

Improving the Academic Achievement of Engineering Undergraduates Through the Intervention of Biofeedback Training Protocol

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ABSTRACT

Poor academic performance among undergraduates can be associated with many factors. Among them are poor concentration, poor personality performance and peer influence. These are considered the most significant factors that lead to poor academic achievement among students. This study is proposing a new method to improve student's academic performance. It employs personality profiling information system together with a biofeedback game protocol. The model uses computer based personality profiling to explore personality problems among students. It also uses biofeedback devices that can detect emotional performance of the user. Participants with a low academic achievement were selected randomly as a sample for the research. They are given a training module and have to attend a few biofeedback training sessions. They are also required to correct their misbehaviour based on the module given to them. During biofeedback training session, they are required to improve their emotional performance and practice the protocol on a daily basis. After completing the training, the result shows that the participants are able to improve their academic performance. They can increase Cumulative Point Average (CPA) results from being in the low achiever category to high achievers. The results of the study shows that the proposed module and the biofeedback training protocol are able to assist engineering undergraduates in improving their academic performance.

Keywords: Academic Performance, Biofeedback, Personality

ACADEMIC IMPROVEMENT PROGRAMME

College students face various forms of stress that can lead to decreased levels of self esteem and self perception (Goldman and Wong, 1997). Study performance is the most significant topic concerned by parents, educators and government. Various efforts taken to conduct education programme to improve poor academic performance among students. Most of the programme to improve academic achievement concentrating on developing subject competency. Various approaches to instill knowledge and skills to help students perform better in schools. Normally, most students can follow the learning programme provided. They can learn and understand subjects provided by teachers. However what are the suitable techniques to teach low performance students. Most of the weak students cannot follow learning provided to them. They have to attend additional programme to help them learn better. They also have to spend more time in order to help them better learn the perform.

EMOTION AND STUDY PERFORMANCE

Emotion has a close relationship with study performance. Individuals who have the ability to control their emotion are able to control their activities effectively. A calm mind, controlled emotion will be able to direct individual to be more planned and organized (Appelhans & Leucken, 2006). Studies which were conducted found that individuals who were able to control their emotion can perform better in games (Hammond, 2007) It is similar with the academic achievement. On the other hand individuals who were unable to control their emotion having difficulties to perform well in study. They are easily more worried, tensed and anxious while carrying out reading

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and solving academic activity. This will result in poor academic performance. A controlled emotion has relationship with the power of mind and academic performance. Individuals who are able to concentrate have better memory power and are able to remember facts effectively (Mc Craty, 2003).

BIOFEEDBACK

Biofeedback is the process in which a subject receives information about his biological state. Usually a subject is not aware of his physiological functions, especially those controlled by the autonomic nervous system, such as heart rate and peripheral vasoconstriction. Biofeedback creates an external loop by which a subject can monitor one or more of his physiological states (O'Hair, 1998). One of the current techniques used to measure emotional performance is through biofeedback (Nubli, 2008). Biofeedback technique can be defined as measuring emotional changes physiologically. Through this biofeedback technique, physiological changes are measured through the use of biofeedback sensor which is connected to a computer. From the physiological changes, the device and computer will be able to measure and interprets the rate of emotional changes for individuals.

This technique is also known as psychophysiology. Normally the physiological changes which are measured are the changes in heart beats, pulse rate, muscles tension (electromiogram), changes in body temperature and changes in brain waves (EEG-electroencephalogram). Through these physiological changes, emotional changes can be measured. With biofeedback, it can help users learn to control their emotion by controlling their physiology. The ability to change physical activity can assist students to learn to control their emotion as well as their study behavior. With the help from the computer graphic, and biofeedback sensors, the students can easily learn to change their behavior that lead to perform better in their academic.

SAMPLES SELECTION

In this research the techniques used to measure low academic performances using the academic result of General Point Average (GPA) for a semester. Engineering students were selected for the training among those have GPA lesser than 3.0. For the purpose of the training, the participant who has undergone biofeedback training should have better academic result as compared to previous semester. The students starts their biofeedback training in the beginning of the semester and at the same time follows the academic curriculum. After completion of the biofeedback training for three weeks, samples are asked to maintain self regulation skills throughout the semester. Method of sample selection is based on voluntary basis. They are not selected based on directive forced rather than they themselves agree to involve in the research samples. The GPA of samples after the biofeedback training should show better improvement compared to the previous. This research uses engineering students and not others because, generally engineering programme is more challenging as compared to social and humanities programme. Engineering students was also chosen since Malaysian government gives more emphasis on the engineering and science programme to fulfill the shortage of technical work force from industries of the country.

PERSONALITY PROFILING SYSTEM

Personality is closely related to habit, interest and actions. It's normally arising from education and environment which have been exposed to an individual. Research has shown that personality is closely associated with achievement and performance in studies (Sulgado, 1997) and careers (Anderson and Keith, 1997). Personality type has specific characteristics, likes, dislikes, strengths and weaknesses. Understanding personality will help to determine how people fit to the study environment and suitability for specific academic field. Personality traits can be developed from nurturing and training. Personality traits can be described as a quality or characteristic of a person that is enduring and generally remains stable after age 25 to 30. Personality can be classified by consistent or repetitive patterns of a behavior. It can be measured as very strong, medium or weak or placed on continuum of opposites.

Through education, personality is shaped. Normally personality is associated with the learning process which the individual gets during their infancy and childhood. In this study a computerized personality profiling system was developed. It aims to measure the types of personality one has acquired. In this system the user has to answer psychometric questionnaires using likert scale. The questions answered are able to measure the type of personality one adopts either strong or weak. This information is important for students as its enables students to know strengths and weaknesses of their personality.

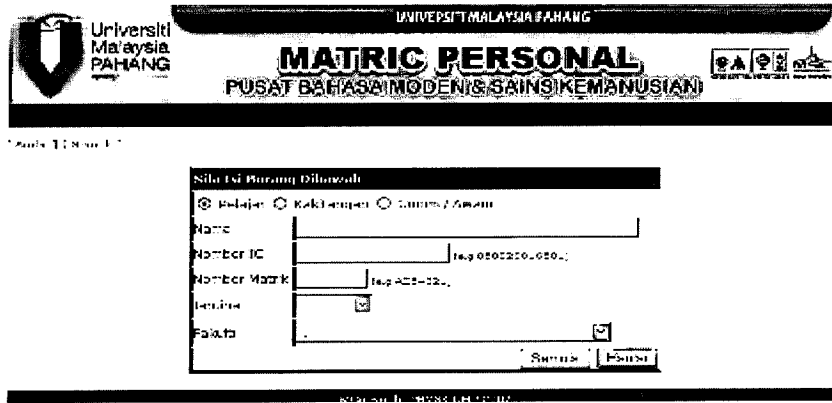


Figure 1: Screen shot of personality profiling system

Figure 1 shows the initial screen shot of the personality profiling system which the participant has to answer. Before doing so, they have to fill in their personal information. Through this system, participants are required to answer the questions which measure their personality type as shown in Figure 2.

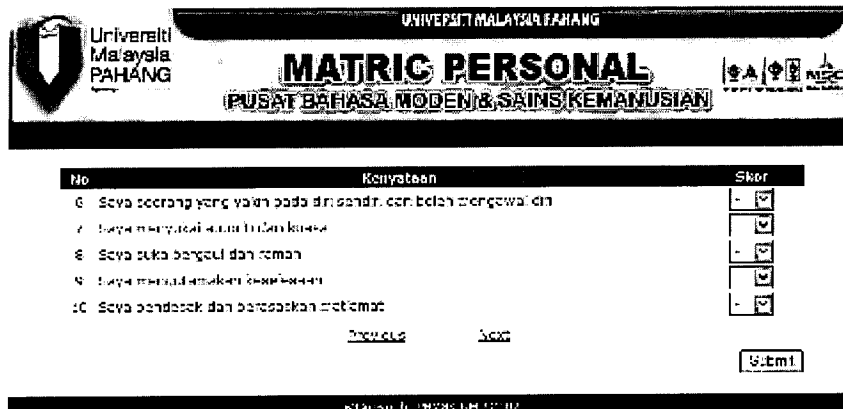


Figure 2: Screen shot of personality profiling questionnaire

Figure 2 shows a part of the questions which have to be completed by the students. They are required to answer the questions by choosing the options from a likert scale ranges from 0 to 10. The 0 score means not at all, and 10 score means very likely. Students have to answer truthfully based on their habits and behaviors which they practice.

After answering the questions, the system will then analyze the student’s responses. The results will be shown to the participants on line. A sample of the results is shown in Figure 3. It shows the display screen of the participant’s personality type. Generally, the system profiles six types of personality. Each personality has its own characteristics. From the answer, it shows that if their personality is strong, ranged more than 65%, it means that the students should continue with their present personality. If their personality is considered weak, (scores ranged

less than 40%, they have to strengthen it. Figure 3 shows the student has a weak personality in 4th and 5th categories, but have strong personality in type 1, 2 and 6.

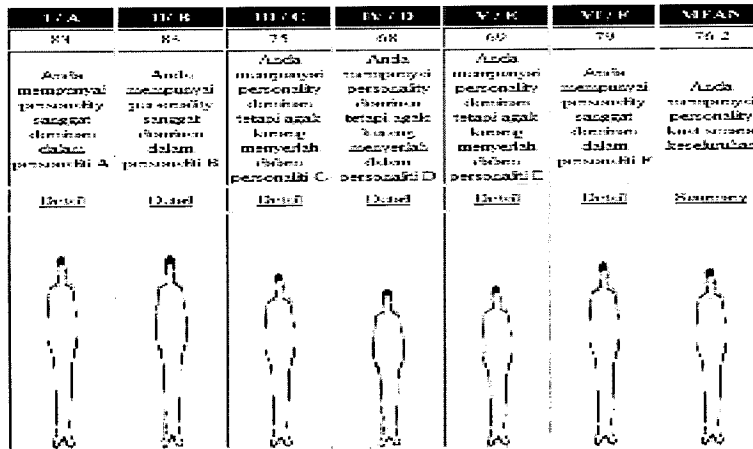


Figure 3: Screen short of personality profiling assessment result Biofeedback test

Other than that, biofeedback test is used to measure the emotional strength of the students. They can learn to consciously alter things which are normally involuntary, such as heart rate, hand temperature, brain waves, muscle tension or perspiration (Alexander, 1995). In biofeedback, the students are required to use the biofeedback software together with the device. This is aimed at measuring the emotional strength of each individual student. Through this technique, the participants are required to play with biofeedback device which can detect changes in the pulse rate. The changes in the pulse rate will be shown on the computer screen. Besides that, the graphics which are shown by the computer will stimulate changes in the student's emotion.

This is shown in Figure 4. The figure shows the multimedia graphics display which stimulates the participant to respond to the specific computer graphic.

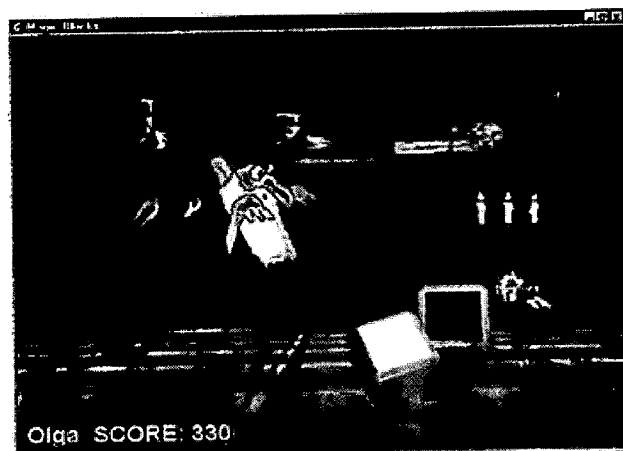


Figure 4: Screen shot of biofeedback computer game

After the participants have completed the games of measuring their emotion, the computer will analyze whether the participant shows a stable, strong or weak emotion. The result is as displayed in Figure 5. Figure 5 show the individual has a weak emotion. The descending graph shows the participant was not able to control his emotion while using the biofeedback device. The display shows that students requires training program to strengthen his emotion.

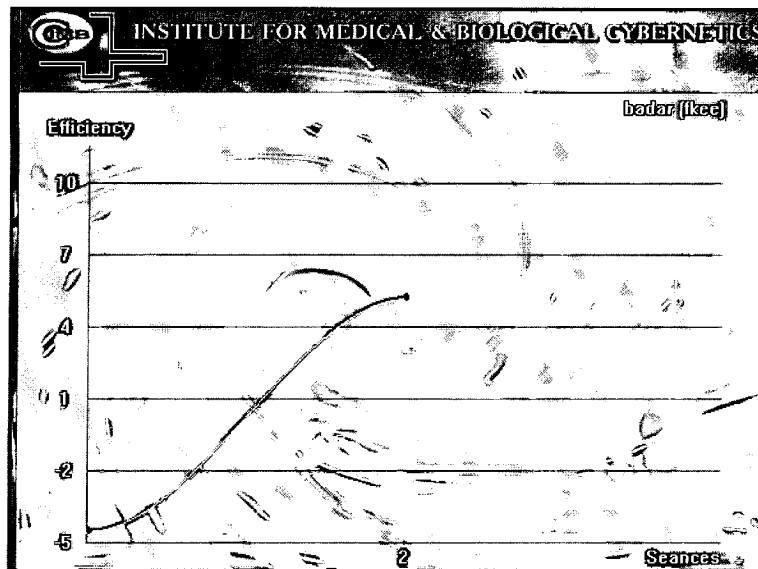


Figure 5: Screen shots of biofeedback game result

BIOFEEDBACK PROTOCOL

In the process of strengthening an emotion, the participants are taught how to control their emotion. This technique or protocol emphasizes regulation breathing techniques, mind concentration and relaxation of physical activity. By engaging this protocol, the participant will be in a better position of controlling mind and pulse rate. Regulating the pulse rate has a direct relationship with emotional performance. Individuals who are able to control their emotion will have direct control in the pulse rate and vice versa. The protocol which is taught to the participant is in the form of breathing techniques and mind concentration. The participants are required to use the protocol at least twice a week to familiarize them on how to control their minds, pulse and breathing. This protocol must be used together with biofeedback game kit. The students are required to train at least 20 minutes per session, twice a week for 6 weeks. During this time, the students are required to attend the training at the biofeedback lab and carry out the required biofeedback training.

SELF IMPROVEMENT MODULE

To improve the student's performance, they are also provided with a module. Through this module they are exposed to the five components in human change. The module explains how each of these components is able to influence their academic performance. The five components are the soul, mind, emotion, passion and heart. These elements always influence students to perform in their academic. During the training, biofeedback protocol gives emphasis on developing emotion, whereas the mind component focus on knowledge, the passion component focus on controlling and the heart component focus on cleansing. To facilitate easier understanding, the participants are given a module in the form of multimedia. The computer based multimedia module makes the training more attractive for the students to learn on improving oneself. Figure 6 shows a section of the multimedia module which has been developed.

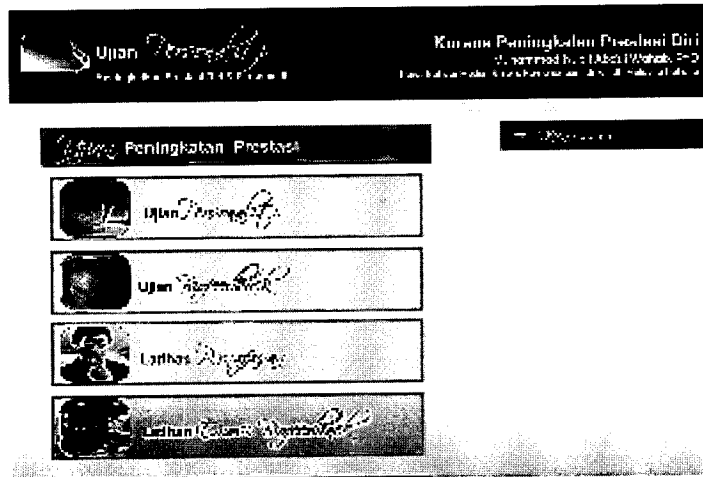


Figure 6: Computer based multimedia assist learning module

RESULT OF THE PROGRAM

Table 1 shows the examination performance of the students before and after the biofeedback training was conducted. The first column shows the result of the examination (GPA1) before the biofeedback training whereas the next column (GPA 2) shows the exam result after the training. The third column shows the differences between before and after the training. The result shows that all students are able to improve their academic performance after attending the training. The table shows that they have better academic result after attending biofeedback training. It also shows that the students are able to improve their emotion performance as well as their personality. As previously mentioned, to control emotion is to control minds, activities and being in a calm and controlled situation.

Grade Point Average - GPA1 (Before Treatment)	Grade Point Average - GPA2 (After Treatment)	Differences between treatment (GPA2 – GPA1)
2.17	3.22	+1.05
2.48	3	+0.52
2.5	3.49	+0.99
2.86	3.29	+0.43
2.69	3.4	+0.71
2.79	3.11	+0.32
3.14	3.6	+0.46

Table 1: Result of the biofeedback training with students

DISCUSSION

In this clinical study, the participants who were chosen were required to follow the training consistently and diligently. Due to this, the number of the participants involved in the course was limited. However, the data obtained shows that the protocol and module which were given to the participants to change themselves were effective. These findings show that the individuals who are able to control their pulse rate are able to control other activities as well.

This study did not look at the student's external academic factors such as study environment, lecturer's performance, subject matter familiarities and many other academic performance influence factors. This is because of limitation of time and inconsistency of environmental factors to the academic performance. However, the study shows that, if the students are able to control their emotional performance and do change their internal factors are also able to improve their academic performance, this is due important to help students improve their academic performance. In the academic improvement programme, such factors need to be considered. Thus taking into consideration too many factors as an influence factors to academic performance is useless and requires more time. The more important to use the most influence factors at improving academic performance that is emotion and behavior.

The study shows that, there are connectivity between biofeedback protocol, personality performance and self improvement module. Its shows that emotional performance and personality types as an indicators to academic performance. The participants who have low personality score has to strengthen it so that the personality will be more apparent. The stronger the personality will assist the participants to make effort in improving themselves. The module which is given exposes the individuals to the factors which can affect their academic performances. Participants should use their self potential to make self changes based on the treatment programme. With biofeedback computer game they learn skills which they will use and practice on a regular basis. It is not a treatment that is done to them. It is a learning process which they integrate into their repertoire of inner strengths and skills. They learn to recognize how it feels when they are focusing more effectively and when they are spacing out, allowing themselves to become distracted. If they continue to use their brain, at the new level, then the improvements are retained even without the continued use of biofeedback.

The biofeedback approached is oriented toward helping the individual learn skills which empower him or her to take greater self responsibility for health and all other dimensions of functioning life. It is not a treatment or therapy. It is a coaching and training process. Under the biofeedback control they can analyze their actions during the game that help them choose the most proper individual strategy of relaxation by playing the game, they will reveal new behavioral possibilities under stress conditions, acquire physical sensations of comfort and relaxation. In a real stress situation they can use their skill of self-regulation to get relaxed easily.

This study shows that academic improvement in schools and university should uses biofeedback training programme, personality profiling assessment systems and self improvement module to assist students learn more in techniques for performing better in academic and study activities. By practicing relaxation techniques, the students can be trained to control excessive arousal brought on by any stressful situations. At the same time while playing the game, the students have to stay focused and maintain concentration which contributes to better performance. As a result they achieve better control of psycho-physiological state, effective coping with anxiety and better performance. The students can learn the skills of relaxation and will be ready to control them, manage their emotions and yet change their undesired behavior.

CONCLUSION

The preliminary study finds a combination of personality profiling, self improvement module and the biofeedback protocol are suitable to help students improve their study performance. This study should be improved to cover more samples. The period of study needs to be extended within various level of academic programme. This is to strengthen the findings of the study. Further studies have to be done using a better biofeedback protocol. For that, the participants have to be given a longer training so that they become familiar with the training protocol. This is to ensure their academic performances can be measured easily and clearly. Other studies have to be carried out especially among workers using the same technique to get better results of working.

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