

## **The Study of the Effects of the Growth Mindset Program in Engineering Classroom**

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### **Abstract:**

**Background:** Nowadays, teenagers are easily losing interest for class and trying to escape from learning. Students with limited mindset feel panicked and seek their own shelter which indicate the minus-motivation and lead poor grades. However, mindset is learning strategies which can be change and development to reach the achievement.

**Materials and Methods:** The purpose of this study was to study the effects of the growth mindset workshop program in undergraduate students. The sample comprised 20 students of the major of Telecommunication Engineering, Institute of Engineering, Suranaree University of Technology, Thailand, in the trimester 2 of academic year 2019, obtained through random assignment and matching into two groups. Twenty students were assigned into the experimental group, and another 10 into the control group. The research instruments were the growth mindset program and a mindset assessment scale. Two comparisons were made. The first was comparing the growth mindset score of the experimental group with the control group after the experiment; and compare the growth mindset score after the experiment with the score before the experiment.

**Results:** The results of study show that the students in the experimental group demonstrated higher growth mindset score in the post-test than the pre-test, with statistical significance at 0.01. Moreover, the students in the experimental group statistical significant demonstrated higher growth mindset score in post-test than the control group.

**Conclusion:** The results indicated that the growth mindset program could develop growth mindset of students better, and the growth mindset of the students in the experimental group is better than those in the control group.

**Key Word:** Growth mindset development; Undergraduate engineering students.

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### **I. Introduction**

Mindset is a learning strategy that can be modified or improved to achieve success This was caused by inspiration, the ability to challenge the obstacles, that must be faced, attempts to solve various problems. Dweck (2006) invented the theory of mindset classifies people into 2 types: people with a growth mindset and those with a fixed mindset [1]. Persons with a growth mindset often have the opportunity to reach a high level of success, better grades, and independent freedom of thought. On the other hand, a person with a fixed-minded may have less progress and may not fully utilize their potential which affecting poor study. From this theory, it can be seen that mindset can influence the success and learning of a person.

Nowadays, teenagers are easily losing interest for class and trying to escape from learning. Students with limited mindset feel panicked and seek their own shelter which indicate the minus-motivation and lead poor grades [2]. However, mindset is learning strategies which can be change and development to reach the achievement.

Caine et al (2009) proposed the 12 brain, mind and learning principle, which was an effective learning principle based on the functions of the brain that are linked to the mind [3-4]. Besides, to good learning principles. The developing mindset was also effective in promoting good learning. Anderson (2006) had suggested the concept to develop the mindset that included five important steps in which (1) had to know own mindset. (2) try to ask questions about the new mindset about how advantages would happen. (3) studied methods that had been adopted to improve the old mindset. (4) test and experiment with the method to see whether they are effective enough good results or not. (5) re-examining the mindset that it was changed or not [5]. Arbinger Institute presented the mindset model which stated that the mindset derived behavior and the behavior drive results as shown in Figure 1. So, the mindset was the major key to success.

This research aimed to apply the principles of the 12 brain, mind and learning principles [4-5] to develop the growth mindset as the growth mindset workshop program. This workshop program was organized for fourth-year students who will step into the carrier path through cooperative education programs and achieve good results in the future of working, including able to extend their abilities at the graduate level.

Section 2 introduces the objectives of the research. The method is presented in Section 3. Section 4 presents the results of the evaluations and discussions. Finally, Section 5 gives the conclusion.

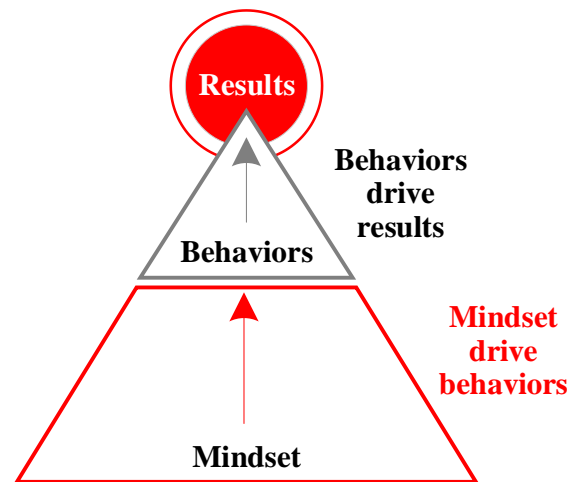


Figure no 1. The Arbinger mindset model [6]

## II. Objectives

To study the results of the growth mindset development program with senior students at the major of Telecommunication Engineering by comparing growth mindset score as follows:

1. To compare the growth mindset score between the control group and the experimental group.
2. To compare the growth mindset score of the subject group between before and after joining the growth mindset development program.

## III. Method

This research focused on implementing growth mindset workshop program as extra-curricular activity which was our independent variable. There were three dependent variables, namely, growth mindset score, classroom satisfaction, and learning achievement as shown in Figure 2.

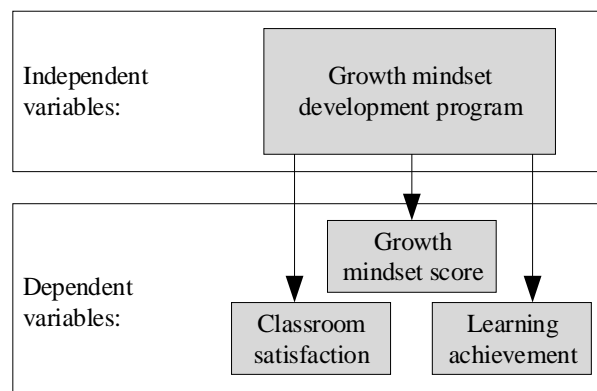


Figure no 2. Independent and dependent variable of the research.

### Population and Subjects:

1. Population in this research are 119 of fourth-year bachelor students from major of Telecommunication Engineering in trimester 2/2019.
2. Subjects in this research are fourth-year bachelor students from major of Telecommunication Engineering who attended growth mindset workshop program. There are 30 students in trimester 2/2019 which are recruited by purposive sampling method. Ten of them were in the control group and twenty of them were in the experimental group.

Table no 1: Questionnaire [7]

Code	Questions
	<b>Fixed mindset</b>
F1	My IQ is foundation which is difficult to change.
F2	I learn somethings new but it cannot change my fundamental IQ level
F3	No matter what level of my IQ, I can slightly change it
F4	I am just a type of persons, nothing really can change it.
F5	I can do something differently but the major part of me cannot be changed.
F6	Absolutely talented people do not need to spend a lot of effort.
F7	I avoid facing new things because it creates pressure.
F8	People do not to change, some people are good, merciful, some are not.
F9	If I have to put in a lot of effort, I feel like I'm not really good at it.
F10	If I think the work to be done is unsuccessful. I will not do since at first.
	<b>Growth mindset</b>
G1	I can clearly change my IQ level, definitely.
G2	I can change myself, not matter how I am.
G3	I can always change the basic components of being myself.
G4	The more I try, I can do that better
G5	Fundamentally, everyone is a good person but there was a chance of terrible wrong decision.
G6	When facing challenging or difficult things, I will try more and more without giving up.

**Methodology of the Study:**

1. Designing tools for data collection including 1) Growth mindset evaluation forms 2) Evaluation form of satisfaction to growth mindset workshop program 3) Activity plan embedded to teaching and instruction of growth mindset workshop program (see Figure 3)[8].
2. Pre-evaluation using growth mindset evaluation forms before organizing the program.
3. Organize the growth mindset workshop program.
4. Final-evaluation using growth mindset evaluation forms after organizing the program.
5. Evaluate satisfaction of students to growth mindset workshop program.
6. Analyze data by comparing pre-evaluation and final-evaluation of growth mindset workshop program including control group and experimental group.

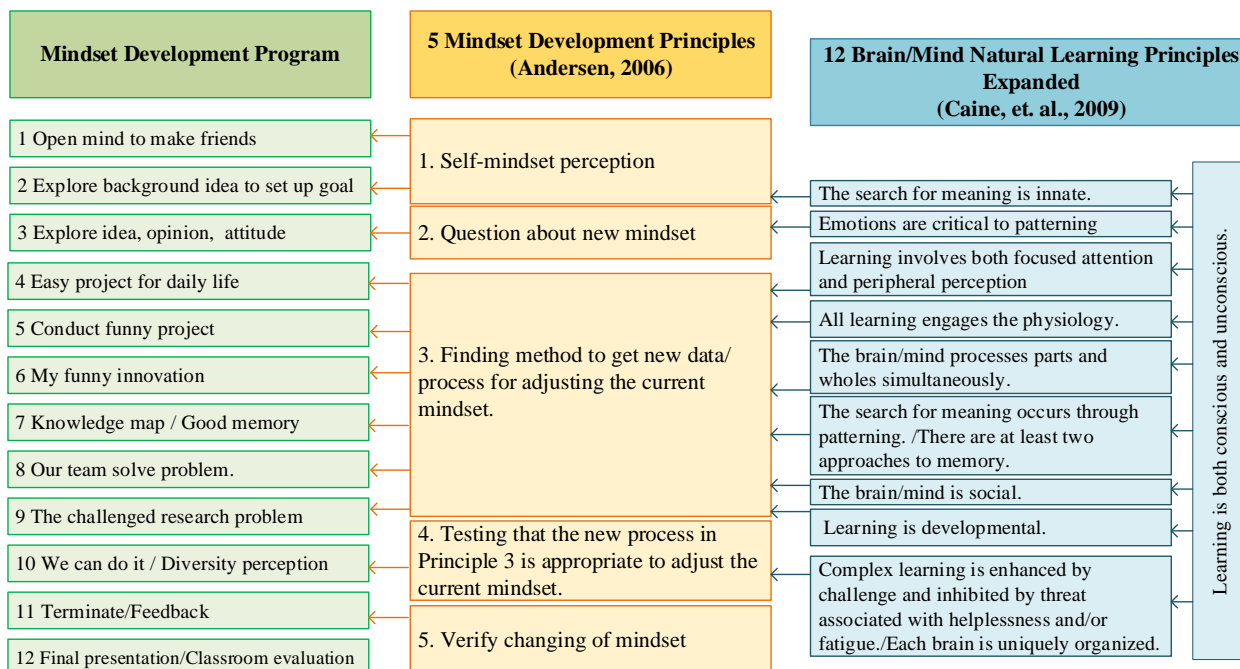


Figure no3. Mindset development program for engineering classroom.

#### IV. Result and Discussion

In this section, we present assessments in perspective of fixed mindset evaluation, growth mindset evaluation, and total mindset score comparison between control group and experimental group as follows.

##### Fixed Mindset Evaluation

We deploy a fixed mindset assessment by conducting a pretest before conducting the program and posttest after conducting the program with the experimental group. The questionnaire in Table 1 (F1-F10) was used as the assessment tool. From the perspective of the fixed mindset, there are ten questions of the Likert-type scale (from 0 = strongly disagree to 6 = strongly agree). The pretest and posttest scores of the experimental group in terms the fixed mindset were compared as shown in Figure 4.

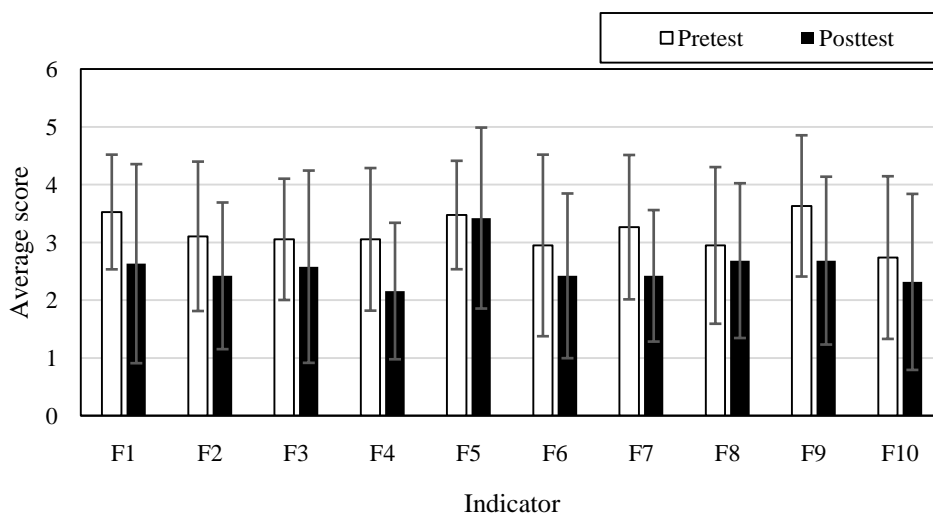


Figure no4. Comparison of the fixed mindset score.

##### Growth Mindset Evaluation

We deploy a growth mindset assessment by conducting a pretest before conducting the program and posttest after conducting the program as well. The questionnaire in Table 1 (G1-G6) was used as the assessment tool. From the perspective of the growth mindset, there are six questions of the Likert-type scale (from 0 = strongly disagree to 6 = strongly agree). The pretest and posttest scores of the experimental group in terms of growth mindset were compared as shown in Figure 5.

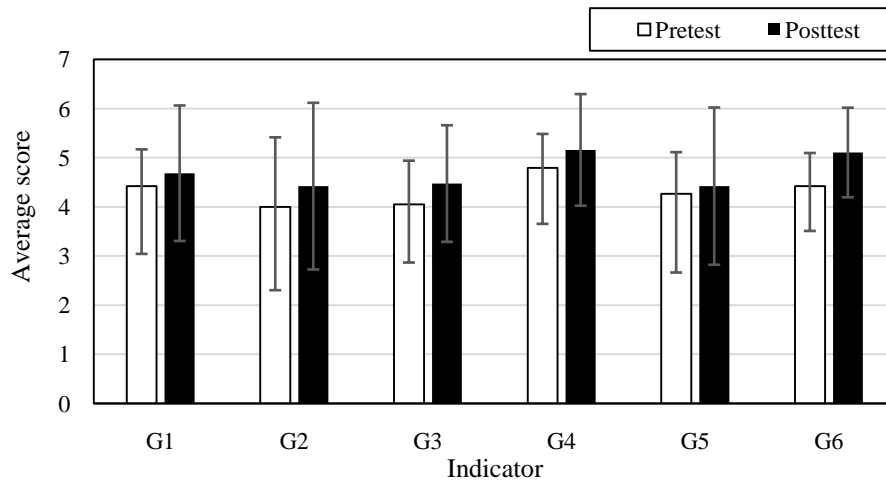


Figure no5. Comparison of the growth mindset score.

**Control Group-Experimental Group Evaluation**

This section presents the mindset score comparison between the control group and the experimental group. We transformed the fixed mindset score and the growth mindset score to the mindset score for evaluation and comparison. The fixed mindset score ( $F$ ) was operated by “ $6 - F$ ” into transform to the mindset score. For the growth mindset score ( $G$ ) we use the original values. The average mindset score of pretest and posttest from both the control and the experimental group was presented in Figure 6.

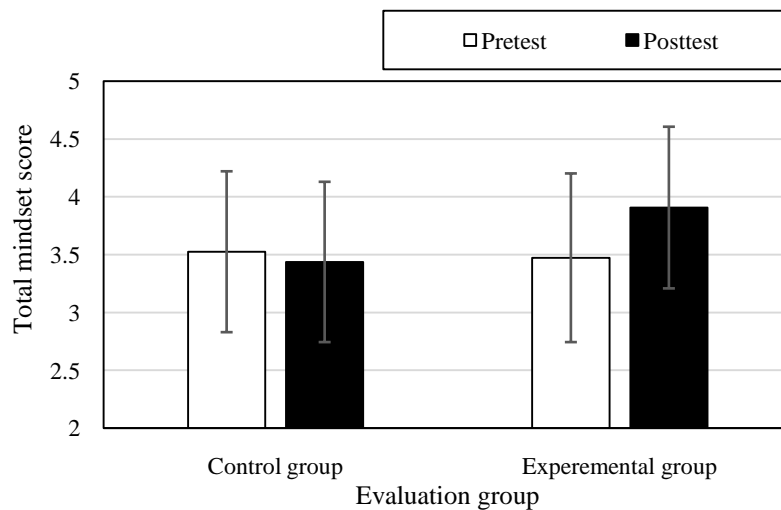
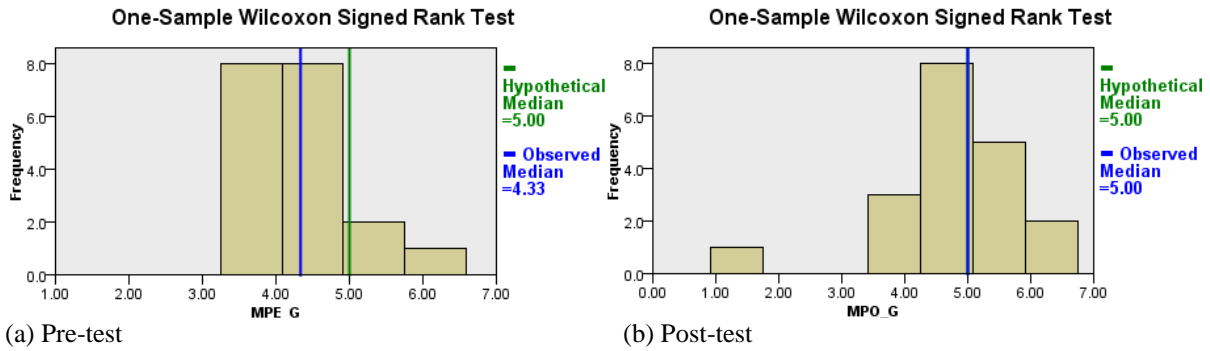


Figure no6. Mindset score comparison between the control group and the experimental group

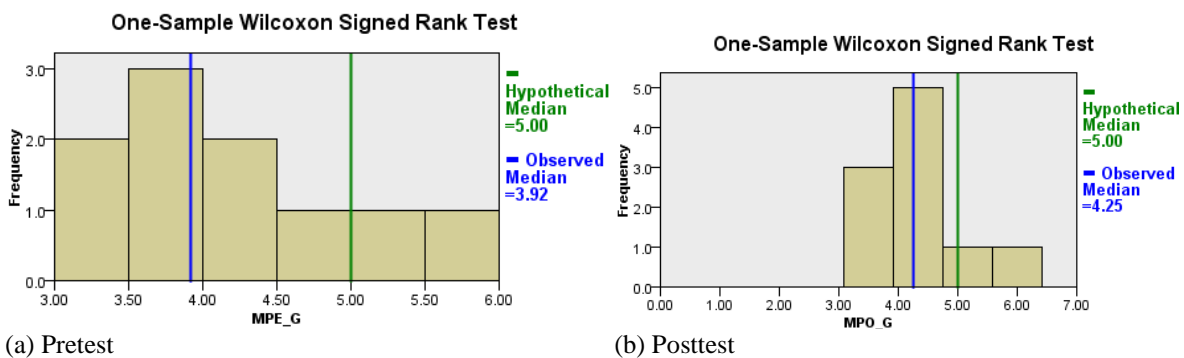
As mention before, growth mindset will be increasing of motivation, which it was relate to learning behavior and the attention of the student to learn. To show the significantly increasing of mindset, we compare the increase rate of growth mindset on each group at 5.00 score between pretest and posttest (as shown in Figure 7-8 and Table 2-3) by using the Wilcoxon Signed Rank method [9]. It was shown that the growth mindset of experimental group before participate in our mindset development program was less than 5.00 with statistical significant at 0.01, and after their finished the mindset program their growth mindset score were increase to 5.00. In the other group, both of pre and post-test was less than 5.00 with statistical significant at 0.01.



(a) Pre-test (b) Post-test  
**Figure no 7.** Median test graph of growth mindset (pretest (a) and posttest (b)) of the experimental group

**Table no 2:** Median test parameters of growth mindset of the experimental group

Parameters	Pretest	Posttest
Total N	20	20
Test Statistic	10.500	47.500
Standard Error	21.048	19.300
Standardized Test Statistic	-3.136	-1.062
Asymptotic Sig. (2-side test)	0.002	0.288



(a) Pretest (b) Posttest  
**Figure no 8.** Median test graph of Growth mindset (pretest (a) and posttest (b)) of the control group

**Table no 3:** Median test parameters of growth mindset of the control group

Parameters	Pretest	Posttest
Total N	10	10
Test Statistic	4.000	3.500
Standard Error	9.772	8.434
Standardized Test Statistic	-2.405	-2.253
Asymptotic Sig. (2-side test)	0.016	0.024

## V. Conclusion

This research presented the study of growth mindset development by the growth mindset workshop program into engineering students. We conducted the growth mindset workshop program in trimester 2/2019. The core activities in our growth mindset workshop program were ice breaking, brain gym, empathic listening, 4 DISC personal testing and contemplative education. The evaluation and assessment results were compared between before and after attending the program. There was a comparison of the control group who did not attend the program and the experimental group who attended the total program. The results showed that the growth mindset workshop program can lead to a higher output of mindset score assessment. This can present the success of the growth mindset workshop program implementation to the engineering student. Besides, we implemented the advanced statistic analysis using the Wilcoxon Signed Rank method to confirm the workshop program results. The results showed that our growth mindset workshop program can significantly improve the growth mindset for participants.

The future work we will implement the advanced statistic analysis to our research works, e.g. t-test, chi-square test to find the statistic signification learning achievement and activity's satisfaction.

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