# Students' Emotion in Utilising Virtual Reality Power System Equipment Competencies Training Using AEQ

Darni Darmin
Politeknik Sultan Azlan Shah,
darni@psas.edu.my

Syahrunizam Buyamin
Politeknik Kota Kinabalu
syahrunizam@polikk.edu.my

Syafizwan Nizam Mohd Faroque
Jabatan Pendidikan Politeknik dan Kolej Komuniti,
syafizwan@mohe.gov.my

**Abstract**
The emotional aspect plays an important role in ensuring the effectiveness of learning. It depends on the students' learning experience of the instructional materials produced to deliver the learning content. Learning using slides and videos is no longer relevant nowadays, especially when dealing with students who are from Z Generation. The inappropriate instructional materials have the potential to negatively impact student learning and enhance the students' emotions. In this study, students' emotions in utilizing Virtual Reality Power System Equipment Competencies training were identified using the Achievement Emotions Questionnaire (AEQ). The AEQ was distributed to 30 students of the Department of Electrical Engineering, Politeknik Sultan Azlan Shah after they went through a training-based learning session. It contains positive items such as enjoyment, hope, and pride; and negative items such as anger, anxiety, shame, hopelessness, and boredom. IBM SPPS Statistics Version 26 software was used to analyze the collected data. The results found that students felt enjoy, confident, and proud of themselves during the training sessions using Virtual Reality (VR). They also agreed that this training session did not make them feel angry, worried, embarrassed, resigned, and bored. The positive emotions can help students increase their desire to learn as well as engage in VR-style training sessions. Details for negative emotions still need to be clarified especially from the aspect of anxiety when handling learning materials. Finally, future research should focus on the relationship between emotions and student achievement of virtual reality-assisted learning.

**Keywords:** AEQ, VR, virtual reality

## 1.0 Introduction

Virtual Reality (VR) has great potential in the field of education and training (Tang, Au, Lau, Ho, & Wu, 2020) in the aspect of increasing student achievement levels (Alhalabi, 2016), and user motivation (Sattar et al., 2020). It stimulates students to develop communication and teamwork skills, as well as encourages students to more actively develop their practical skills (Lee & Shvetsova, 2019). Studies on the emotional aspects and involvement of students while using Virtual Reality are also seen to have a

positive impact compared to the use of text and video (Allcoat & Mühlenen, 2018).

The emotional aspect plays an important role in ensuring the effectiveness of learning. It depends on the students' learning experience of the teaching materials produced to deliver the learning content. Inappropriate teaching materials have the potential to give a negative impact on student learning and increase student emotions (Mohd Najib, 2015). Learning using slides and videos is no longer relevant nowadays, especially when dealing with students who are from Z Generation. Therefore, in this study, VR was used as a platform to deliver learning content especially in Power System Equipment Competency. The VR content trains the students about the procedure of operating high voltage protection equipment without having to go to the field area (electrical substation) and potential accidents can be avoided. The emotional aspect is seen after students go through the learning process using VR. There is a need to measure emotional achievement based on different tendencies among students experiencing the learning material. This is because the emotions experienced by each individual are not the same, even if they go through a similar situation. Various instruments developed by psychologists are used to measure students 'emotions including the Achievement Emotions Questionnaire (AEQ), to assess the impact of a person's emotions particularly in learning (Pekrun et al., 2011).

## 2.0 Method

A total of 30 students of the Electrical Engineering Department utilize Virtual Reality Power System Equipment Competencies training with the guidance of the lecturer. They wear a VR set which consists of an Oculus Quest 2 head-mounted display and controllers and undergo the training on a scheduled basis. Figure 1 shows a part of the training content in the VR electrical substation and Figure 2 shows the student while having the training.


**Figure 1.** A part of training in the VR electrical substation

**Figure 2.** Students access the content using a VR set

The adapted Achievement Emotions Questionnaire (AEQ) from Mohd Najiib (2015) contained 38 questions (Likert Scale of 1: Totally Disagree to 5: Totally Agree) representing positive emotional items: enjoyment, hope, and pride; and negative emotional items: anger, anxiety, shame, hopelessness, and boredom was distributed after the training session. Before the data is analyzed, the scale of negative items needs to be recoded before data analysis is performed. Recode is the process of reversing a Scale of 1 to 5, 2 to 4, 3 to 3, 4 to 2, and 5 to 1 (Ahmad Zamzuri, 2018). Data collection was analyzed using IBM SPPS Statistics Version 26 software.

A reliability test (Cronbach's Alpha) was used to look at the internal consistency of questionnaire items using a Likert scale. It was found that the value of Cronbach's Alpha was .840, as in Table 1 below.

**Table 1**. Reliability Test (Cronbach's Alpha)

| Cronbach's Alpha | N of Items |
|---|---|
| .840 | 8 |

## 3.0 Results and Discussion

In this study, the mean score for each item was analyzed using the IBM SPPS Statistics Version 26. The result of data analysis was referred to the mean score interpretation scale (Mohd Najib, 2003) as in Table 2.

**Table 2.** Mean Score Interpretation Scale (Mohd Najib, 2003)

| Mean Value | Mean Score Interpretation |
|---|---|
| 1.00 – 2.33 | Low |
| 2.34 – 3.67 | Middle |
| 3.68 – 5.00 | High |

Table 3 below shows the mean analysis for each item. There were 3 positive emotional items and 5 negative emotional items which the negative scale was recoded before the analysis was done.

**Table 3.** Mean Analysis

| Items | N | *M* | *SD* |
|---|---|---|---|
| **Positive emotions** | | | |
| Enjoyment | 30 | 4.7222 | .47208 |
| Hope | 30 | 4.4000 | .69701 |
| Pride | 30 | 4.5133 | .48618 |
| **Negative emotions** | | | |
| Anger | 30 | 4.6667 | .59500 |
| Anxiety | 30 | 3.8667 | 1.04826 |
| Shame | 30 | 4.0933 | 1.00719 |
| Hopelessness | 30 | 4.3933 | .87017 |
| Boredom | 30 | 4.5000 | .71967 |

*M* mean, *SD* standard deviation

Referring to Table 3, it was found that the level of enjoyment for 30 students is high based on the mean score of 4.7222. They enjoyed and felt excited dealing with the learning material and the challenge in the learning content. Students are happy about their learning progress and acquire new knowledge after the training. The mean score of the hope item is 4.4000, and this proves that students agree they felt confident, inspired, and motivated while studying the learning content.

Based on the score mean of pride item, which is 4.5133, students proud of themselves of their abilities while handling the training using VR, especially when they can solve the task during the training. For the mean score of the anger item, which was 4.6667, students felt that the learning did not make them irritated and feel angry although they studied more than they should have. They did not worry, get tense or nervous while studying based on the mean score of 3.8667. It was found that students did not feel ashamed during the training (mean score 4.0933) and stayed until the end of the training (mean score 4.3933). Results found that the students were not boring and they are not tired during the learning session based on the mean score of 4.5000. The positive emotions can help students increase their desire to learn as well as engage in VR-style training sessions. Details for negative emotions still need to be clarified especially from the aspect of anxiety when handling learning materials. This is because the mean score for the anxiety item is the lowest among the other mean scores. Most likely most of the students are first-time using a VR set and they are nervous while using it.

## 4.0 Conclusion

The findings of the study found that students are fun, motivated, confident, and do not feel stressed during the learning process in the form of VR. This coincides with the study of Allcoat & Mühlenen (2018) which stated that there is a positive impact on the emotional aspects of students while using VR compared to other methods. Students also engaged with the content. This is in line with Xie J. (2021) that the more engaged the students are, the less bored they feel and the less monotonous they find the class activities. It will indirectly encourage the educators out there to develop more learning materials in the form of training in the form of VR. This does not only motivate students but may even help students focus more on the learning content. The frequency of interactions between students and learning content can also be increased, compared to the use of traditional methods that are linear in nature.

## References

Ahmad Zamzuri Mohamad Ali (2018). *Multimedia dan Perisian Pendidikan*. Tanjong Malim: Penerbit Universiti Pendidikan Sultan Idris.

Alhalabi, W. (2016). Virtual reality systems enhance students' achievements in engineering education. *Behavior and Information Technology*, 35(11), 35, 919-925. https://doi.org/10.1080/0144929X.2016.1212931.

Allcoat, D., & Mühlenen, A. v. (2018). Learning in virtual reality: Effects on performance, emotion, and engagement. *Research in Learning Technology*, 26, 1-8. http://dx.doi.org/10.25304/rlt.v26.2140.

Lee, J. H., & Shvetsova, O. A. (2019). The impact of VR application on student's competency development: A comparative study of regular and VR engineering classes with similar competency scope. *Sustainability*, 11(8), 1-26. http://dx.doi.org/10.3390/su11082221.

Mohd Najib Abd. Ghafar (2003). *Rekabentuk Tinjauan Soal Selidik Pendidikan*. Johor: Penerbit Universiti Teknologi Malaysia.

Mohd Najib, H.2015. *Tahap realistik karaktor animasi talking-head dan kesannya terhadap emosi dan prestasi pembelajaran.* (Unpublished Doctoral Thesis). Universiti Pendidikan Sultan Idris, Tanjong Malim,Perak.

Pallant, J. (2001). SPSS Survival Manual - A step-by-step guide to data analysis using SPSS for Windows (Version 10 & 11). Maidenhead, Philadelphia: Open University Press.

Pekrun, R., Goetz, T., Fenzel, N.C., Barchfield, P., & Perry, R.P. (2011). Measuring emotions in students' learning and performance: The achievement emotions questionnaire (AEQ). Contemporary Educational Psychology, 36(1), 36-48. https://doi.org/10.1016/j.cedpsych.2010.10.002

Sattar, M. U., Palaniappan, S., Lokman, A., Shah, N., Khalid, U., & Hasan, R. (2020). Motivating medical students using virtual reality-based education. International Journal of Emerging Technologies in Learning (iJET), 15(2), 15, 160-174. https://doi.org/10.3991/ijet.v15i02.11394.

Tang, Y., Au, K., Lau, H., Ho, G., & Wu, C. (2020). Evaluating the effectiveness of learning design with mixed reality (MR) in higher education. Virtual Reality, 24, 797-807. https://doi.org/10.1007/s10055-020-00427-9.

Xie J. (2021) The Effects of Boredom on EFL Learners' Engagement. Front. Psychol. 12:743313. doi: 10.3389/fpsyg.2021.743313