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## The effect of active learning lessons in students' performance

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## Background

The Office of Faculty Development with the support of HHMI grant provided the intensive STEM Instructional Program for WMU students from different disciplines in Summer 2018. It followed with a one year mentoring program with the help of former WMU provost for students who participated in this program.

The goals of this program were categorized as:

- ❖ Provide professional foundations and necessary techniques for current STEM student to improve their teaching skills
- ❖ Help the STEM students to build their path for future career in academia

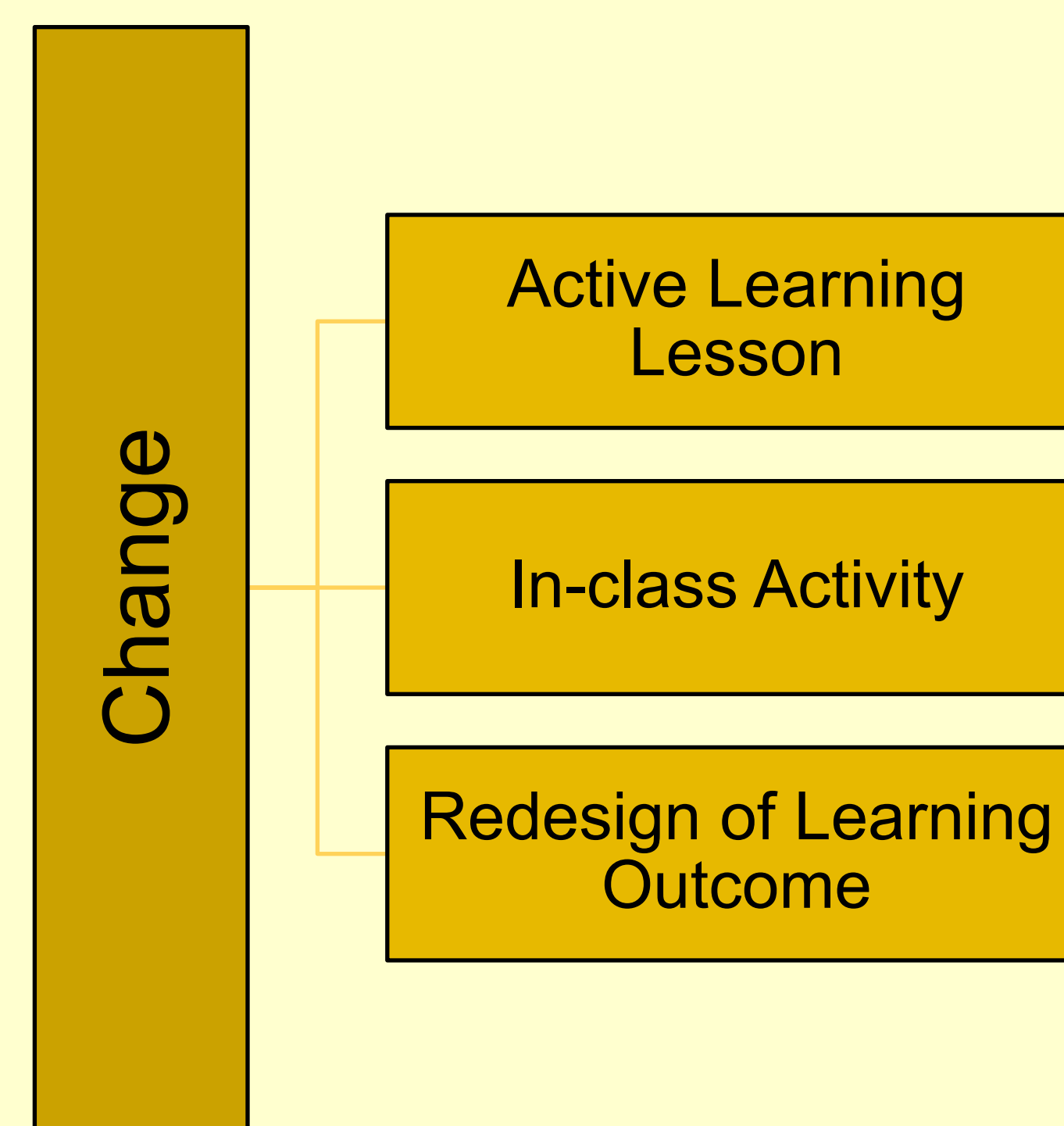


## Introduction

As a participant in this program, I was inspired to apply what I learned to the class that I was assigned as a TA in Fall 2018 and Spring 2019.

The course is offered in Industrial and Entrepreneurial Engineering department for graduate level called "Design of Experiment and Regression Analysis".

The effort has been placed to redesign this course for two following semesters. The new change can be categorized in these areas.



## Challenges

The following challenges and difficulties were identified during the applying of these new changes.

- ❖ Students from different engineering majors take this course. They do not have the same statistical background which is the prerequisite for this course.
- ❖ The students did not engage in class discussions.
- ❖ The assignments focused on theoretical aspect and they were not helpful for current learning outcomes.

## In-class activity



- ❖ In order to satisfy new learning outcomes, two small group based class activities were designed to perform during class lectures. These activities were designed to involve students more in class discussion and also with their classmates as a group.
- ❖ The new assignments were designed based on simulation of real manufacturing problems. The goal was to show students how to use the methods and techniques of this course for solving real-world problems.

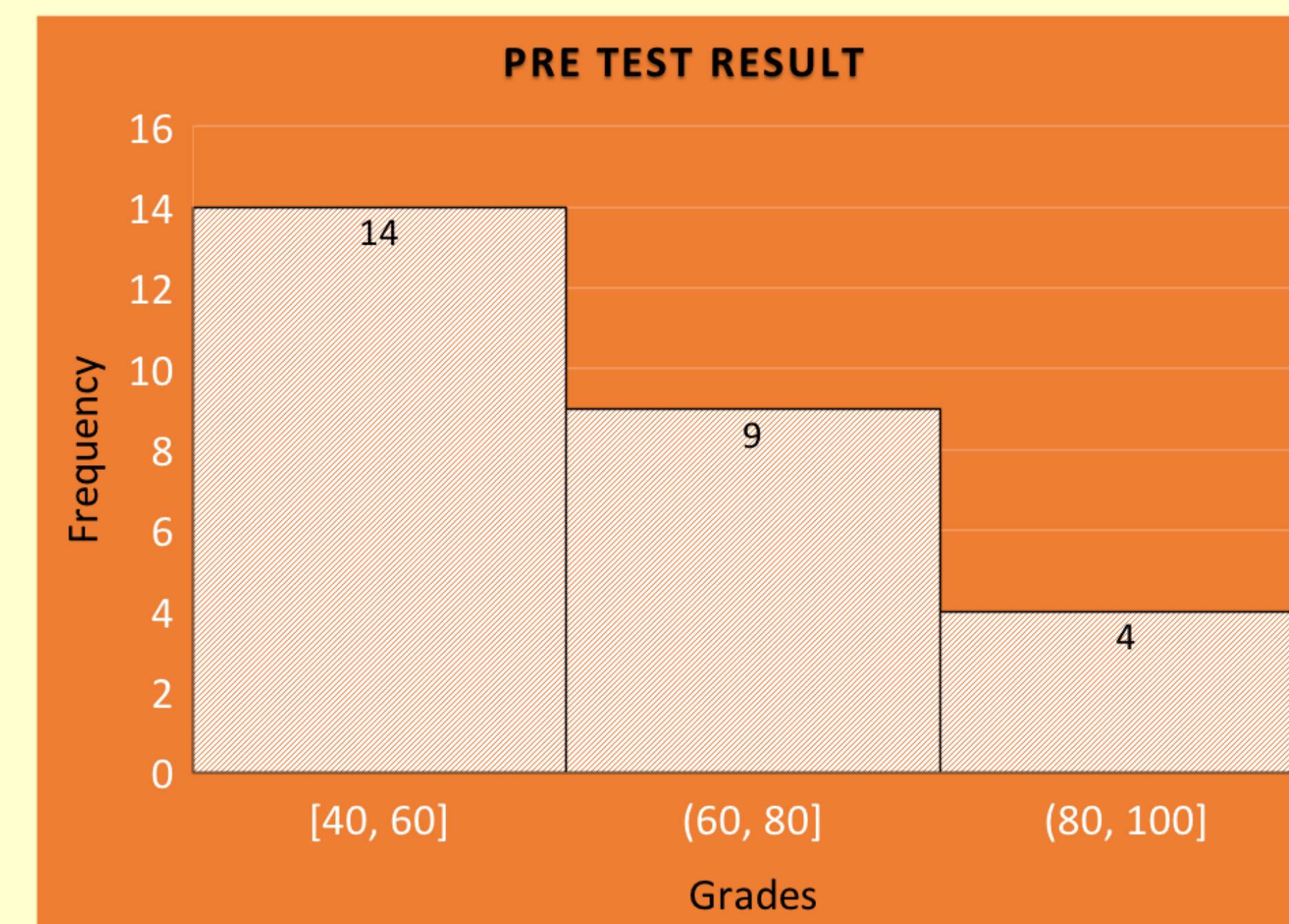
## Survey

Three questions asked from students at the end of the semester to evaluate the new changes:

- ❖ How well did you achieve the learning outcome?
- ❖ What did we the instructor did that helped you achieve the learning outcome?
- ❖ What could the instructor could have done differently to help you better achieve the learning outcomes?

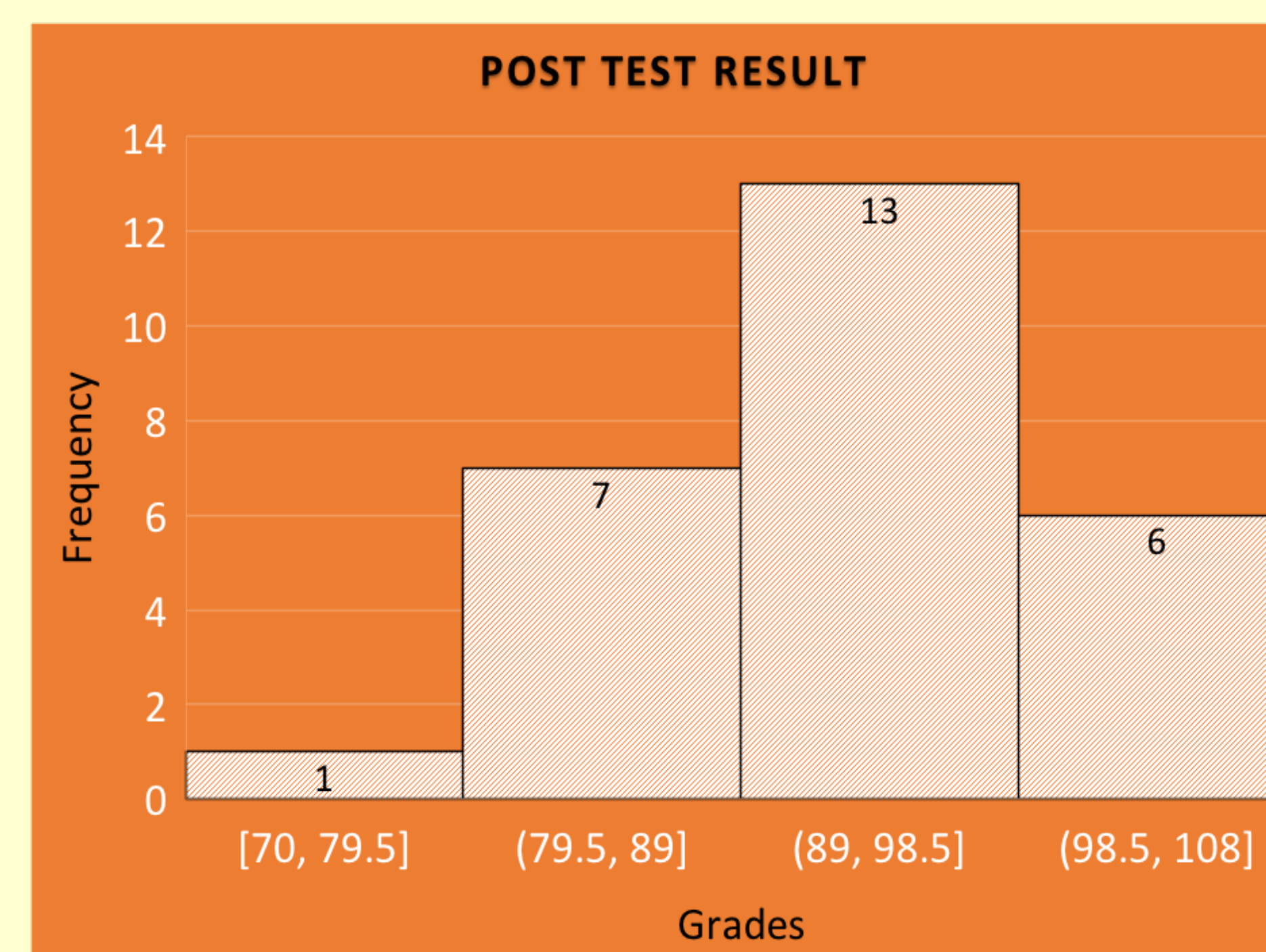
## Pre test result

At the beginning of a semester, a pre test was given to the students to evaluate their basic knowledge of statistics. Based on their result the area that students had a poor performance was identified. The required material was prepared and lecture video was uploaded in the E-learning for students to catch up with the class.



## Post test result

Post test have been given to the students after implanting new changes to the courses. The histogram of the grades of post tests is shown here. It worth to mention the grades greater than 100 is due to the curving.



## Results

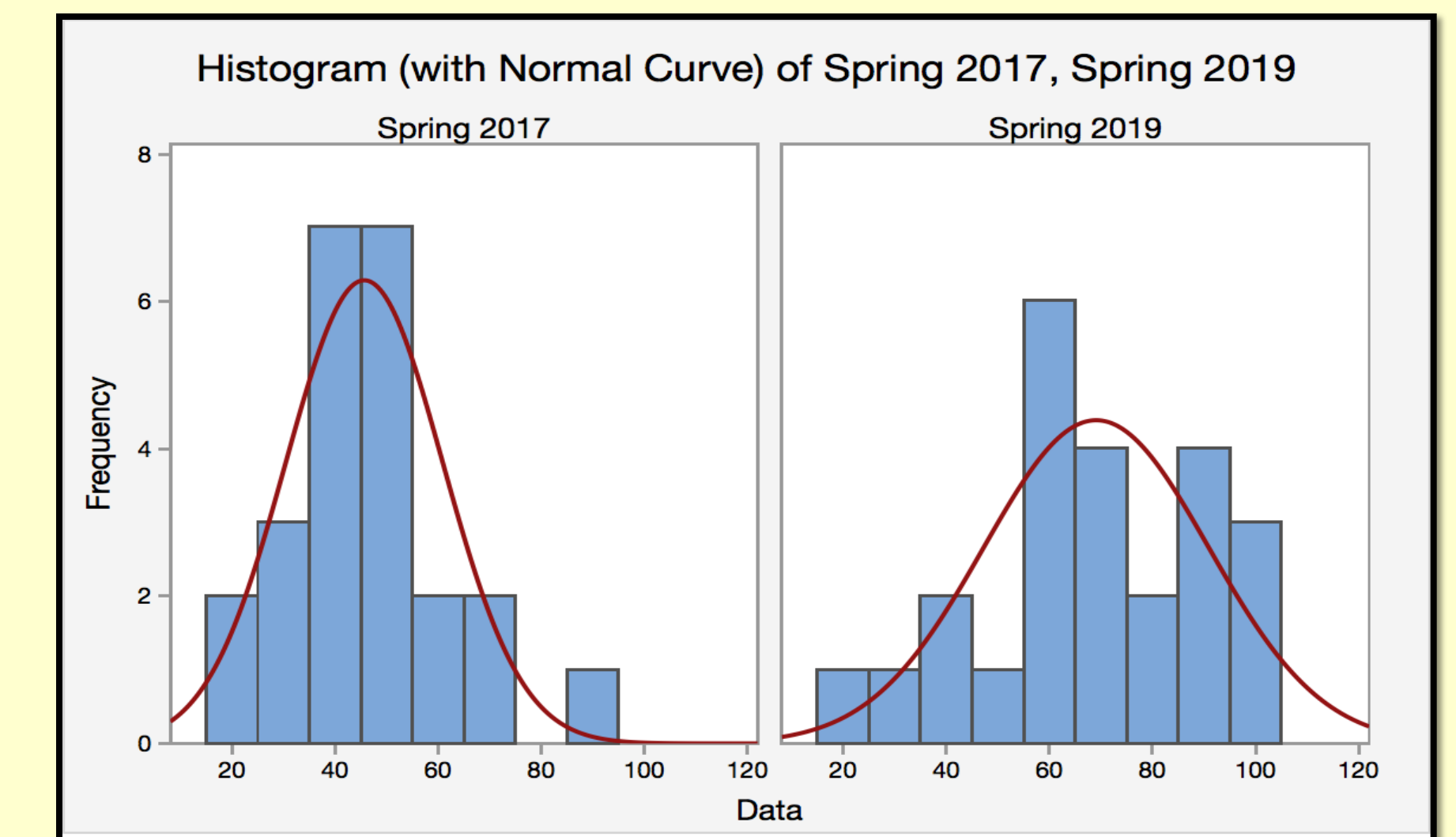
The final grades of students after applying new changes in Spring 2019 has been compared to the grades before modification in Spring 2017.

The descriptive statistics of the final grades are shown below.

Statistics										
Variable	N	N*	Mean	SE Mean	StDev	Minimum	Q1	Median	Q3	Maximum
Spring 2017	24	0	45.667	3.108	15.228	19.000	37.000	44.000	54.000	88.000
Spring 2019	24	0	69.083	4.454	21.819	24.000	57.000	74.000	88.750	100.000

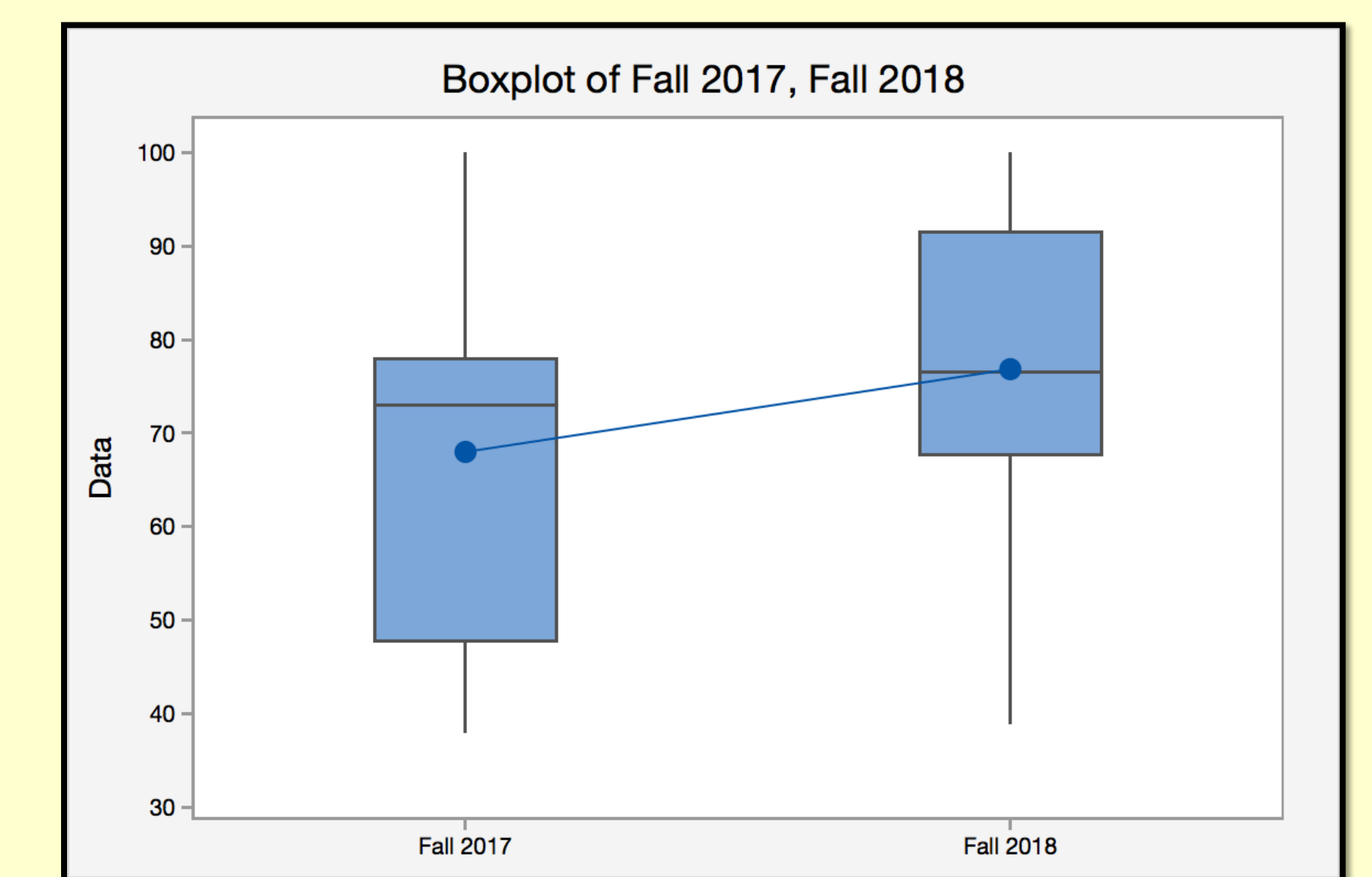
## Result comparison

The histograms of before and after in spring semester is shown here.



The final grades of students after applying new changes in Fall 2018 has been compared to the grades before modification in Fall 2017. Two sided t-test has been done on the grades to statistically investigate the difference between the average of the grades.

Descriptive Statistics					Test		
Sample	N	Mean	StDev	SE Mean	Null hypothesis	$H_0: \mu_1 - \mu_2 = 0$	
Fall 2017	26	68.000	18.519	3.632	Alternative hypothesis	$H_1: \mu_1 - \mu_2 \neq 0$	
Fall 2018	26	76.846	16.252	3.187	T-Value	DF	P-Value
					-1.83	49	0.0732



## Conclusion

The results shows an improvement in students performance in final exams. The students engaged more in class discussion. Additionally, more students participated in office hours for TA. The students are more willing to give feedback to the instructor and TA to improve the course quality.

## Contact information

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