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Take Home Exam (THE) as an assessment method for STEM students

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Research question

Will STEM students have better grades in Heat transfer course if they take it as a Take Home Exam (THE)?

Research hypothesis

Take-Home Exam (THE) provides the students with an elongated exam time, unlimited access to resources, and stress relief during an In-Class Exam (ICE), the performance of the student's is expected to increase.

Objectives

To compare the mean of ICE and THE grades for each student in the class.

Methodology

- Give the students the heat transfer exam in-class, open-book only and for 2 hours session.
- Give the SAME exam to the students to solve it at home and return it back next day at noon.
- Data analysis of the results of both ICE and THE for each student and make some statistics using Excel and Minitab.
- Discuss the results.

Introduction

Testing in Academia is necessary for both the instructor and the students at the same time. Students build their academic efforts and give them an indication of the skills they mastered during the course. Despite the diversity of the assessment methods, distinguished universities consider ICE as the major assessment method.

Introduction

ICEs are characterized by limited time, stress imposed on students and reduce unethical behavior of students; however it is not suitable for assessing higher levels of Blooms taxonomy.

On the other hand, take-home exam THE is like an open-exam and assignment mix.



Pros of THE:

- No anxiety, nor stress.
- At home: Pajamas and socks
- Snacks and drinks.
- Open resources.
- Time span: days to week.



Cons of THE:

- High expectations.
- Not suitable for all subjects.
- False sense of security.
- Chance of cheating.

Statistical analysis

The sample: 41 Students
ICE time: 2 hours
THE time: 14 hours
Software: Excel and Minitab 19

Hypothesis Test:

Since we need to compare the results of the exams (two samples) with each other, Paired t-test is the suitable test, it will examine the mean difference between the two exams to determine if they are significantly different or not.

Null hypothesis, $H_0: \mu_{THE} - \mu_{ICE} = 0$

Alternative hypothesis, $H_a: \mu_{THE} - \mu_{ICE} \neq 0$

The Confidence Interval (CI)= 95%

Level of confidence (α)= 0.05

If $P \geq \alpha \rightarrow$ Fail to reject $H_0 \rightarrow$ cannot accept H_a

If $P < \alpha \rightarrow$ reject $H_0 \rightarrow$ accept H_a

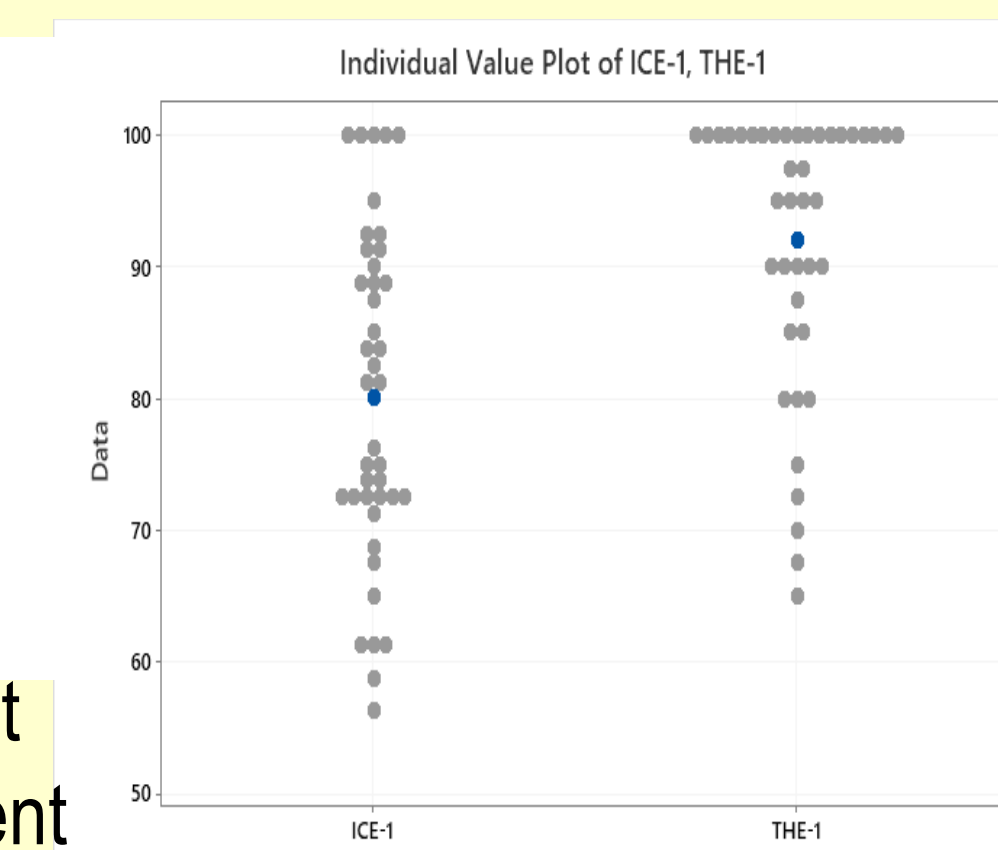
Results and discussion

Heat Transfer Exam

The mean and standard deviation of both ICE and THE were calculated, the distribution of individual grades around the mean is shown in fig.(1)

Descriptive Statistics

Sample	N	Mean	StDev	SE Mean
THE-1	41	92.01	10.45	1.63
ICE-1	41	80.09	12.62	1.97



Grade-ICE1>mean:21 student
Grade-THE1>mean :25 student

For each student, the results of both exams were plotted as a bar chart in fig.(2)

Fig.(1): Individual plot of the grades

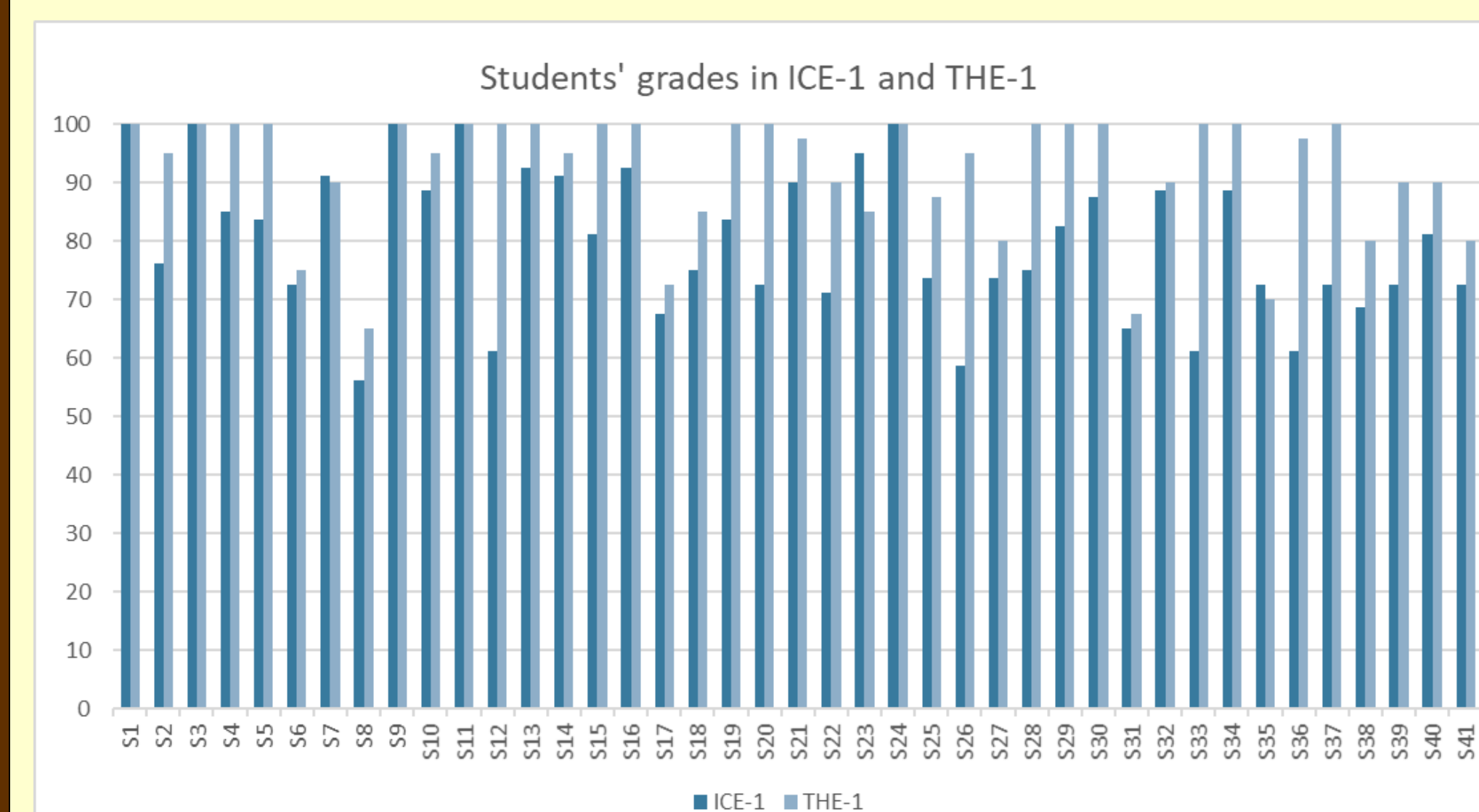


Fig.(2): Bar chart plot of the grades of ICE and THE for each student.

Results and discussion

Testing the hypothesis using Minitab 19, paired t-test is performed and the results are:

Estimation for Paired Difference

Mean	StDev	SE Mean	95% CI for $\mu_{\text{difference}}$
11.92	11.91	1.86	(8.16, 15.68)

$\mu_{\text{difference}}$: population mean of (THE-1 - ICE-1)

Test

Null hypothesis	$H_0: \mu_{\text{difference}} = 0$
Alternative hypothesis	$H_a: \mu_{\text{difference}} \neq 0$
T-Value	6.41
P-Value	0.000

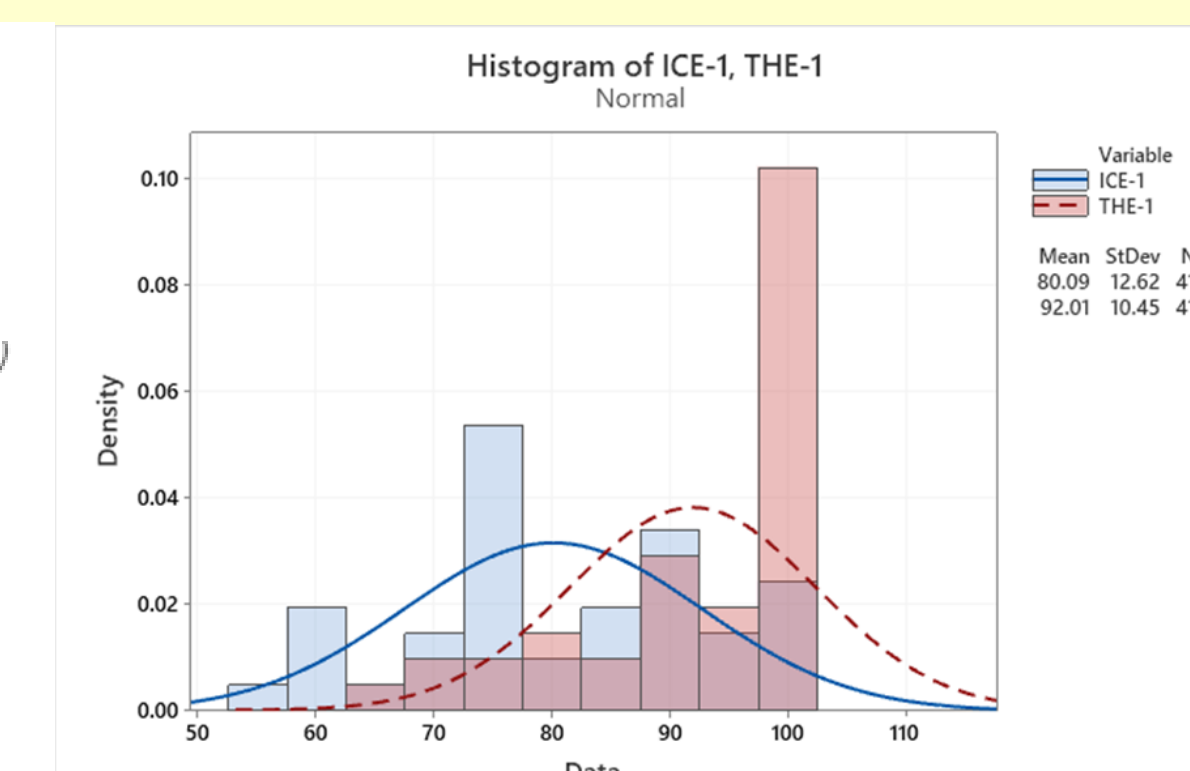


Fig.(3): Histogram plot of the grades of ICE and THE for each student.

The histogram, fig.(3), demonstrates that the students had better grades in the THE and the mean value of the grades in the normal distribution curve was shifted to the right. P -value < 0.05 which means that we can conclude that the mean of ICE is significantly different than THE at 0.05 significant level. The mean of the paired differences is less than zero. From the results, we are confident that 95% that the true mean difference is between (-15.681, -8.16). The histogram compares the location of the differences to zero.

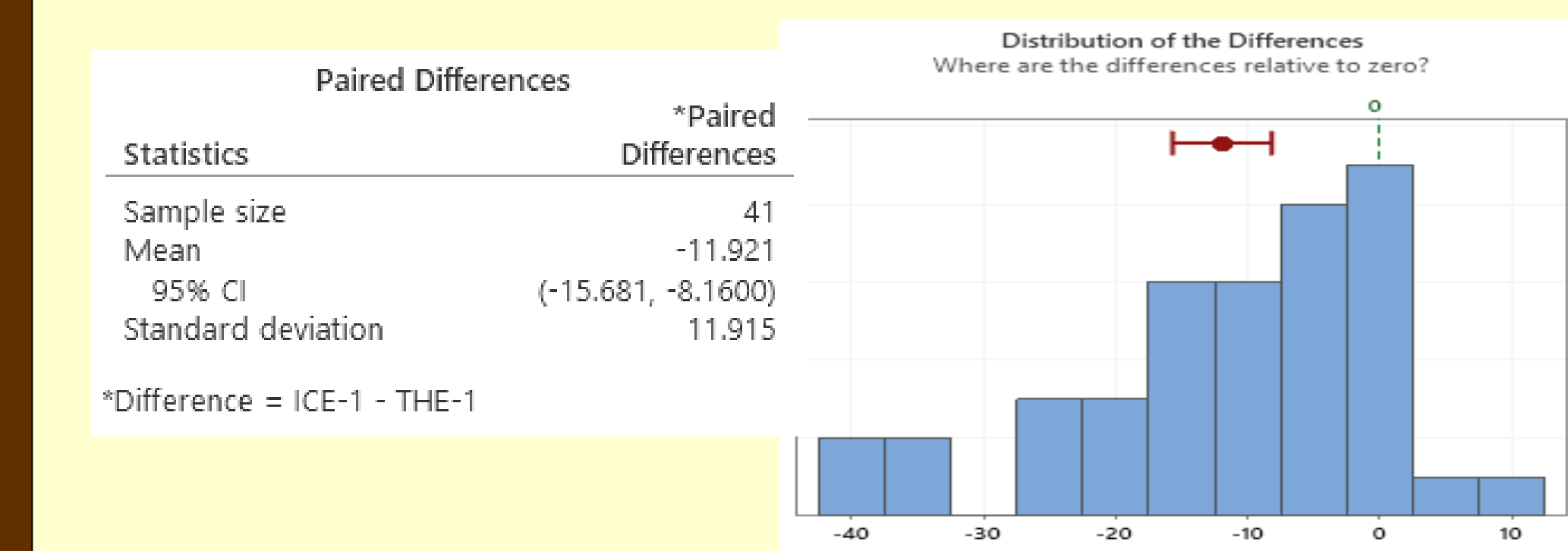
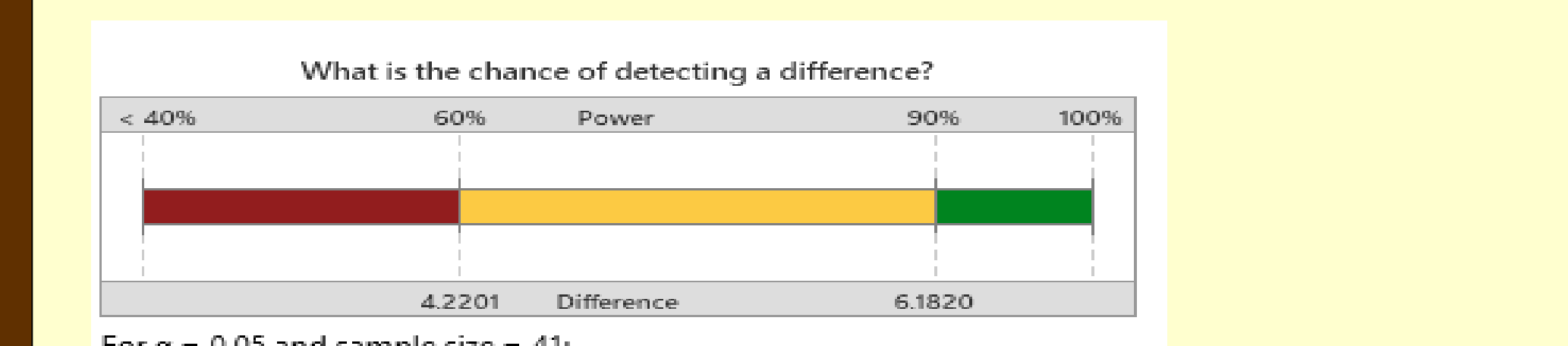


Fig.(4): Histogram plot of the distribution of differences



For $\alpha = 0.05$ and sample size = 41:

The paired t-test provides the chance of detecting the differences if the true mean is given, i.e. the "power". If the grades differ by 4.2201, there is 60% chance of detecting the difference with the paired t-test.

Conclusion

We checked that the sample size is sufficient to detect a difference between the means and the test is accurate with non-normal data. Also, there are no unusual pair differences. So we conclude that STEM students have better grades in Heat transfer course when they took it as a Take Home Exam.

References

1. Davis, B. (2009), Tools for teaching, Jossy-bass.
2. Bengtsson, L. (2019). Take-Home Exams in Higher Education: A Systematic Review. Education Sciences, 9(4), 267.
3. <http://www.universitytimes.ie/2017/01/the-pros-and-cons-of-take-home-exams/>
4. <http://www.statstutor.ac.uk/resources/uploaded/paired-t-test.pdf>