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

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Take Home Exam (THE) as an assessment method for STEM students
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STEM Instructional Program 2019-20

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.

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.

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.

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, Ho: \( \mu_{\text{THE}} - \mu_{\text{ICE}} = 0 \)
Alternative hypothesis, Ha: \( \mu_{\text{THE}} - \mu_{\text{ICE}} \neq 0 \)

The Confidence Interval (CI)= 95%
Level of confidence (\( \alpha \))= 0.05
If \( P \geq \alpha \) Fail to reject \( H_0 \) cannot accept \( H_a \)
If \( P < \alpha \) reject \( H_0 \) accept \( H_a \)

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)

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

The histogram, fig.(3), demonstrates that the students had better grades in 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.

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