



Learning efficiency in paper versus electronic note-taking in high school students

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Our Classroom at Mahidol Wittayanusorn School

Gadgets are becoming smaller and lighter that makes students below 20 more attached to computers.
(Vershinskaya, 2014, p.4).



Electronic note-taking

Paper note-taking

Presentation Outline

1. Introduction

2. Literature Review

3. Research methodology

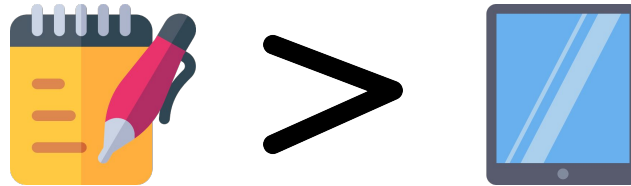
4. Results and Discussion

5. Futures studies

Purpose

To compare high school students' learning efficiency of note-taking on paper and electronic device.

Hypothesis



Note-taking on electronic device is not as efficient as that on paper because high school students are more accustomed to note-taking on paper than on electronic device.

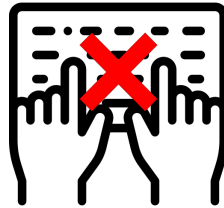
The Pen Is Mightier Than the Keyboard: Advantages of Longhand Over Laptop Note

Pam A. Mueller and Daniel M. Oppenheimer (2014)

Research about taking note with pencil is better than taking note by typing in keyboard. This research's material is TED Talks video. Method is giving student in a room with a computer or notebook and taking note from the video.



**higher recall and
conceptual scores**

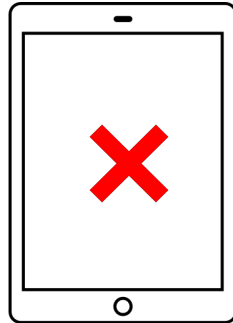


**Performed worse on
conceptual questions**

Transcribe lectures verbatim rather than processing information and reframing it in their own words is detrimental to learning.

Paper Notebooks vs. Mobile Devices: Brain Activation Differences During Memory Retrieval

Keita Umejima, Takuya Ibaraki, Takahiro Yamazaki and Kuniyoshi L. Sakai (2021)



-Writing on physical paper can lead to more brain activity when remembering the information an hour later.

-Paper completed the note-taking task about 25% faster than those who used digital tablets or smartphones.

Methodology

Research Methodology

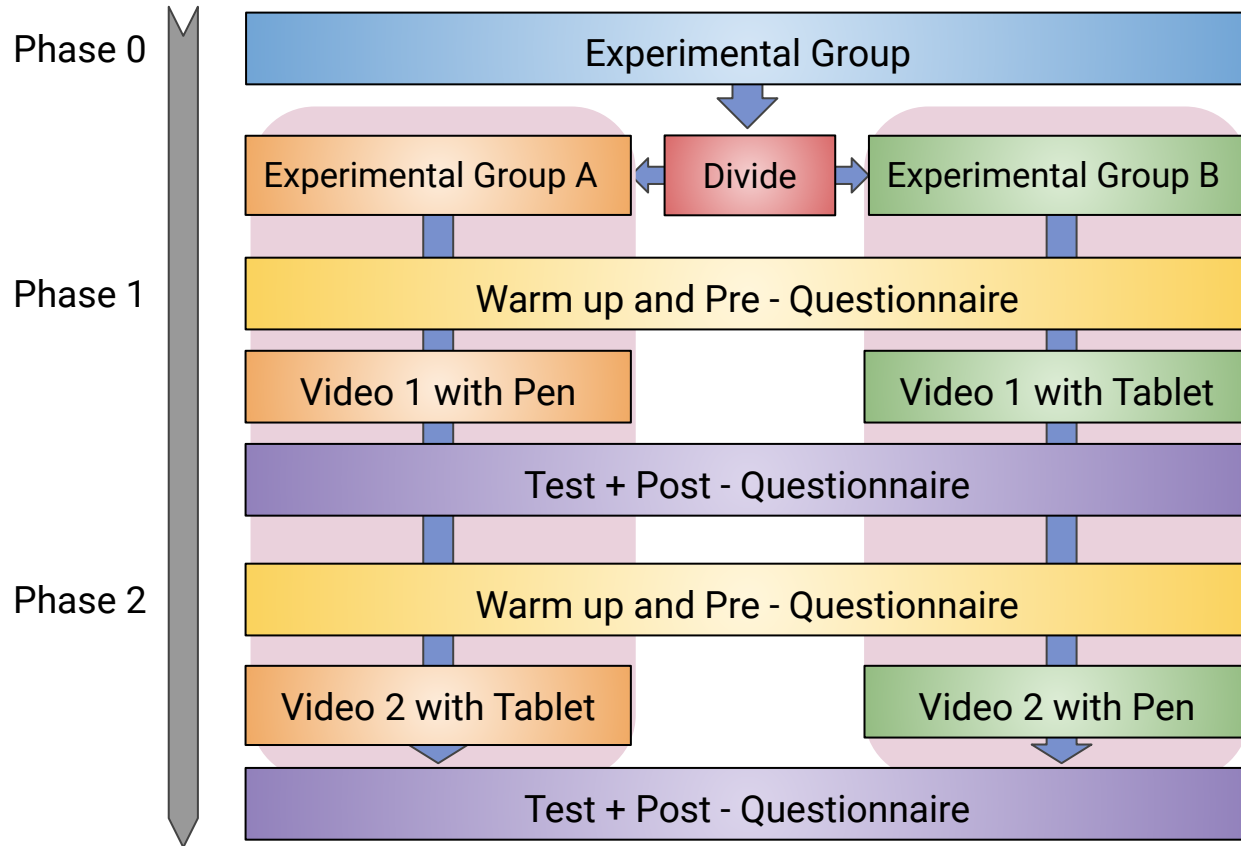
Participants

- 60 students from Mahidol Wittayanusorn School, Grade 10 to 11
- Used electronic device for learning

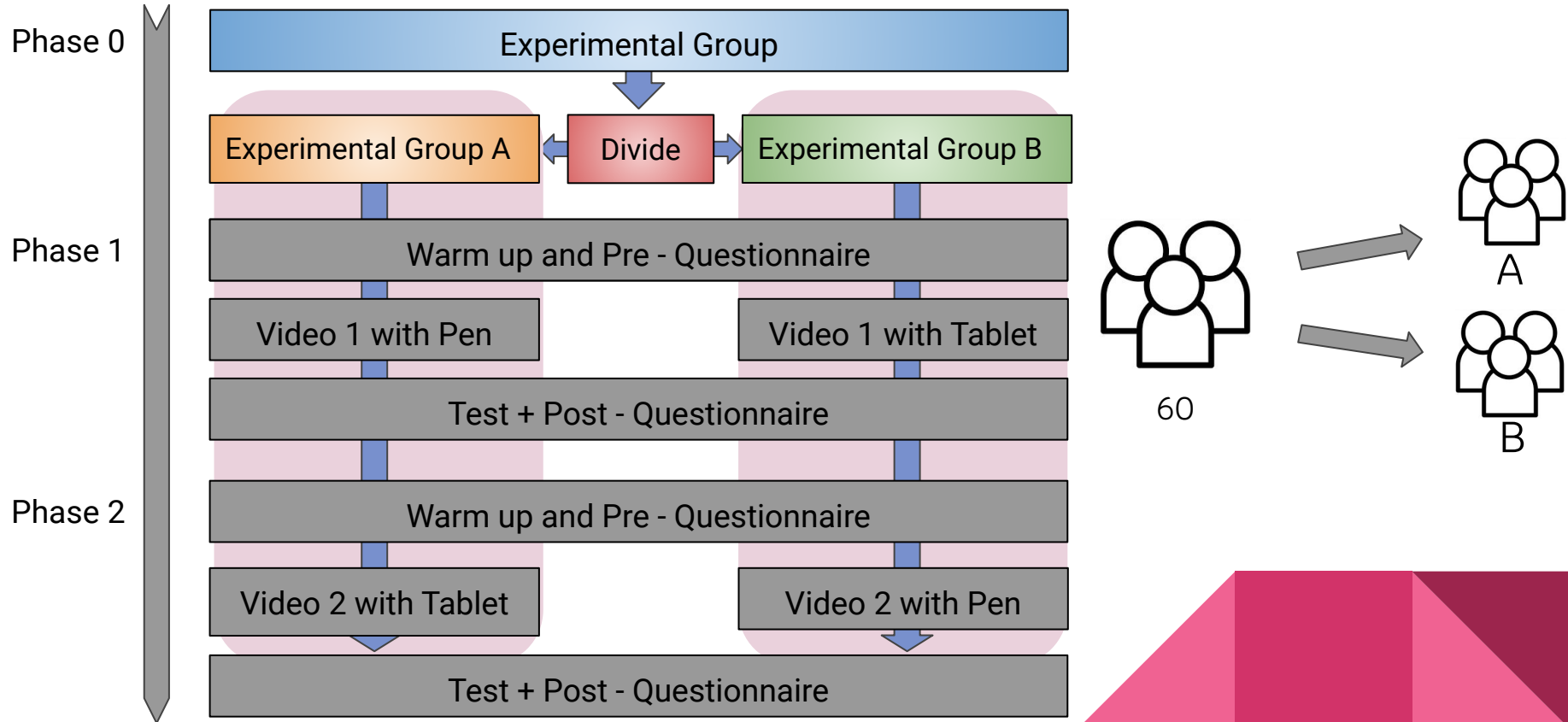
Experiment time (Online)

- On weekends from 18.00 - 21.00 (December 2020 - February 2021)

Experimental steps

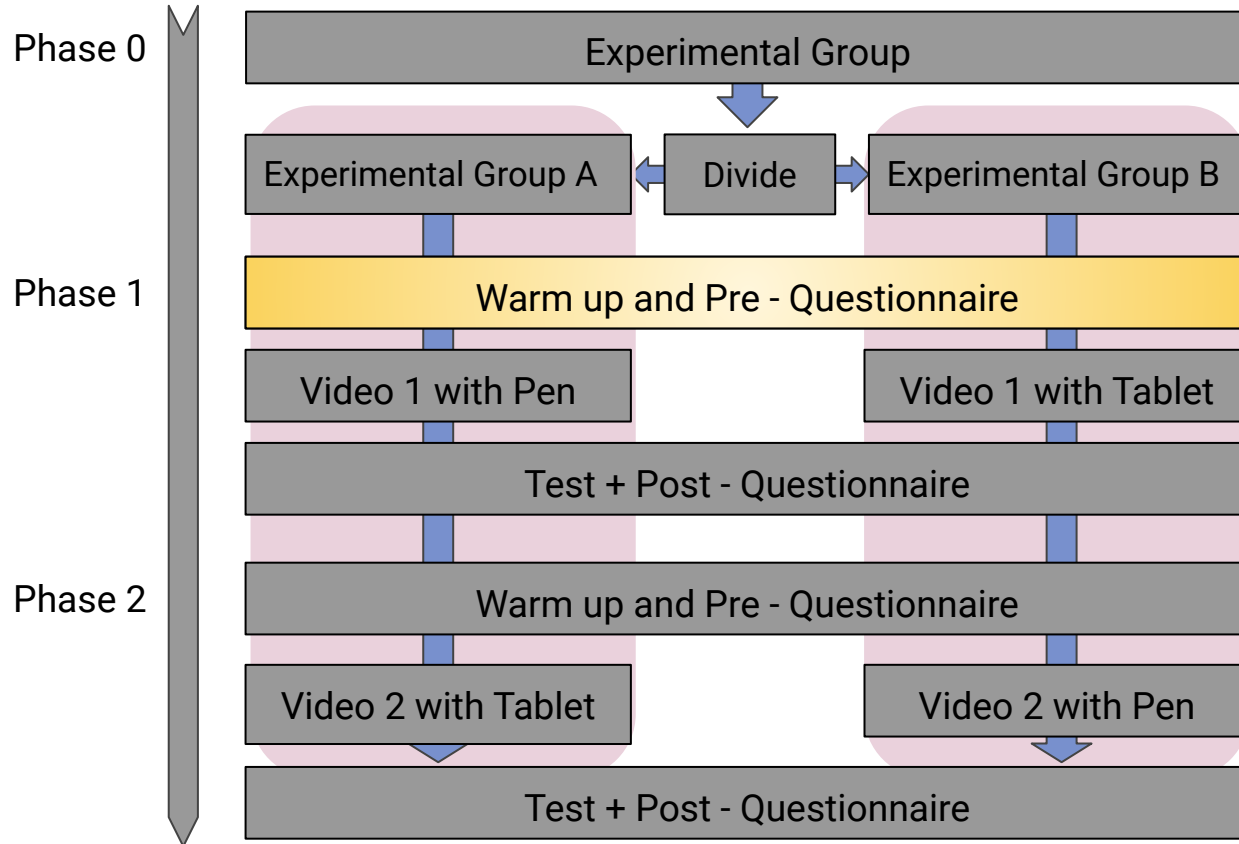


Experimental steps



Experimental steps

3. Research Methodology



Self satisfaction while conducting the test

1 2 3 4 5
Lowest Highest

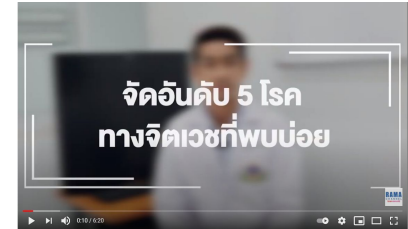
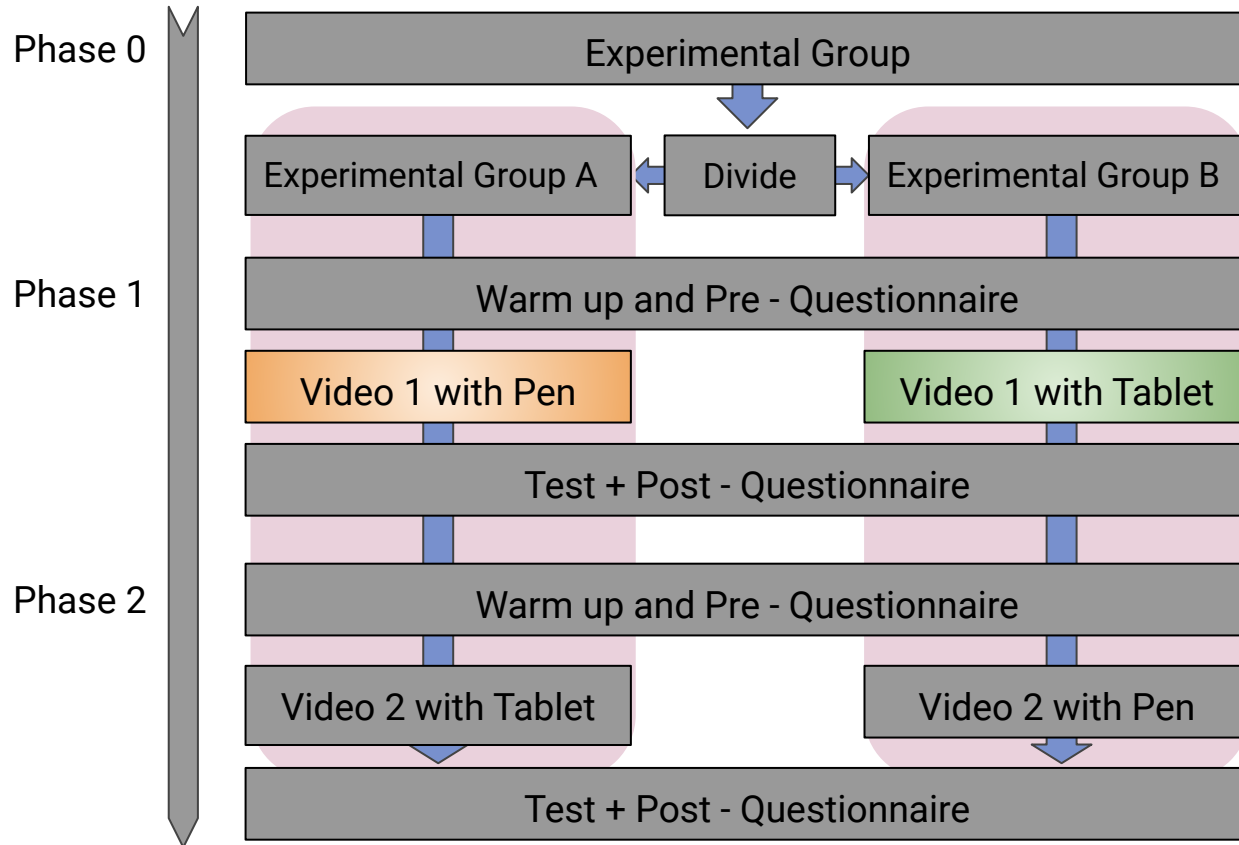
Confidence while taking note

1 2 3 4 5
Lowest Highest

Excitement while taking note

1 2 3 4 5
Lowest Highest

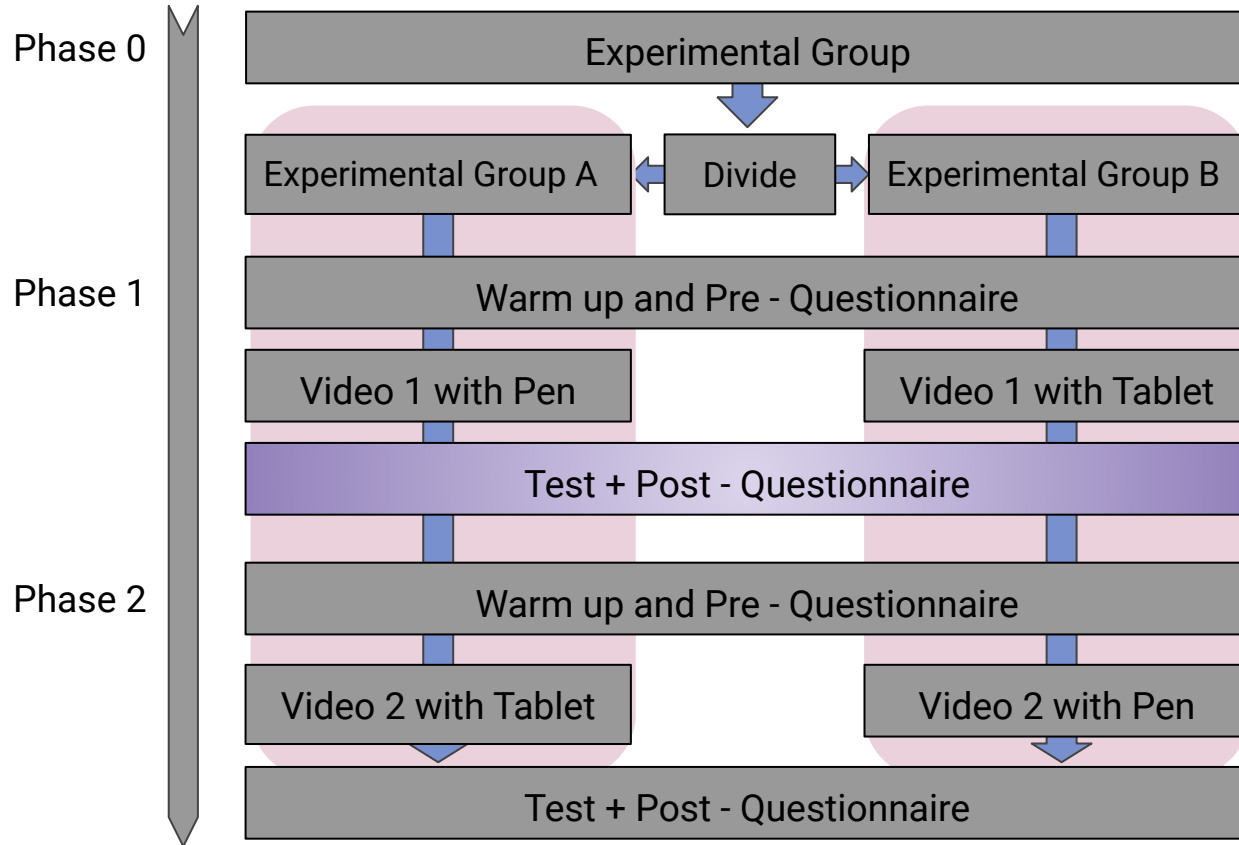
Experimental steps



Video 1 : Schizophrenia

Experimental steps

3. Research Methodology



1. Where did the conflict in this war take place? *

- Kuwait desert
- Iran, Iraq, Kuwait
- Iran, Kuwait
- Iraq, Kuwait

2. What is correct about Operation Desert Storm? *

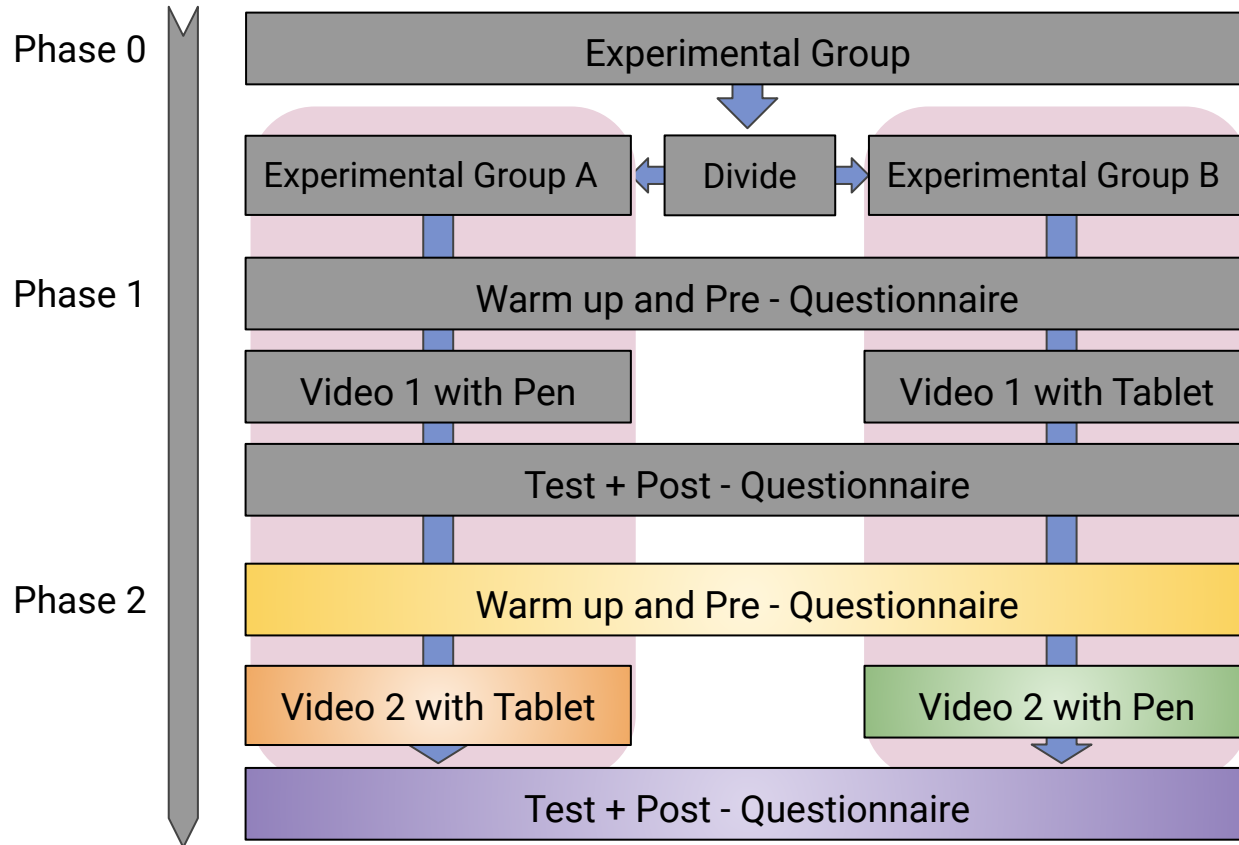
- USA invaded Kuwait because Kuwait has important oil resources.
- The invasion of Kuwait to repel Iraqi forces within Kuwait
- Invasion of Iraq to overthrow Iraqi authoritarian government
- Iraqi invasion of Kuwait to capture land and natural resources

3. Who was the President of the United States in the Persian Gulf War? *

- George Bush III

Experimental steps

3. Research Methodology



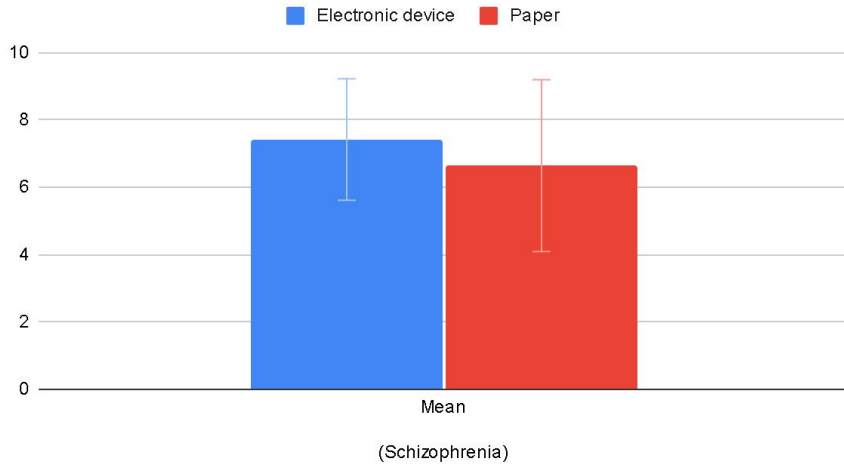
Video 2 : Gulf War

Source :
youtu.be/thdOdQwo-ck
youtu.be/tHjrK_EeSr8

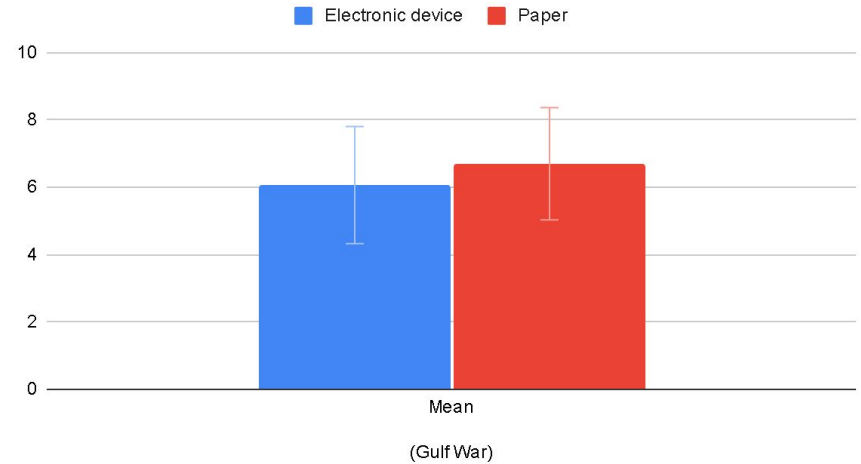
Result and Discussion I

Quiz score of Schizophrenia and Gulf War

Electronic device and Paper

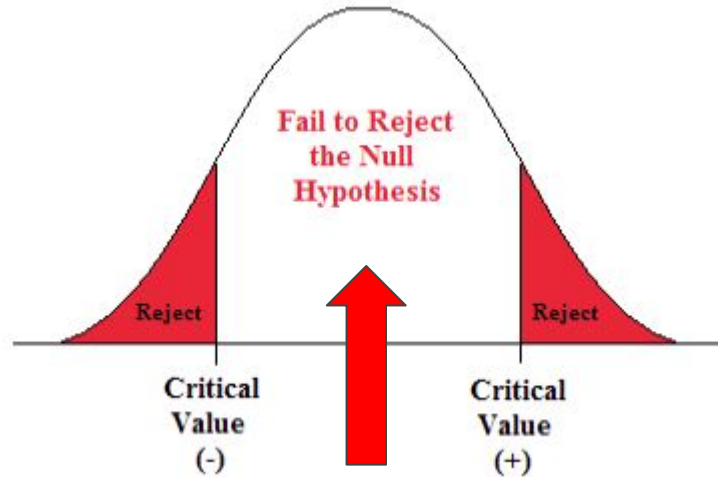


Electronic device and Paper



Result

Learning efficiency from taking note in electronic device and paper does not have significantly different. (level of significance = 0.05)



$$z^* = \frac{6.7 - 6.066666667}{\sqrt{\frac{1.664020888^2}{30} + \frac{1.740656502^2}{30}}} = 1.440529029$$

$$\frac{z_{0.05}}{2} = 1.96$$

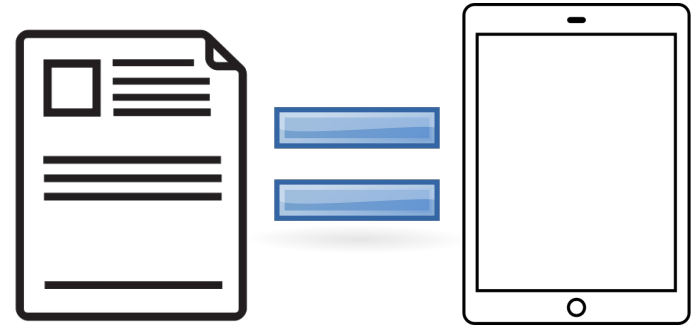
$$-\frac{z_{0.05}}{2} < z^* < \frac{z_{0.05}}{2}$$

Discussion I

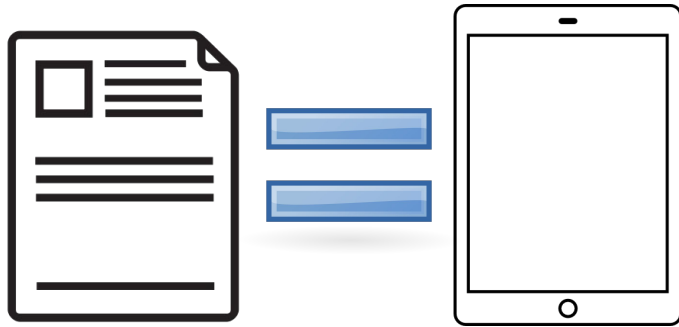
- Effects of the use of paper notebooks and tablet devices on cognitive load in learning—An Electroencephalographic (EEG) study. (Hatano et al. 2015)
- Differences in brain activity after learning with the use of a digital pen vs. an Ink PEN—AN ELECTROENCEPHALOGRAPHY Study (Kiyoyuki Osugi, et al. 2019)

Effects of the use of paper notebooks and tablet devices on cognitive load in learning—An Electroencephalographic (EEG) study (Hatano et al. (2015))

- Conducted an EEG experiment in which the participants took notes with a digital pen on a tablet or with a mechanical pencil on paper while listening to scientific lessons.
- There were no significant differences in the scores of **comprehension and memory tests** performed after taking notes on a tablet and paper.



Differences in brain activity after learning with the use of a digital pen vs. an Ink PEN —AN ELECTROENCEPHALOGRAPHY Study (Kiyoyuki Osugi, et al.(2019))

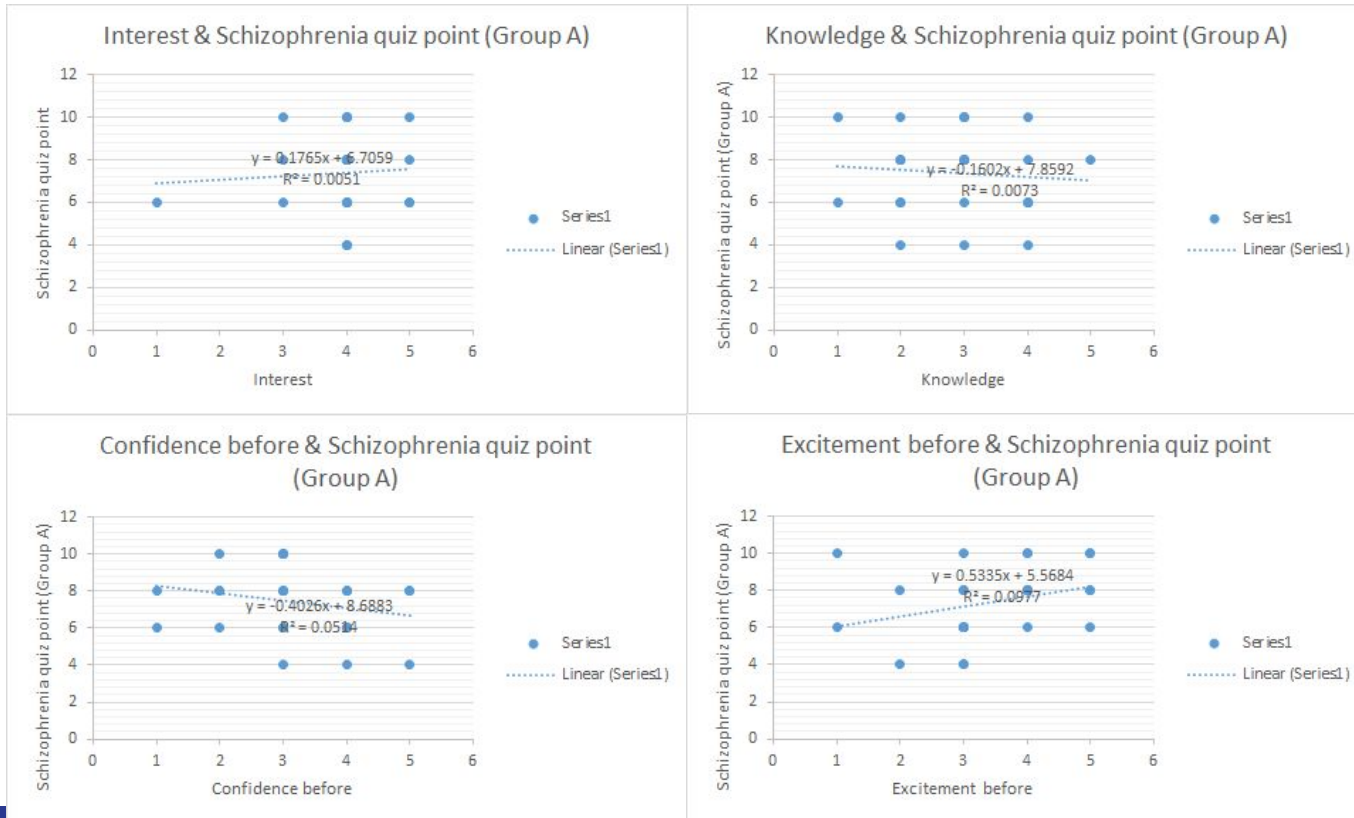


The participants learned to read difficult words by writing with an ink pen vs. a digital pen.

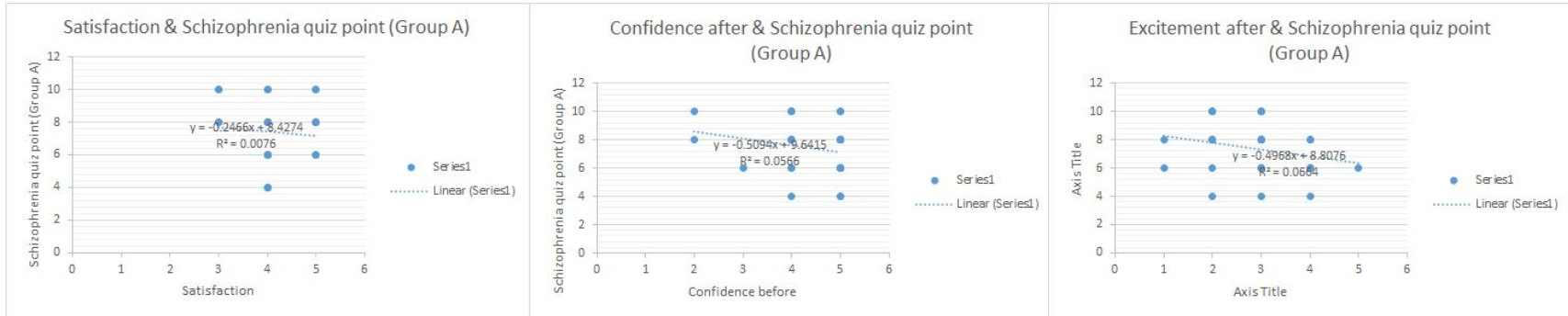
Result is performance in learning was not affected by either familiarity or the learning device used.

Result and Discussion II

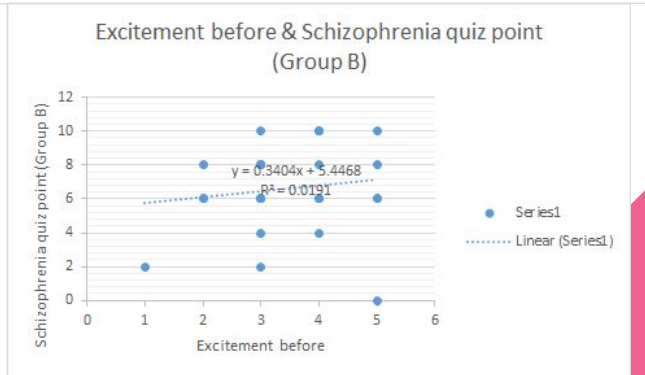
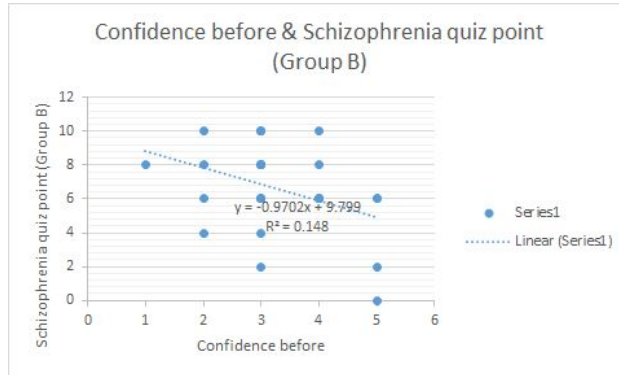
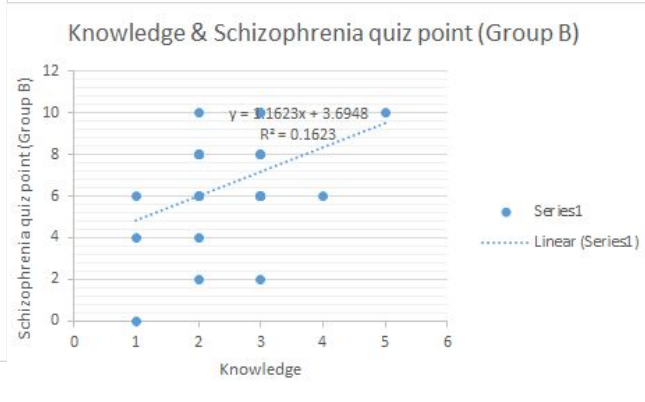
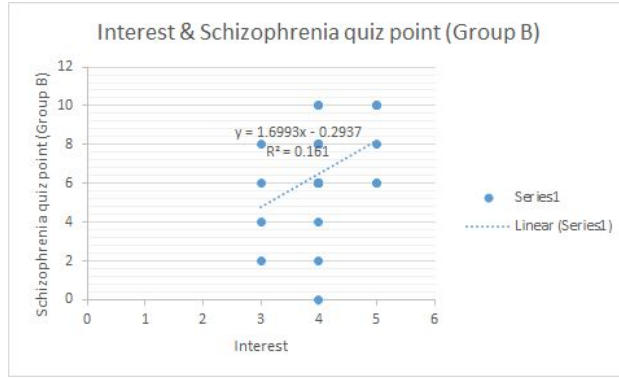
Pre Questionnaire & Schizophrenia (Electronic device)



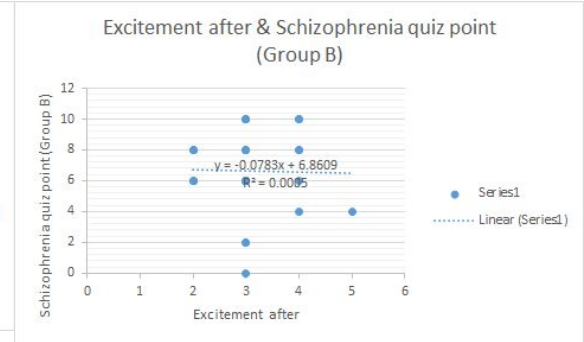
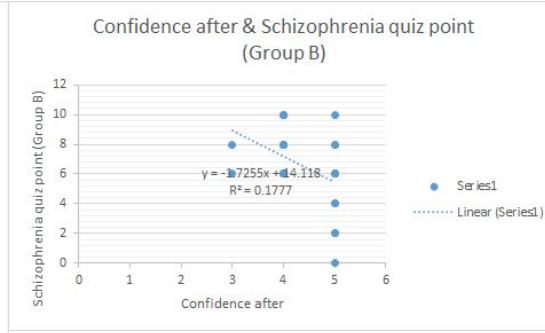
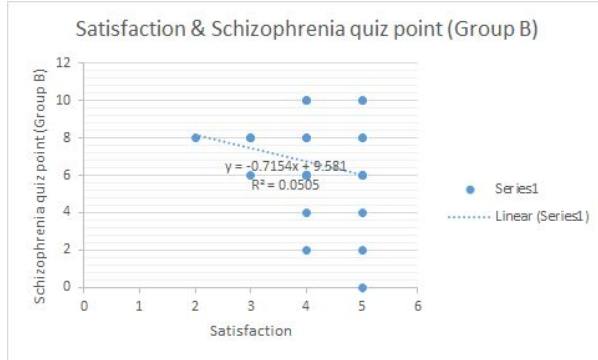
Post Questionnaire & Schizophrenia (Electronic device)



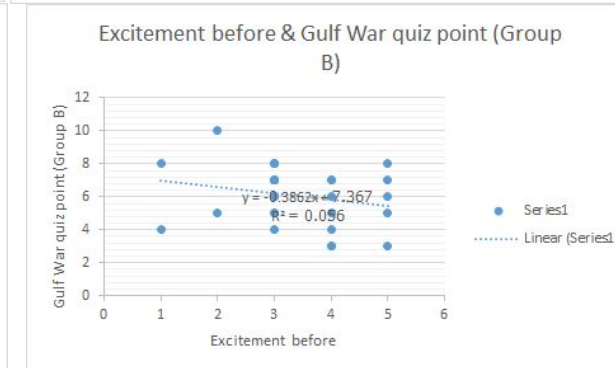
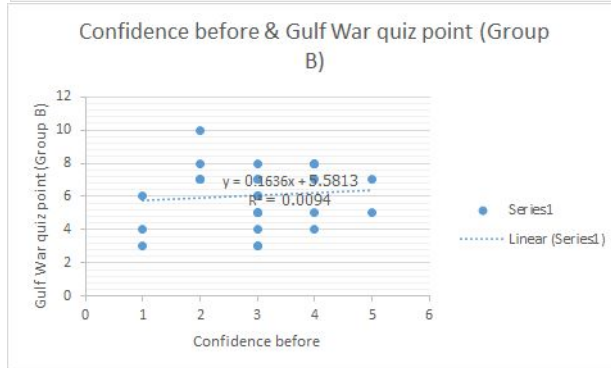
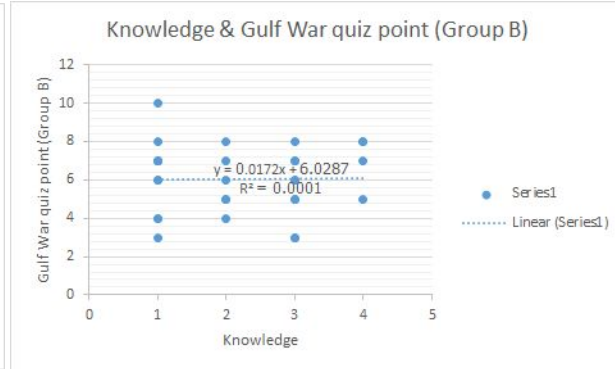
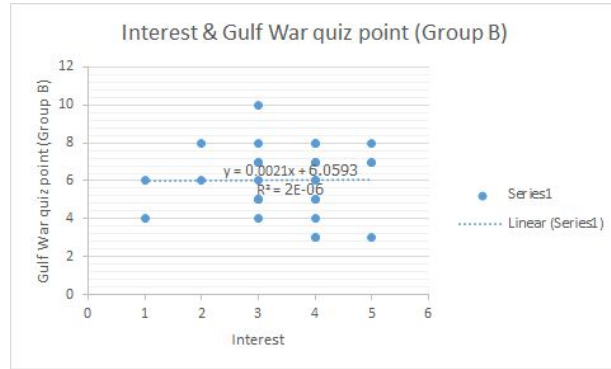
Pre Questionnaire & Schizophrenia (Paper)



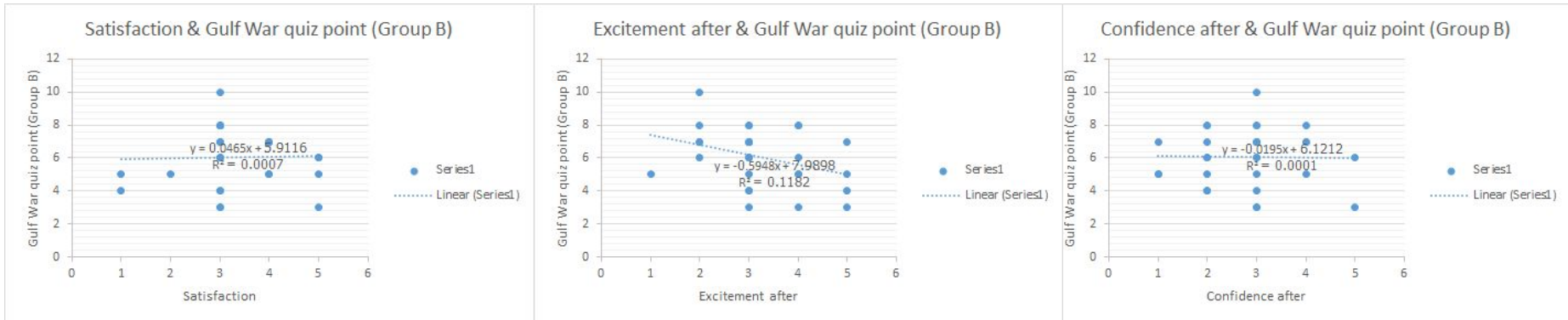
Post Questionnaire & Schizophrenia (Paper)



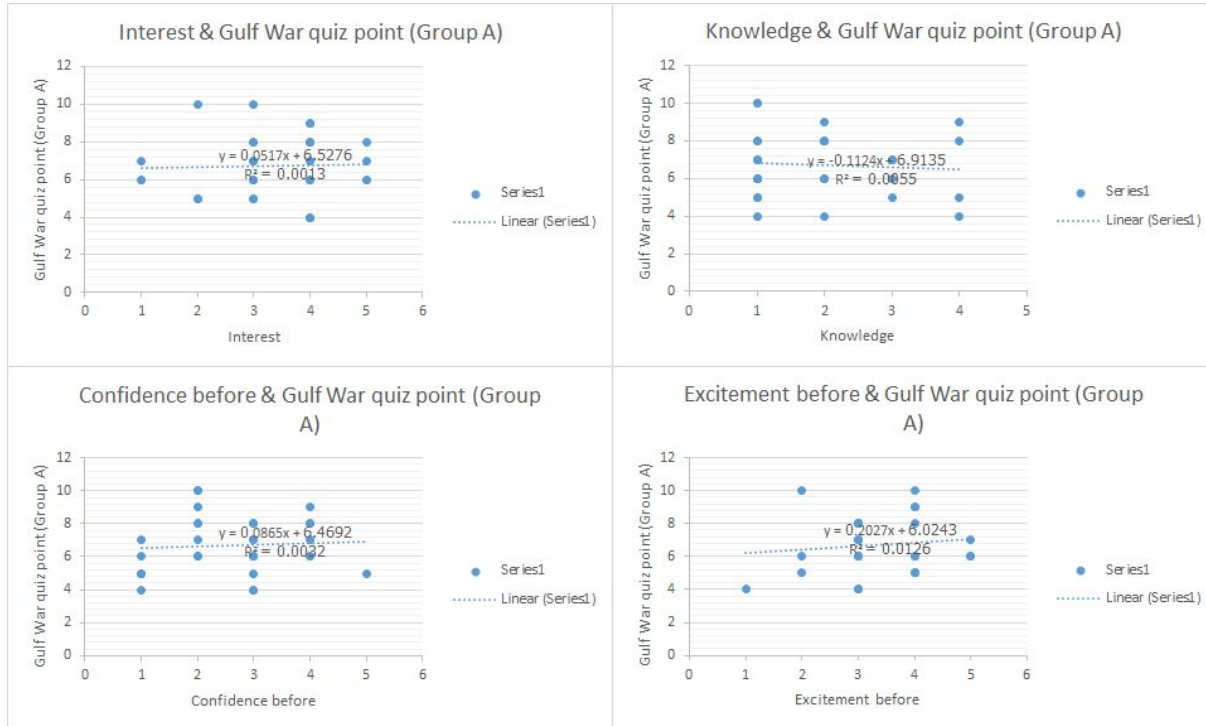
Pre Questionnaire & Gulf War (Electronic device)



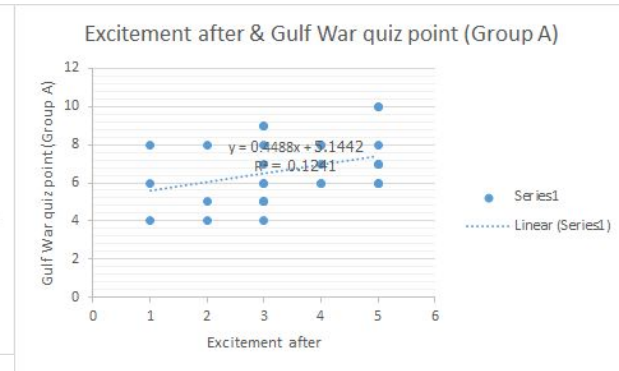
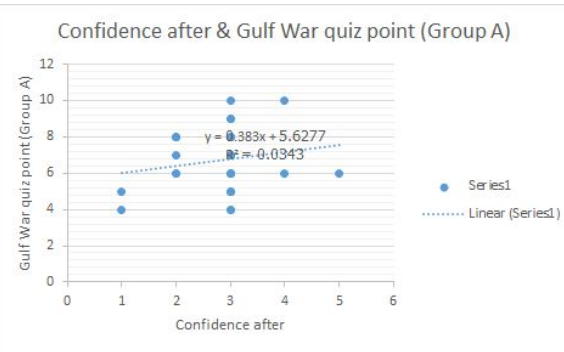
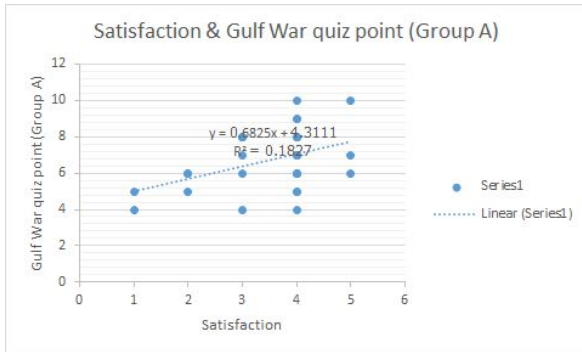
Post Questionnaire & Gulf War (Electronic device)



Pre Questionnaire & Gulf War (Paper)



Post Questionnaire & Gulf War (Paper)



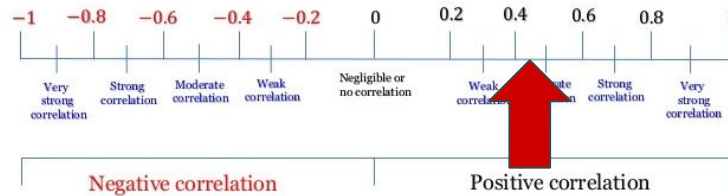


Result

Interest, knowledge, confidence, excitement before testing and confidence, excitement and satisfaction while testing of 2 videos and quiz points have weak correlation.

Correlation Coefficient Interpretation Guideline

The correlation coefficient (r) ranges from -1 (a perfect negative correlation) to 1 (a perfect positive correlation). In short, $-1 \leq r \leq 1$.

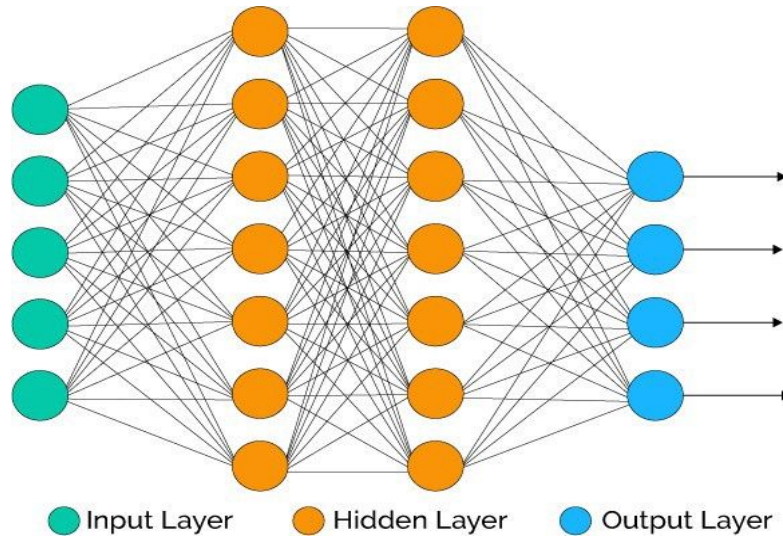


Discussion II

According to the study by Sharot T. & Phelps, E A (2004), **Arousal** is related to keeping and retrieving information in the memory process. People remember emotionally arousing information more than neutral information. That means **attention** is main factor that affects the score so it is possible that result happens because of this reason.

Futures studies

Study and use machine learning models to analyse the content of the note from every participants.



Reference



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Thank you for your attention