The effect of active learning lessons in students’ performance

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The effect of active learning lessons in students’ performance
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Howard Hughes Medical Institute

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.

Active Learning
- 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 form 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.

In-class activity
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.

Result comparison
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.

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.

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Active Learning Lesson
In-class Activity
Redesign of Learning Outcome

Pre test result

POST TEST RESULT

GRADUATES

Grades

POST TEST RESULT

GRADUATES

Grades

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.

<table>
<thead>
<tr>
<th>Statistics</th>
<th>Sample</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>SE Mean</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Q1</th>
<th>Median</th>
<th>Q3</th>
<th>Interquantile</th>
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<tbody>
<tr>
<td>Spring 2017</td>
<td>25</td>
<td>0</td>
<td>69.1</td>
<td>9.53</td>
<td>3.03</td>
<td>56.0</td>
<td>80.0</td>
<td>58.0</td>
<td>68.0</td>
<td>70.0</td>
<td>12.0</td>
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<tr>
<td>Spring 2018</td>
<td>25</td>
<td>0</td>
<td>69.08</td>
<td>9.36</td>
<td>3.02</td>
<td>57.5</td>
<td>80.0</td>
<td>60.0</td>
<td>70.0</td>
<td>80.0</td>
<td>10.0</td>
</tr>
</tbody>
</table>

Change

<table>
<thead>
<tr>
<th>Change</th>
<th>Active Learning Lesson</th>
<th>In-class Activity</th>
<th>Redesign of Learning Outcome</th>
</tr>
</thead>
</table>