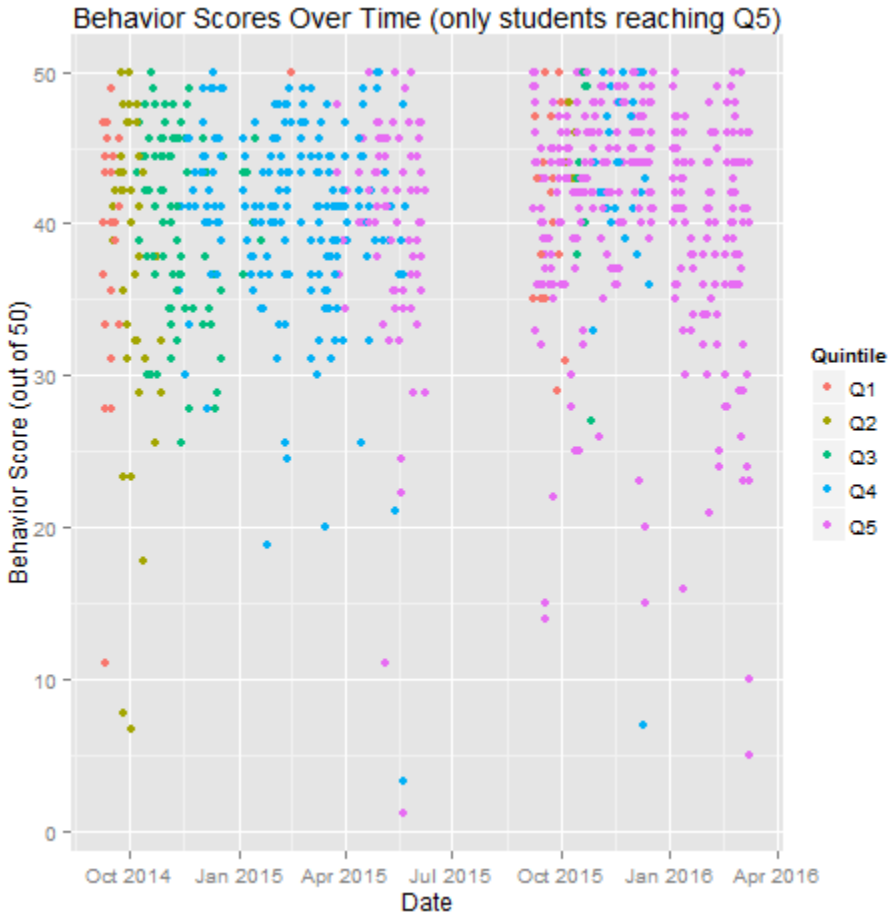


Interpretation: The scatter plot displays the relationship between cumulative Aikido training and behavior over time. Students were divided into five quintiles, Q1, Q2, Q3, Q4, and Q5, based on their level of cumulative aikido exposure on a given date. Q1 is the lowest level of Aikido exposure with Q5 being the highest level of Aikido exposure. There is a significant difference in overall behavior scores based on how much Aikido training has occurred. The red dots (Q1 = lowest Aikido exposure) have the lowest

average behavior score (35.09), and this increases until around Q3. Between levels Q3 and Q5, behavior scores tend to level out and remain similar. As seen on the scatterplot, Q3 (green), Q4 (blue), and Q5 (purple) individuals tend to cluster and remain in the upper portion of the graph. While Q1 (red) dots tend to be more prominent in the lower level of the graph as seen between October 2015 through April 2016.

Note: See Appendix: B for "R" Code and Table of Means.

Relationship Between Aikido Training Over Time In Top Quintile

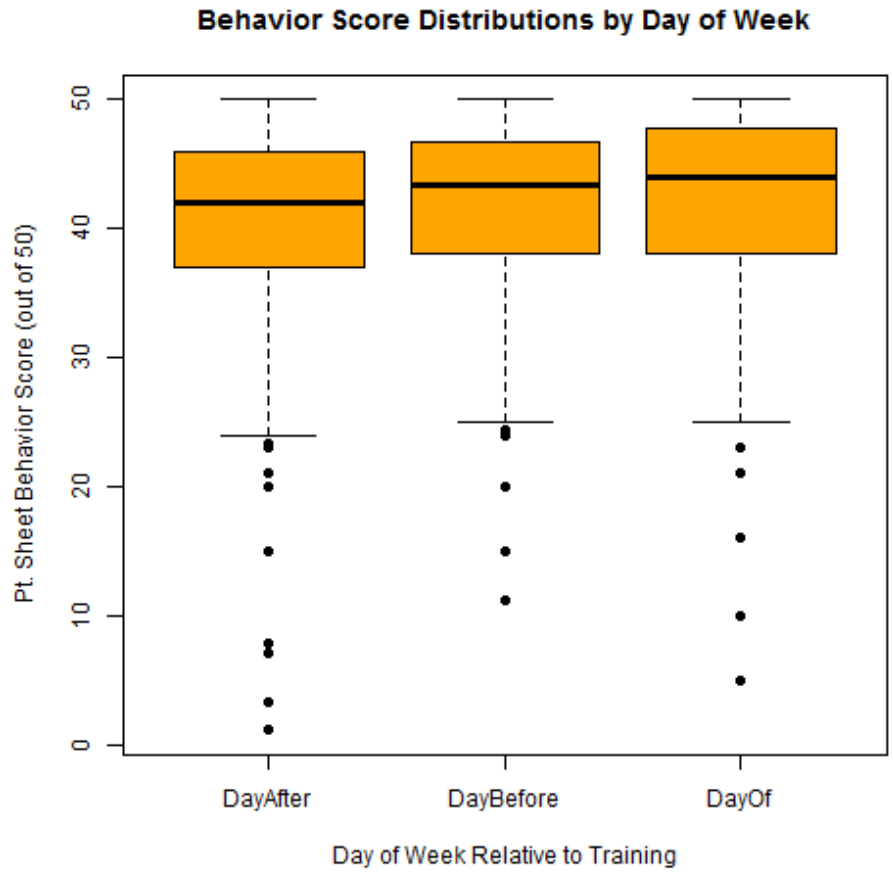


Note: In this analysis, only students who progressed to Q5 are considered. By separating out the Q5 students, the analysis can be looked at objectively to see if the increase in behavior scores over time with more Aikido training is best explained by the training or

as a trait inherent in these students. If behavior scores in this sub-group increase with more Aikido then it is likely due to the training. If they remain constant, then the high scores may be due to characteristics inherent to these students. See Appendix: B for "R" Code and Table of Means.

Interpretation: The scatter plot displays the relationship between cumulative Aikido training and behavior over time with a focus on students who reached the top quintile, or Q5. There is no significant difference in behavior scores across quintiles once we select out those who progress through the highest amounts of training. As shown by the scatterplot, the students who have attained Q5 status have exhibited consistently high scores in regards to behavior, regardless of how much training they have received. This indicates that the high behavior scores associated with more Aikido training may be due to factors within the students themselves rather than increased training. If so, these intrinsic factors apparently lead to both increased behavior scores as well as the perseverance needed to make it to higher levels of training. As a disclaimer, only 4-5 students attained Q5 status. For more approximate results that increased Aikido training has a positive correlation with behavior scores, further research with more data in regards to students who reach Q5 would be needed.

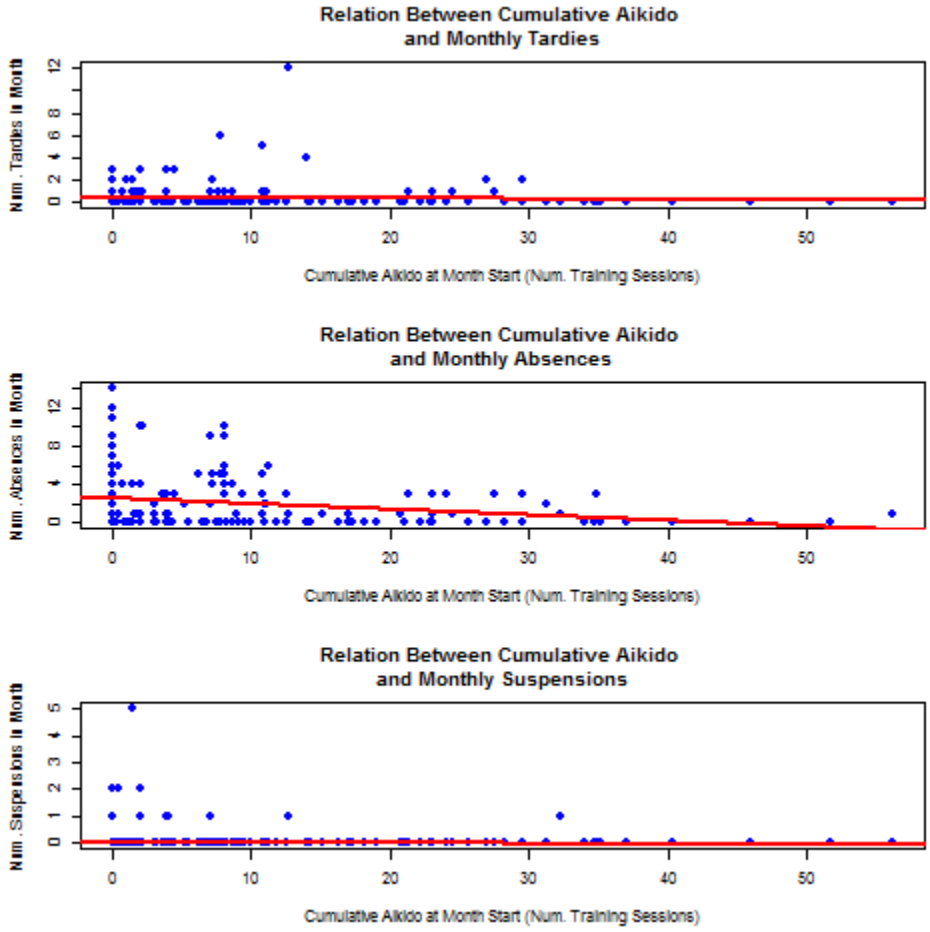
D. Score Distribution by Day/Before, Day/Of, and Day/After



Interpretation: The boxplot is displaying the behavior score distributions by day of the week. There are slight differences between day before/day of/day after Aikido training, and these differences are approaching significance. In particular, the day of training and day before are noticeably higher than the day after. The day after (ie. Monday) may have resulted in the lowest average behavior scores due the decaying effect of the training over the weekend, possibly invalidating the day-after measurements in this data. Moreover, the day of training resulted in the highest scores. However, the weekday of training was not constant over the period. In particular, it should be noted that training occurred on Fridays for part of the time and Wednesdays for the other.

Note: See Appendix: C for “R” Code and Table of Means.

E. Aikido Training Relate to Monthly Tardiness, Absences, and Suspensions



Interpretation: The scatter plots display the relationship between cumulative Aikido training related to monthly tardies (first graph), absences (second graph), and suspensions (third graph). All three graphs show that as Aikido training progresses, tardies, absences and suspensions all decrease slightly. It appears that there is a significant relationship between the amount of Aikido training and absences – more training is associated with fewer absences. The research team then selected out those students who made it into Q5 to see if increased Aikido leads to lower absences. Once the research team controlled for students in Q5, the effect of Aikido training on absences disappears. It appears that

students with the highest amounts of training have the lowest absences overall (See Appendix: D “Aikido Training Related to Absences in Students Reaching Top Quintile “R” Code” for Table of Means). They also had this before reaching the higher levels of training. So the effect seems to be explained by something intrinsic to the students, not the training.

Note: See Appendix: D for “R” Code and Table of Means.

VII. Conclusions

In conclusion, the research team came to four separate conclusions based on the analyses completed. First, the team did find that there is a general relationship between more Aikido training and higher behavior scores. As shown in the graph, Aikido Training Related to Behavior Score Overall, the regression line displays that a positive correlation exists between the increased cumulative Aikido training and behavior scores overall. This result leads to the second conclusion. To further assess if increased Aikido training results in higher behavior scores the research team separated out the students who attained Q5 status and graphed their progress over time. As seen in the graph, The Relationship Between Aikido Training Over Time In Students Reaching Top Quintile, the behavior scores of the students that reached Q5 status remained constant while they were in Q1 through Q5, regardless of which level of Aikido level they are in. The research team concluded that the data suggests there are factors that are intrinsic to the student that lead to both increased behavior scores and perseverance to attain higher levels of training. Thirdly, after the analysis of the graph, Aikido Training Related to Days of the Week, the research team concluded that The Day/Of behavior scores were higher than the Day/After and Day/Before. While the Day/After (ie. Monday) scores

were consistently lower, this could likely be due to the decaying effect over the weekend because of the Aikido training that occurred on Friday. Lastly, when the research team analyzed Aikido Training Related to Monthly Tardiness, Absences, and Suspensions, the team concluded that there is a general relationship between more Aikido training and lower amounts of monthly absences. Although similar to conclusions 1 and 2, we found no differences with students who attained Q5 status regardless of which Aikido level status they were in overtime.

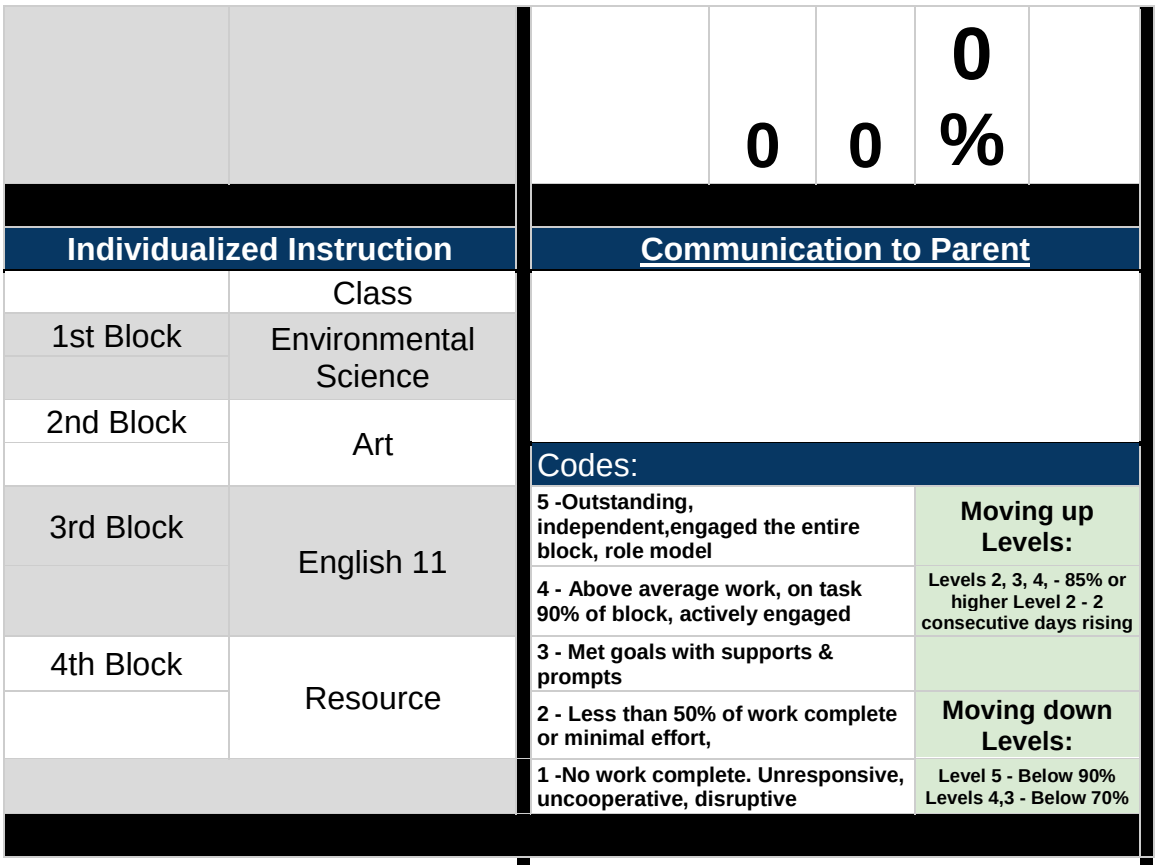
VIII. Recommendations

Since there were various limitations regarding the data, the research team has a few recommendations for future research. The first being a Database Management System. This would allow all collected data to be located in one easily accessible place. It would also allow users to establish a "data entry" as well as create a uniform point of access. This means that all faculty could access and update the data on the same database, making information much more accurate and accessible. The second recommendation would be to analyze a larger sample size; especially in regards to those who attain Q5 status in their training. In this study, only 4-5 students attained Q5 status. Attaining a larger sample size will help better discern whether or not an increase in cumulative Aikido is correlated to an increase in academic and behavior scores.

IX. Appendices

Point Sheet Data:

A	Courthouse Academy Communication Sheet	Data Collection			
		Intervals	Academic	Behavior	Notes
Teacher		Arrival 8:10-8:25			
Student		8:25 - Transition to 1st Block - 8:30			
Date		1st Block - 1 Mauldin			
Level for Today		9:10 - Transition to Elective - 9:10			
		Elective Creative Write.			
		10:20 - Transition to 1st Block - 10:20			
		1st Block - 2 Mauldin			
Target Behaviors & IEP Goals	Goals Met Y or N	Transition to Lunch			
		LUNCH			
Taylor will follow staff directions the first time they are given within 1 minute 100% of the time		Transition to 3rd Block			
		3rd Block - 1 Hoag			
Taylor will start academic assignments with no more than 1 reminder per period		3rd Block - 2 Hoag			
Taylor will start academic assignments with no more than 1 reminder per period		Transition to 4th Block			
		4th Block -1			
		4th Block - 2			
		Transition to Homeroom for Dismissal			
		Dismissal 2:20			
			Total	Total	Level For Tomorrow



			0	0	0 %
Individualized Instruction		**Communication to Parent**			
	Class				
1st Block	Environmental Science				
2nd Block	Art				
3rd Block	English 11	Codes:			
4th Block	Resource	5 -Outstanding, independent,engaged the entire block, role model			Moving up Levels:
		4 - Above average work, on task 90% of block, actively engaged			Levels 2, 3, 4, - 85% or higher Level 2 - 2 consecutive days rising
		3 - Met goals with supports & prompts			
		2 - Less than 50% of work complete or minimal effort,			Moving down Levels:
		1 -No work complete. Unresponsive, uncooperative, disruptive			Level 5 - Below 90% Levels 4,3 - Below 70%

Description: The above image is a blank example of point-sheets received by the research team from Courthouse Academy. Point-Sheets are used by teachers to evaluate each student's behavior and academics at different time periods on a daily level. Points were assessed on a 1-5 scale (codes for each level detailed above in the image). Moving up levels, as well as moving down level requirements are also explained on the Point-Sheet. Note spaces are provided for teachers as well as goals for each student to work on in the future.

A. Impact of Grade and Condition Type on Behavior Score

Grade "R" Code:

```
Tables of means
Grand mean
```

```
38.08692

 q_grade
      Lower High School Middle School Upper High School
                  40.13          30.28               36.22
rep           1529.00         158.00           1018.00
> summary(aov.grade)
             Df Sum Sq Mean Sq F value Pr(>F)
q_grade      2  19586    9793   80.55 <2e-16 ***
Residuals   2702 328482       122
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
2 observations deleted due to missingness
```

Analysis:
As the highlighted P-value above to displays, the behavior scores differ significantly by grade level.

Condition Type “R” Code:

```
> aov.condition <- aov(behavior_total ~ condition_id, data=ptsh)
> model.tables(aov.condition, "means")
Tables of means
Grand mean

38.09161

 condition_id
      A      B    C     D
      42.28  30.63   40.47  39.06
rep 670.00 757.00 1132.00 148.00
> summary(aov.condition)
             Df Sum Sq Mean Sq F value Pr(>F)
condition_id      3  60455   20152   189.3 <2e-16 ***
Residuals   2703 287756       106
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Analysis: The P value reveals that behavior scores differ significantly by condition.

B. Relationship Between Aikido Training and Behavior Over Time

Relationship Between Aikido Training and Behavior Over Time “R” Code:

```
> aov.cum_aikido <- aov(behavior_total ~ q_cum_aikido, data=ptsh)
> model.tables(aov.cum_aikido, "means")
Tables of means
```

```
Grand mean

38.09161

 q_cum_aikido
      Q1     Q2   Q3    Q4     Q5
      35.09  37.57  41.11  39.13  40.49
rep 998.00 225.00 427.00 521.00 536.00
> summary(aov.cum_aikido)
            Df Sum Sq Mean Sq F value Pr(>F)
q_cum_aikido      4  16573    4143   33.76 <2e-16 ***
Residuals   2702 331638       123
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Analysis: The P value signifies that there is a significant difference in the overall behavior scores based on how much Aikido training has occurred.

Relationship Between Aikido Training Over Time In Top Quintile “R” Code:

```
> ab <- aov(behavior_total ~ q_cum_aikido, data=tb)
> model.tables(ab,"means")
Tables of means
Grand mean

40.60801

 q_cum_aikido
      Q1    Q2    Q3    Q4     Q5
      40.81 38.61  40.76  41.2  40.49
rep 48.00 56.00 107.00 255.0 536.00
> summary(ab)
            Df Sum Sq Mean Sq F value Pr(>F)
q_cum_aikido   4    326   81.44   1.514  0.196
Residuals   997  53620   53.78
```

Analysis:

The P value here reveals that there isn’t a significant difference in behavior scores across

quintiles once we select out those who progress through the highest amounts of training.

C. Score Distribution by Day/Before, Day/Of, and Day/After "R" Code:

```
> ad <- aov(behavior_total ~ aikido_day_status, data=subset(ptsh,
!is.na(aikido_day_status)))
> model.tables(ad, "means")
Tables of means
Grand mean

41.02769

 aikido_day_status
                   DayAfter DayBefore  DayOf
                   39.95     41.19  41.78
rep   203.00    197.00 246.00
> summary(ad)
                            Df Sum Sq Mean Sq F value Pr(>F)
aikido_day_status   2    382  191.00   2.861 0.0579 .
Residuals           643  42919   66.75
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Analysis:
The P value supports that there are slight differences between day before/day of/day after

Aikido training, and these differences are approaching significance (see Pr(>F) above).

D. Aikido Training Relate to Monthly Tardiness, Absences, and Suspensions

ANOVA for impact of Aikido training on each of the 3 attendance-related dependent variables (tardiness, absences, and suspensions) "R" Code:

```
> abs.aov <- aov(absent ~ q_cum_aikido, data=att)
> summary(abs.aov)
            Df Sum Sq Mean Sq F value Pr(>F)
q_cum_aikido   4   90.2  22.549     2.49 0.0445 *
Residuals   198 1793.0   9.055
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
> model.tables(abs.aov,"means")
Tables of means
Grand mean
```

```
2.118227

 q_cum_aikido
      Q1     Q2   Q3    Q4      Q5
      2.537  3.167  1.517  2.216  0.8333
rep 95.000 12.000 29.000 37.000 30.0000

> tardy.aov <- aov(tardy ~ q_cum_aikido, data=att)
> summary(tardy.aov)
             Df Sum Sq Mean Sq F value Pr(>F)
q_cum_aikido   4    5.6 1.40   0.946  0.439
Residuals   198  293.1  1.48
> model.tables(tardy.aov,"means")
Tables of means
Grand mean

0.5073892

 q_cum_aikido
      Q1      Q2        Q3    Q4      Q5
      0.4632  0.8333  0.4483  0.7568  0.2667
rep 95.0000 12.0000 29.0000 37.0000 30.0000
>
> suspend.aov <- aov(suspend ~ q_cum_aikido, data=att)
> summary(suspend.aov)
             Df Sum Sq Mean Sq F value Pr(>F)
q_cum_aikido   4   0.67  0.1665   0.727  0.575
Residuals   198  45.36  0.2291
> model.tables(suspend.aov,"means")
Tables of means
Grand mean

0.09852217

 q_cum_aikido
      Q1    Q2    Q3    Q4       Q5
      0.1263  0.25  0.1034  0.02703  0.03333
rep 95.0000 12.00 29.0000 37.00000 30.00000
```

Analysis: The P value highlighted above supports that there is a significant relationship between amount of Aikido training and absences. Thus, more training is associated with fewer absences.

Aikido Training Related to Absences in Students Reaching Top Quintile "R" Code:

```
> tardy.q5.aov <- aov(tardy ~ q_cum_aikido, data=tb)
> summary(tardy.q5.aov)
             Df Sum Sq Mean Sq F value Pr(>F)
q_cum_aikido  4  0.459  0.1148   0.473  0.755
Residuals    54 13.100  0.2426
> model.tables(tardy.q5.aov,"means")
Tables of means
Grand mean

0.2033898

 q_cum_aikido
      Q1     Q2         Q3    Q4      Q5
      0.1667 0.3333 -1.721e-16  0.1333  0.2667
rep 6.0000 3.0000  5.000e+00 15.0000 30.0000
```

Analysis: The P value result supports that the effects of Aikido on absences can be possibly explained by something intrinsic to the students, not the training.