Increasing Students Motivation to Learn Slope Analysis Using SLOPE/W Software in Geotechnical Engineering Subject with Visual Aid

Jumintono[1,*], Nurnazirah Binti Muhamad Ramzi[1] & Lilik Prasetyarini[2]

[1]Department of Technical and Vocational Education, University Tun Hussien Onn Malaysia, Batu Pahat, Johor, Malaysia

[2]Posgraduate Program, Universitas Islam Negeri Raden Mas Said Surakarta, Indonesia

*Correspondence: Department of Technical and Vocational Education, University Tun Hussien Onn Malaysia, Batu Pahat, Johor, Malaysia. E-mail: masmintostagen@gmail.com. https://orcid.org/0000-0002-7591-649X

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Abstract

This study aims to investigate students' perceptions about the use of visual aids (e.g., video animations, images, films, and projectors) as motivational tools in increasing interest in learning subjects in Geotechnical Engineering. One of the most significant and crucial issues in mining and geotechnical engineering projects is slope stability analysis. This experimental study uses visual aids for the topic of slope stability to investigate whether it has significance for student learning with visual assistance. The quantitative research method approach is used to gather the required data. The instrument used was the Motivation Questionnaire, which comprised five items. The items had a 4-point Likert scale for students to indicate their responses on the scale. Therefore, a total of 25 final-year students from UTHM Civil Engineering assigned to experimental conditions, with or without assistance, were chosen. According to data analysis, the vast majority of pupils think that using visual aids is a good idea. While it can help students increase their knowledge in learning Geotechnical Engineering subjects with interest, using visual aids allows students to interact with their lecturers closely about issue content. This aspect is essential because it helps to produce students' creative and critical thinking skills.

Keywords: slope analysis, SLOPE/W Software, geotechnical engineering, visual aid

1. Introduction

Students are less interested in learning geotechnical engineering. Among the most significant and vital challenges in mining and geotechnical engineering projects, including open-pit mining operations, embankments, dams, landfills, earth dams, and highways, is slope stability analysis (Manna et al., 2014; Zhou et al., 2019). This subject is often considered a difficult question to passing. From the perspective of system engineering, geotechnical engineering is a complex system, and making precise designs by geotechnical theoretical models is challenging to realize (You et al., 2018). Geotechnical engineering is often considered difficult to understand. The first type of learning is foundational knowledge, which includes understanding and remembering information and ideas (Heflin et al., 2017). Students cannot see the relevance of this subject to everyday life. Several engineering students regard some courses, such as design courses, as challenging for many reasons (Shaaban, 2013). Traditional slope stability calculations include considerations for rainfall, which can change the groundwater flow patterns by causing rising pressure heads or groundwater tables. However, it is essential to keep in mind that it's not always safe to presume that the groundwater table is increasing because this is often the case with shallow failures (Fourie, (1996).

Slope safety evaluation is an important reason to study slope stability through various alternative learning methods (Azmoon et al., 2021). The study and analysis of slope stability problems are very important actions to prevent landslide risks in geotechnical engineering (Abderrahmane & Abdelmadjid, 2016). Research on geotechnical characteristics and slope stability analysis was also carried out at the Gushui Hydropower Plant, Southwest China, to assess moisture content and natural soil-rock aggregates (Zhou et al., 2013). Slope stability assessments are also used for the exploration of geotechnical sites (Yang et al., 2019).

Visual aids are mainly things, photographs, videos, and visual pictures. Visual aids are tools that help to make an issue or lesson clearer or easier to understand and know (drawings, models, charts, maps, videos, slides, real objects) (Shabiralyani et al., 2015). According to Collins English Dictionary, "Visual aids are things that you can look at, such as a film, model, map, or slides, to help you comprehend something or to evoke information." The result indicates that less organized designs that frequently provide instructions, stages, and definitions, including visual aids, worked instances, and integrated language, are generally beneficial for beginning learners (Chiu & Mok, 2017). In a most straightforward understanding, visual aid can be a tool in increasing knowledge of things or experiences by watching something. An illustration of an audiovisual technology content development tool is a video (Hussin et al., 2018). Visual aids also function to understand the design and implementation process (Muñoz-Cristóbal et al., 2017). There has been increasing interest in the use of visual learning aids in education (Dolati & Richards, 2011). There are benefits to using visual aids in teaching, such as maintaining the momentum of reading interest among students (Yunus et al., 2012; Shiau et al., 2015).

One of the factors that contribute to students' performance is the motivation factor. The teacher load consists of responsibilities, teaching assignments and additional tasks (Mustafa et al., 2020) such as motivating students. One of the supporting factors is teacher knowledge (bin Nordin et al., 2020), and the main competence is professional competence (Hermita et al., 2020). Koszalka (2001) revealed that teachers seemed to agree that one of the significant issues concerning learner readiness for e-learning is motivation. Motivation is one of the students' understandings of factors (Watkins et al., 2004; Bernaus & Gardner, 2008). Ulbrich and Pacnik (2004) also noted that the issue of human motivation in fulfilling e-learning is essential to be measured.

Many students have narrow cognitive thinking and little motivation. This makes it difficult for them to be more creative and analytical. The purpose of this study was to determine students' motivation level toward visual aid use in learning slope analysis topics at higher education institutions in Universiti Tun Hussien Onn, Batu Pahat, Johor. The following research questions guided this study What is the students' motivation level toward visual aid use in learning?

2. Materials and Methods

This study used a quantitative method approach, in which the researcher used a questionnaire to gather quantitative data. In order to support hypotheses, quantitative data are utilized to summarize data and provide numerical data descriptors (Butler et al., 2019). Data collection consisted of a demographic background survey and a survey questionnaire. Demographic studies are used to gather information about participants' age, gender, and educational background. Section A is the demography of students; meanwhile, Section B is a questionnaire determining the level of motivation for student learning by using a visual aid. The instrument was distributed to five students in the final year of UTHM Civil Engineering. The participation of the students was voluntary, and no equality of gender was emphasized. There were a total of 30 returned questionnaires. The survey questionnaires were distributed to the student before and after reviewing the visual aid video to observe whether this video had an impact on student learning. The data from the survey was analyzed according to means and standard deviation using Statistical Package for Social Sciences version 21.0 (Table 1).

Table 1. Mean Score's Interpretation

Mean Score	Interpretation
1.000 to 2.330	Negative/Low *
2.340 to 3.660	Neutral/Average *
3.670 to 5.000	High /Positive *

Data were analyzed using descriptive statistics (percentage, mean, and standard deviation) for the quantitative data (Nemanich et al., 2009; Zhou et al., 2019). The result analysis from SPSS software of the mean score can be interpreted into three levels, whether low, average, or high for each of the construct items. The level of students' motivation to learn with visual aid has a construct that falls in the range of 1.00 to 2.33 will be defined as low. Meanwhile, if the result analysis shows that data range from 2.34 to 3.66 means students have an average motivation level. Also, if the mean score has a range value between 3.67 to 5.00, it can be interpreted that the students have a high level of motivation in learning with a visual aid.

The instrument used was the Motivation Questionnaire, which comprised five items. The items had a 4-point Likert

scale for students to indicate their responses on the scale. The scale was "1 = strongly disagree", "2 = disagree", "3 = agree" and "4 = strongly agree". The instrument used in this study to measure motivation was used in a similar study by (Butler et al., 2019).

3. Result and Discussion

The method used for this research was survey research, and the reliability determination was by calculating Cronbach's alpha. Cronbach's alpha reliability test was used to examine the degree of consistency between the items representing the scale (You et al., 2018). The reliability analysis for the motivation construct yielded an Alpha (α) of 0.873, and the corrected item-total correlation was above 0.250. Therefore, the reliability of the questionnaire was acceptable (Table 2).

Table 2. The Motivation of Students before Reviewing the Video

		I had fun engaging in this activity so much	That activity was kind of fun to engage	I suppose this is a tedious activity	I would define this activity as so interesting	I supposed this activity was overly pelasurable
N	Valid	30	30	30	30	30
	Missing	0	0	0	0	0
Mean		2.40	2.60	1.80	2.60	3.00

The results of the analysis show that students have low motivation to study slope stability analysis because the average score for the third item 1.80 means the value is at a low level. The average rating ranges at the medium level, meaning students have an average motivation in learning the topic of slope stability without the help of a visual video (Table 3).

Table 3. The Motivation of Students after Reviewing the Video

		I had fun doing this activity so much	This activity was kind of fun to engage	I suppose this is a tedious activity	I would define this activity as so interesting	I supposed this activity was overly pelasurable
N	Valid	30	30	30	30	30
	Missing	0	0	0	0	0
Mean		3.80	3.80	3.40	3.80	3.80

The significance of this research is to determine the level of students' motivation towards learning slope stability topics with the assistance of visual video. The result shows that the motivation level of students increases after reviewing the footage as a visual aid in learning. The third item of, "I think this is a boring activity" which has the lowest mean score before showing the video, proves that the aid of visuals during learning can increase students' motivation. The other four items show the increasing value of the mean score that is in the range of a high level, which has a value of 3.80 for each item.

Quite a number of research have discussed motivation readiness. For instance, you et al. (2018) claimed that motivation is regarded as teachers' readiness element. Similarly, Ulbrich and Pacnik (2004) stated that the problem of human being motivation in executing e-learning is a substantial factor. The results of the survey demonstrated that roughly 80% of participants had substantial motivation readiness towards visual aid utilization, with the whole mean of the students' motivation readiness towards visual aid use at nearly 3.80. That showed that the students have been so motivated towards visual aid utilized for learning, proposing that with heightened motivation, the students could get active learners. Students would reflect on their motivation and the use of motivational strategies in learning by using technology (Zhou et al., 2019).

Visual Contextual Aids have the highest effect on students' reading comprehension (Kyndt et al., 2015; Chiu & Mok, 2017). Previous research results also indicated that audiovisual media was more effective in increasing adolescent knowledge and attitudes about the dangers of HIV / AIDS. Visual descriptions can show the parts and processes of a complex system directly, the use of visual explanations is a powerful learning tool for students. The use of visual aids in the teaching and learning of English in High Schools in the Agbani Education Zone, Enugu State, Nigeria, results in students who perform better than students taught by traditional methods (bin Nordin et al., 2020).

With the increasing knowledge of students about slope analysis, students will be able to provide information or help to

prevent landslides caused by slope collapse. Slope damage is a worldwide natural hazard that can cause damage and cause casualties (Chiu & Mok, 2017). In addition, assessing slope stability is very challenging in developing countries to reduce the risk of landslides. Landslides are initiated as a consequence of the instability of the terrain, and for this reason, it is important in geotechnical practice to ensure the stability of soil or rock conditions (Hussin et al., 2018). Thus, slope stability analysis is an important area in geotechnical engineering, and visual aids can increase student motivation in learning slope analysis.

4. Conclusion

Over the course of this study, it was attempted to analyze students' perceptions regarding the use of visual aids (e.g., video animations, images, films, and projectors) as motivational tools in raising interest in learning subjects in Geotechnical Engineering. To that end, the quantitative research method approach is utilized to gather the required data. The results of the present study demonstrate that visual video can increase students' motivation to study slope analysis. Aids in learning make it easy for students to understand lessons that they initially find difficult. Based on the results of this study, active learning methods are obtained using video. It is hoped that in other experiences, the teacher can apply the same process—knowledge about the development of more effective forms of learning and educational practice.

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