

An Exploration of Engineering Student Effort: Correlations to Exam Performance

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Outline

Background & Purpose
Research Methodology
Results & Discussion
Conclusions



Background

- **Classroom effort is important for students' academic performance and success** (Douglas & Alemanne, 2007)
 - **Measured by attendance, number of discussion posts, course click count, etc.**

Purpose

**Exam
Effort
t**

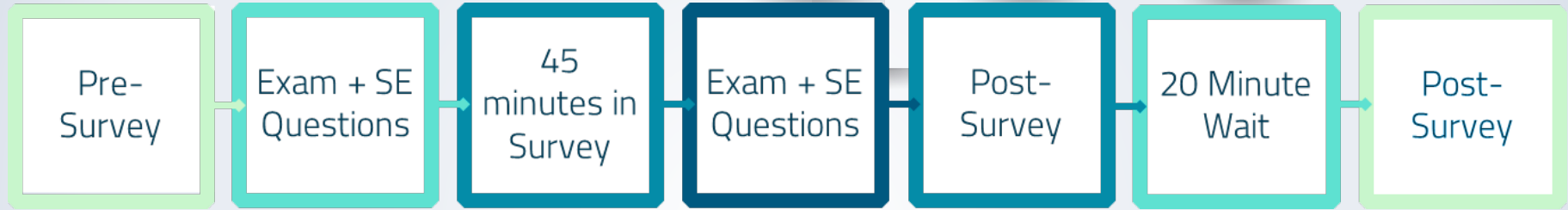


**Academic
Performanc
e**

Participants

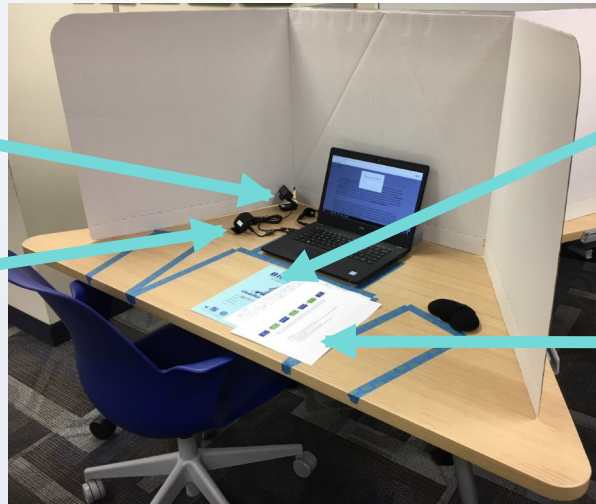
- Engineering Statics Practice Exam**
- Statics is first required ENGR course students take - most students in first or second year**
- Second practice exam at week 8 of 16**
 - One week before actual exam**
 - Similar content and structure**
 - 20 Multiple Choice Questions - Analytical/Problem Solving**
 - Questions provided by instructor**
- 2.5% extra credit given + \$5 gift card**
- 19 students included in this specific analysis**
 - Pre-screened for metabolic disorders, medical conditions, dietary habits, and medication**

Experimental Setup



**Logitech
Webcam**

**EDA Sensor
- Empatica
E4**



**Work
Booklets**

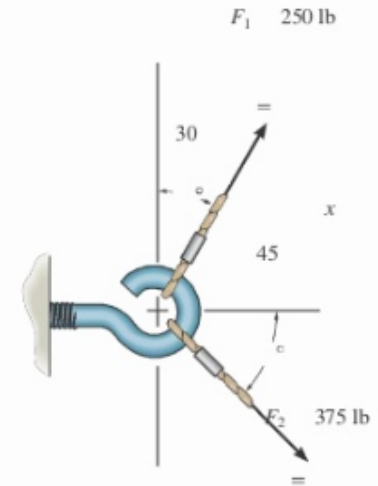
**Equation
Sheet &
Study
Timeline**

Ecological Validity

- Provide same equation sheet given for actual exam
- Standard exam workbooks similar to what is offered in regular exam
- Electronic subset of practice test questions provided by the instructor, which paralleled actual exam structure and content
- Same amount of time given for exam with extra time allotted for surveys and saliva
- Real exam also requires computer

2-3.

Determine the magnitude of the resultant force $F_R = F_1 + F_2$ and its direction, measured counterclockwise from the positive x axis.



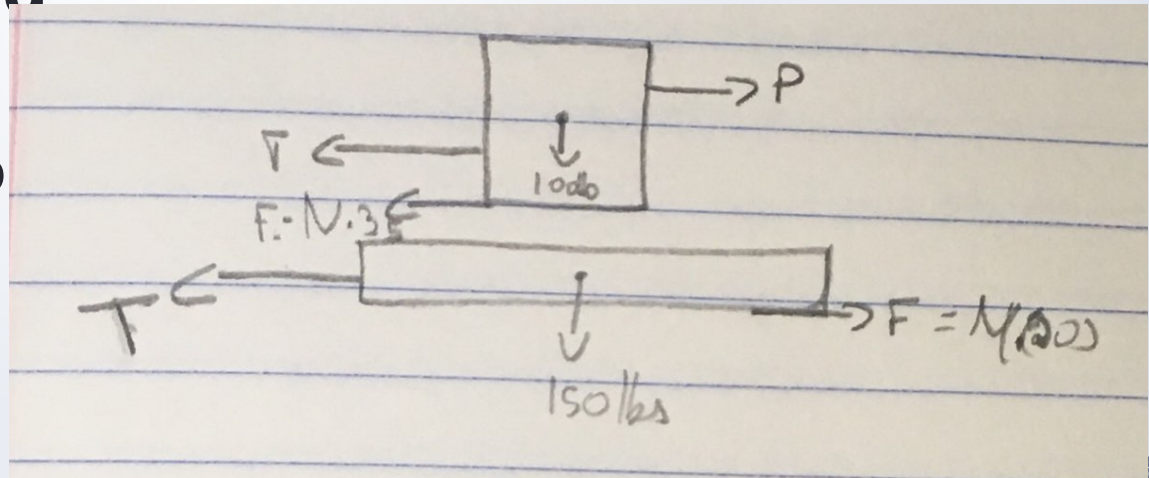
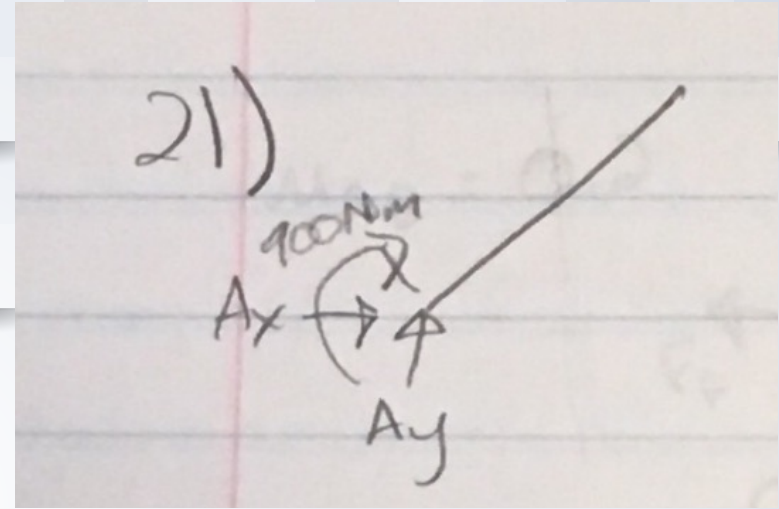
From Engineering Mechanics Statics 14th Edition (Hibbeler, 2015)

Analysis

- Identified questions as correct/incorrect**
- Codebook created**
- Each question analyzed on scale from zero to two**
 - Zero = Nothing written in testing booklet**
 - One = Something written in test booklet, but incoherent and possibly only meaningful to participant**
 - Two = Adequate work shown and can easily be followed through to final answer**
- Performance data and coded effort compared**

Analysis

- One = Something written in test booklet, but incoherent and possibly only meaningful to participant



Analysis

Two = Adequate work shown and can easily be followed through to final answer

①

does this mean anything?

Reactions

$$\begin{aligned} \rightarrow \sum F_x = 0 & \quad A_x = 0 \\ \uparrow \sum M_A = 0 & \quad 0 = 10(2) + D_y(10) - 4(10)(5) \\ & \quad D_y = 18 \text{ lb} \\ \uparrow \sum F_y = 0 & \quad A_y + 18 + 10 - 40 = 0 \\ & \quad A_y = 12 \text{ lb} \end{aligned}$$

V

A to B: $V = 12 - 2x = 0$

B to D: $V = 14 - 2x$

$14 - 2x = 0$

M

A to B: $M = 12x - x^2$

B to D: $M = 14x - x^2$

2.5(4)

$\uparrow \sum F_y = 0 \quad 18 - 2.5(4) - V = 0$

$\downarrow V = 8 \text{ lb}$ (Positive or Negative?)

$\sum M = 0 \quad M = 2.5(4)(1.25) - 18(2.5)$

$= -32.5$

$2F_y = 0 \quad V = 12 - 8 = 4$

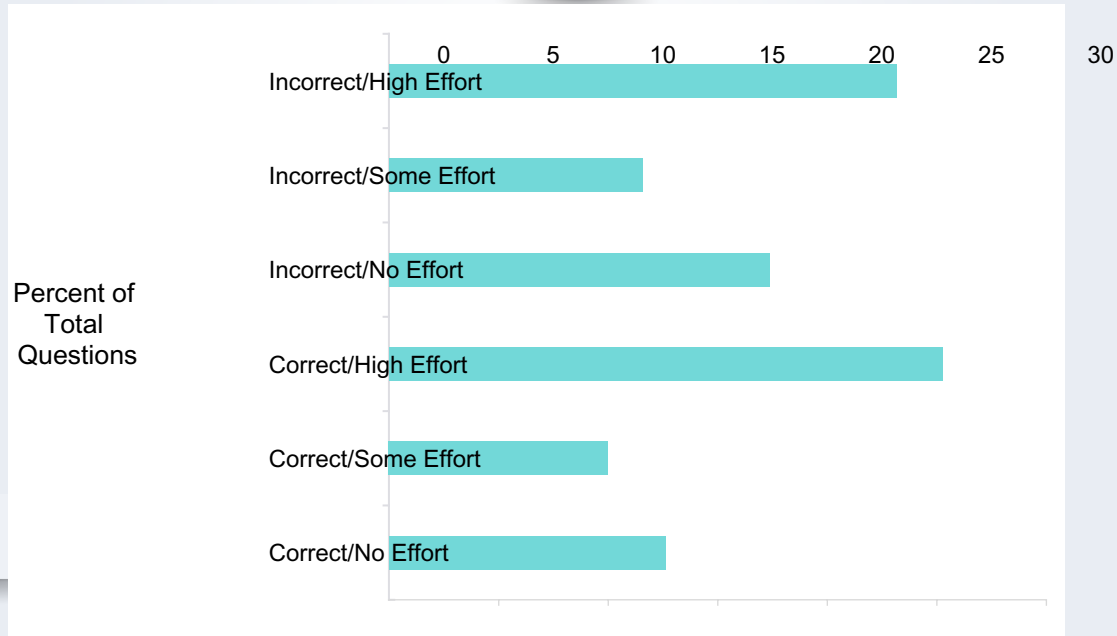
no answer is like mine!

I got a negative answer

I'm doing something wrong!

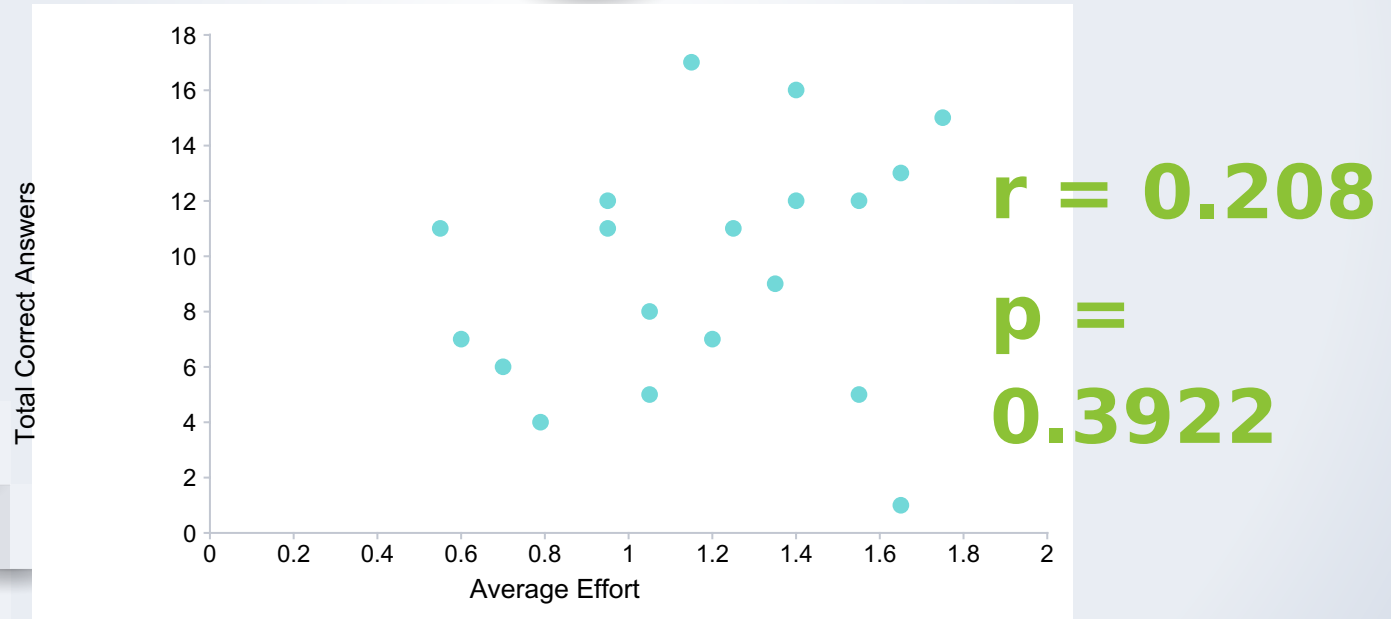
Results

- All 19 participants answered all 20 exam questions = 380 total questions answered and coded



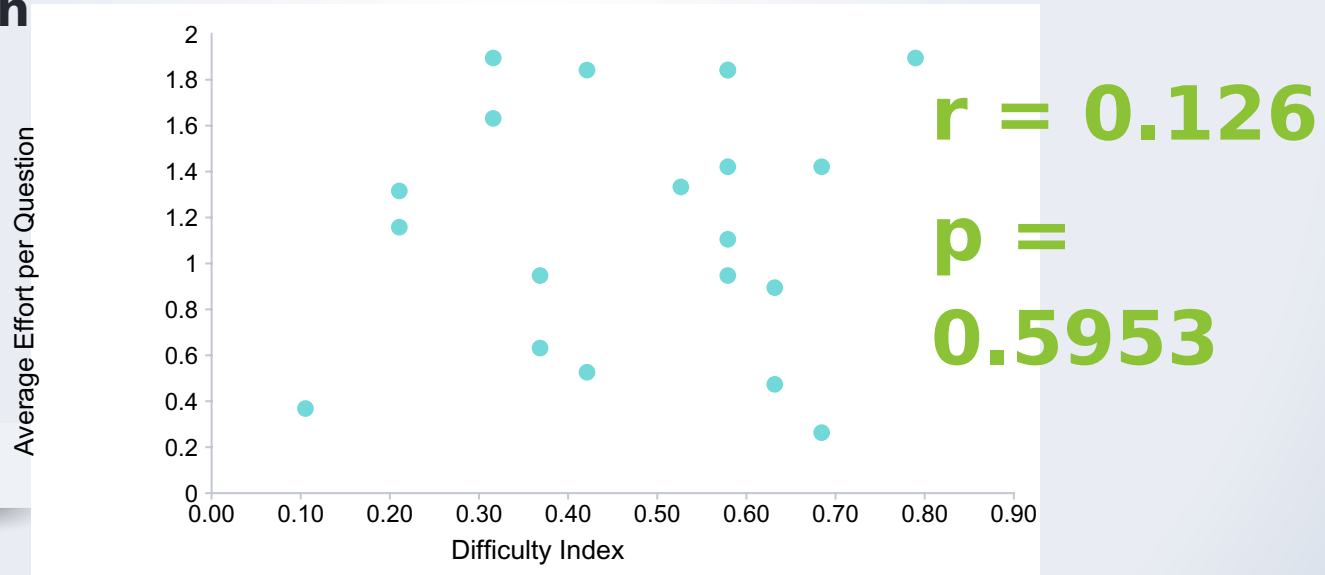
Effort versus Performance

- Each participant's effort was averaged across the 20 questions and a linear regression was performed



Difficulty Index Comparisons

- **Difficulty Index = Number of correct answers divided by the total number of responses**
- **Difficulty Index compared to the average effort per question**



Conclusions

- **Increase in average effort suggests weak but positive trends with amount of problems answered correctly on an engineering statics exam**
- **Increase in difficulty index suggests weak but positive trends with the average effort expended on a problem**

Limitations

- Small sample size means limited statistical power**
- Practice exam one week before actual exam**
- Laboratory environment**
 - While ecologically valid, is not representative of high-stakes exam**

Acknowledgements

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