DEVELOPMENT OF VISUALIZE OFFLINE TEACHING (ViOT) METHOD OF TOOL BIT CUTTING TECHNIQUES FOR BEGINNERS

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Abstract: ViOT or abbreviated to Visualize Offline Teaching Method – Tool Bit Grinding Techniques for Beginner, is a technique that applies the Teaching and Learning (T&L) concept with the aid of video demonstrations. This method implies a sense of vision as the primary medium in focusing mainly on tool bit grinding topics. This approach was implemented for DJJ10022 and DJM10012 Mechanical Workshop Practice 1 for first-semester Mechanical Engineering students at Politeknik Ungku Omar. The instructional video was produced with the Viva Video premium edition for Android and Microsoft Office PowerPoint. The teaching material is disseminated to students through social media platforms, primarily YouTube and Telegram. As a result of this effort, a thorough instructional teaching and learning video was created. This video was made specifically to guide students through the lecturers' perspectives and lesson outcomes. By revising the footage repeatedly, students can memorize the technique demonstrated and apply it. Overall, the application of this T&L video helps to assist students' practical skills.

Keywords: *Teaching and Learning 1; visualization 2; tool bit 3; machining process 4.*

1. Introduction

Visualize Offline Teaching, or ViOT is a teaching pedagogy with video assistance. This method implies visual sense as the primary medium where students should focus on particular topics. As part of Malaysia's 2013 Transformation of Technical and Vocational Education Training (TVET), teaching methods for TVET must also change (Abdullah et al., 2021), (Md Sahir & Mohd Ayub, 2015). This transformation eliminates the idea that TVET is like a second-grade education for academic dropout students (Md Sahir & Mohd Ayub, 2015). One of the transformations of teaching and learning is the application of technology, Information, and Communication (ICT) in teaching. ICT can generate and develop educators' ideas and creativity in school teaching and learning (Md Sahir & Mohd Ayub, 2015). A video is a form of information and communication technology that can be used in educational strategies. For example, teachers assign students to watch videos both in and out of the classroom to introduce a topic, watch recorded lectures, promote discussion, learn a second language, explain activities or assignments, and record step-by-step instructions to complete a procedure or process on a computer (Campbell & Cox, 2018). Also, the use of video in education is not a novel concept

(Muniandy & Veloo, 2011). Therefore, creating digital media is a good strategy for learning and demonstration (Donnelly et al., 2013)(Norton & Hathaway, 2010)(Kamlin & Keong, 2020).

According to (Hartsell & Yuen, 2019), video learning can draw students' attention since it displays the lesson's information that is easily understood and assimilated by the student. (Siang et al., 2019), agreed video technology delivers s (Md Sahir & Mohd Ayub, 2015) or disk audio-visual media that displays motion (Shojaei et al., 2020) (Hamdan & Mohd Said, 2020). Video is essential in multimedia because it can add to and impact multimedia applications (Md Sahir & Mohd Ayub, 2015). Using video-integrated audio, text, pictures, and animations can stimulate students to understand better or master the skills required. In addition, the video can be repeated during the screening process and is convenient to play on several technology platforms, including computers, mobile phones, tabbed computers, et cetera (Md Sahir & Mohd Ayub, 2015)(Mehrotra et al., 2022) (Okta Priantini, 2021).

In this case, the subject would be the tool bit grinding process. It is essential to all Diploma in Mechanical Engineering students since these are the vital skills they have to possess when machining using a lathe machine. Due to the time constraint factor, the student will be assessed on the first meeting, and they cannot imagine the techniques and the outcome of the tool bit. Previous assessments on tool bit evaluation showed unsatisfactory results obtained by students, even though they had been brief and demonstrated by their lecturers. This method will help generate students' understanding before they start their practical work. Additionally, this would make it simpler for lecturers to engage with their students while conducting in-class demonstrations. As a lesson learning aim, students should be able to grind tool bits in line with their geometry and specifications to succeed in their assessments. On top of that, they must also be able to grind well in such a short period.

The problem that occurs among new students were as follow;
i. Semester 1 students registered for DJJ10022 Mechanical Workshop Practice 1 and DJM10012 Mechanical Workshop Practice 1 lacks basic knowledge and skills in grinding tool bits; ii. Time taken by students to produce a tool bit was too long; iii. The end product was unsatisfactory as the tool bit did not meet the specific geometry. This study embarks on the following objectives; To design and develop an instructional education video on tool bit grinding technique.

Currently, available Teaching and Learning kits are in the form of hardcopy tool bit sketches as in figure (1) stationed at every grinding machine. Also, an illustrated sharpening technique for tool bit as in figure (2) was used to brief the students previously. The only available replica of a tool bit was crafted in wooden blocks as in figure (3). These tools were stationed in the workshop and used by lecturers during their briefing and demonstration sessions. Even though these tools were beneficial to students, unfortunately, it was only accessible during practical hours. Students had to go for other revision sources such as handbooks, websites, or online videos besides these hours. Most of these sources were common in general and did not focus on the assessment rubric for this course.

Figure 1: Tool bit sketches stationed at the grinding machine

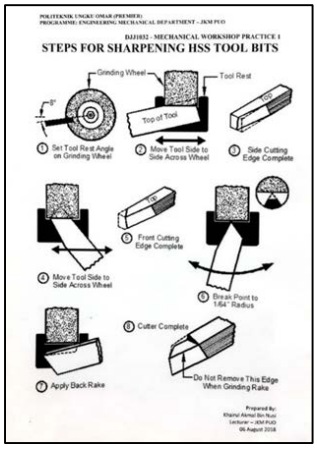


Figure 2: Tool Bit grinding process diagram

Figure 3: Tool bit wooden block sample. Teaching and Learning tool kit

The demand to produce a new education Teaching and Learning (T&L) tool kit adapting new techniques with comprehensive coverage of methods and techniques in line with social media evolution are essential. There is a need for a learning medium that can effectively deliver practical information clearly and comprehensively. A learning video is an appropriate medium for achieving these objectives. It is essential to promote video learning(Siang et al., 2019).

2. Literature Review

According to (Norton & Hathaway, 2010), instructional strategies are "the plans and techniques that the instructor or instructional designer utilizes to engage the student and facilitate learning," as well as "a strategy, method, or group of activities designed to achieve a certain purpose." The subsequent phase is video production. Researchers engage in brainstorming sessions to establish objectives and compelling content. (Siang et al., 2019) (Mayer & Moreno, 2003) suggested the procedural model is a descriptive model that illustrates the steps involved in producing the product. (Siang et al., 2019) (Sidek & Hashim, 2016) (Syaripuddin et al., 2019) recommended three phases: planning, design, and development. This process involves identifying the need, aims, and objectives, locating the source of materials, and creating flowcharts, as well as developing storyboards, screenplays, and narrative outlines (Hofer & Swan, 2008), while (Campbell & Cox, 2018) proposed the ICSDR (Identify, Conceptualize and Connect, Storyboard, Develop, Review, Reflect, Revise) model for videography.

The process of creating content involves capturing raw footage and then processing it (Shojaei et al., 2020). Considering the current technological advancement, it is prudent the produced video should be at a resolution near 4K. (Muniandy & Veloo, 2011) (Okta Priantini, 2021). A good video lesson requires the instructor to prepare the right equipment. A standalone 4K video camera and a sturdy tripod should be employed (Lipomi, 2020). Previously, video usage was considered an expensive option due to a lack of equipment and preparation time. Various tools and applications exist now for the creation of video-based learning. Therefore, instructors can create video clips based on their instructional style and creativity (Syaripuddin et al., 2019) (Sidek & Hashim, 2016). Today's smartphones make the video quality more satisfactory with the installation of 4K mode and many more instructional T&L videos may be developed in the future, thanks to the increasing sophistication of smartphone technology and other digital devices with video recorder functionality. 4K video gives greater image clarity and detail than regular video recordings, even when digitally amplified. 4K video can move from a global to a detailed view without reducing clarity, which is vital for this application. The benefit is that videos can be sent straight to a server or a cloud storage system (Woolfitt, 2015). It is one of the factors that has led to the widespread adoption of video as a powerful communication medium.

Videos will be more entertaining and impactful if the audio is relevant and appropriate. The following are some provisions on music and sound effects: The music used as accompaniment should have a low volume level (be mild) so that it does not interfere with the visual presentation and the narrator. The background music should be instrumental; refrain from using music with popular tunes. It will result in the distraction of students who are more focused on the sound of the song, using sound effects to enhance the scene, match the visual presentation, and improve the overall impression (Sulihin et al., 2020). It has been proven that, contrary to other pedagogical methods, music has a lot of advantages because it provides a comfortable atmosphere, elicits emotional responses, stimulates the neuro-mental activity of pupils, and has a positive effect on the physiological functions and emotional state of the body (Akhmadullina et al., 2016).

One of the major features that should be addressed to optimize student attention is the design of brief learning video recording duration (Kamlin & Keong, 2020); (Buchner, 2018); &

(Roller, 2016); nevertheless, the usage of multimedia-based instructional media has the potential to raise cognitive load (Mayer & Moreno, 2003); (Falvo, 2008); hence, a reasonable time frame for this instructional video must be considered. (Debra S. Osborn, 2010) suggested to educators that video lectures must not exceed 15 to 20 minutes. To overcome the issue of limited attention, (Kay & Kletskin, 2012) recommended the length of the produced video clip to a minimum duration of 3 minutes. The maximum time is 15 minutes. (Henno et al., 2014); (Whatley & Ahmad, 2007) consensually agree to 5 to 10 minutes for video duration with the maximum being 10 minutes (Fonte & Nistal, 2018). Contrary to (Martin & Martin, 2015), students do not study educational tutorial recordings for more than three minutes. (Noor et al., 2014) (Buchner, 2018) states that six minutes is the maximum time for videos. Students prefer to view some or a portion of the movie, skipping to the sections they felt were most relevant to them (Bowles-Terry et al., 2010). It will be able to limit the cognitive burden of students (Sidek & Hashim, 2016) if other researchers provide the proposed period for creating videos. Synchronization is the critical factor in producing this systematic instructional video and fulfilling the objectives at the required time.

3. Methodology

The project was initiated with brainstorming sessions with fellow collaborators to gain ideas and directions for this T&L video. A flow chart of activities as of figure (4) was formed based on the (Siang et al., 2019) (Sidek & Hashim, 2016) (Syaripuddin et al., 2019) recommendation. There were three phases involved; planning, design, and development. This process involves identifying the need, aims, and objectives, locating the source of materials, and creating flowcharts, as well as developing storyboards, screenplays, and narrative outlines (Hofer & Swan, 2008). These elements are determined based on; **i**. teaching pedagogy, **ii**. the objective of the video, **iii**. the outcome expectation and safety reminders, and **iv**. working procedures (grinding technique, marking rubric specification, and tool bit output figure complete with parameter checklist). Important elements such as essential parameters in the tool bit were highlighted for better understanding.

Figure 4: ViOT design and development flowchart

After creating a flowchart, then proceed with making a written storyboard. Storyboards are made to make it easier to visualize the ideas in mind so that they are more organized. followed by the next step development or video production. The storyboarding process was done by sketching out ideas on a piece of paper while the discussion keeps on continued so that each opinion or argumentation was pointed out clearly and highlighted. The next step is the decision-making and idea refinement process where only the critical element is selected. This video must be presented in a short and simple but loads with information.

The next step is the script and narration process. At this level, scripts were drafted according to key elements selected in the previous process. The aim was, that any subtitle embedded in this T&L video must be simple, straight forward and easy to understand. The third step is taking pictures or shooting videos. This audio and video production process includes shooting video, downloading, and image and voice recordings according to the demands of the storyboards and scripts that have been prepared previously. For this process, the image was captured and video shooting sessions were done by using multiple smartphones with tripods as a stabilizer. 4K video modes were selected for the whole shooting process. Microsoft PowerPoint software and Viva Video premium edition application for android were chosen for editing and narrating video stories. The Premium edition removes branding watermarks and can narrate a video for more than five minutes compared to the free version. . By applying Viva Video applications, video and audio are flawlessly blended. Images using the.jpg format and audio using the.wav format are used for MPEG video formats. Text or subtitles are added to video narration to make the video more understandable and engaging. The length of this video was fixed to five minutes. Suitable upbeat genre music is also included in this instructional video so that it will be more exciting. Music was downloaded from the Viva Video library.

4. Result and Discussion

Educational innovation based on digital technology has opened up a wide space for instructors to explore new knowledge toward producing pedagogical methods that are accepted by students in line with current technological developments. An idea started with designing until developing a new alternative teaching method leads to a successfully skill-based instructional video produced. The objective of this T&L video production was successfully fulfilled and achieved the goal. Important elements to convey to students were successfully summarized in a short video packed with information and demonstrations. The narration started with the front cover of the T&L video as figure (5) clearly stated the title. Students could easily identify the kind of T&L video they going to watch. To make the students attach to the video, as planned, the aim and the objective of the T&L video were shared with them before the actual demonstration started as in figure (6). Meanwhile, figure (7) showed how the video reminds all students to always wear personal protective equipment before handling the operation. Of course, on-site, the lecturers will ensure these safety precautions will be obeyed by students.

Figures5: Front page of T&L video

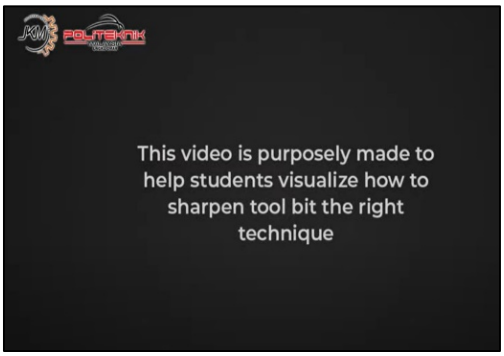


Figure 6: The aim and the objective of the video presented at the beginning ofthe video.

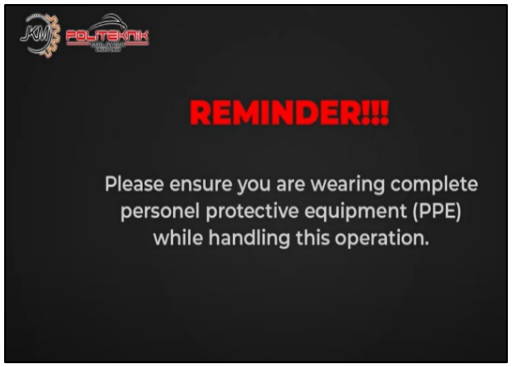
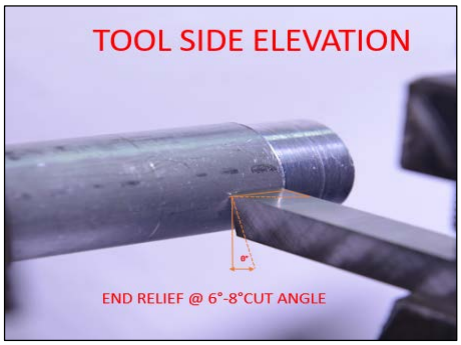
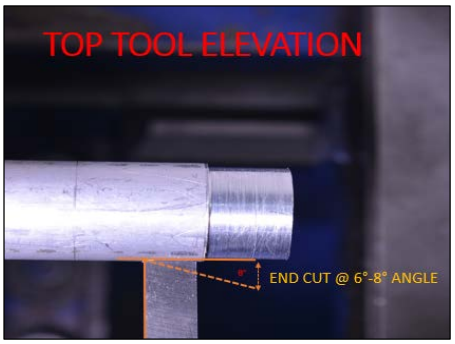


Figure 7: Students are reminded to wear personal protective equipment (PPE) while handling this operation

Still shots of components and processes captured by cellphones in 4K high-definition mode enhanced the clarity and vibrancy of the scene. Figures (8) and (9) illustrate the image quality produced by various smartphones. This will enable the instructor to visually communicate to students which angle to cut at and also indicate the tool bit's components. The tripod stabilizers are extremely useful for capturing stable images and videos. This video's content is more engaging as a result of its crystal-clear visual and video quality.



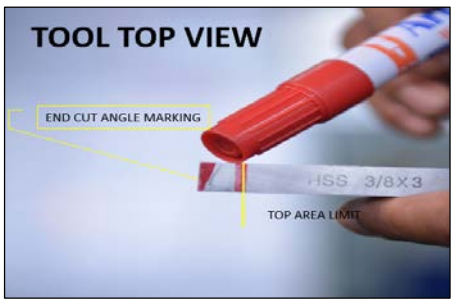


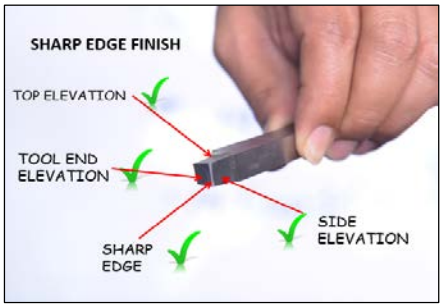
Figures 8 & 9: Image captured with a 4K resolution smartphone with a tripod for stability helps enhance photo clarity

Microsoft Office PowerPoint is software for animating and converting main slides to video to be utilized as parts of video content. Fonte & Nistal, 2018, employed a similar method to capture a slide show that might include audio for the explanation. The first phase involves photographing or filming. Using Microsoft PowerPoint slides is the simplest method for accentuating significant information and details. Therefore, the arrangement and editing of narration would indeed be simple. Using this software made animation and video transcoding straightforward. Key aspects such as objectives, lesson outcomes, tool bit parameter labelling, and other graphics can be animated to make them more engaging and then converted to video format. Any free Android video application edition is limited to 15-minute recordings and includes a watermark, and webcam recordings are limited to 5 minutes. (Snelson, 2018).

When creating this video, the major consideration was the students' concentration. The developer of the video does not want the instructor to distract the viewer's attention from the main objective. Throughout the entire process, only the instructor's hand is visible to the students, not the instructor. Therefore, students will only devote attention to the technique and not the instructors. Figures 12 and 13 illustrate how demonstration tactics are only applicable to the instructor's hand. With the inclusion of high-definition images and videos, the creators ensure that only the tool bit parameters, techniques, and procedures are highlighted by zooming in. The video is more systematic and also of higher quality when it incorporates step-by-step demonstration methods. Text or subtitles were other essential elements necessary to complete this video. By reading the subtitles, any technical terminology or instructions could be comprehended more easily. Despite video presentations, this certainly improves students' comprehension of the procedure. Therefore, embedded subtitles and Google's Artificial Intelligence (AI) voice-over were added to the video. Figures 10 and 11 demonstrate how subtitles are inserted within a video.

Figures 10 & 11: Subtitles embedded in the video in the simplest way for better understanding





Figures 12 & 13: Figure focusing only on the key lesson rather than to instructor

To make this T&L video more accessible, this video had been uploaded to YouTube aside from Whats App and Telegram platforms. More quality videos with high-definition clarity can be made when it comes to YouTube. This will enable the video size limitation when it delivers thru Whats App. This Teaching and Learning (T&L) video was shared with respective workshop lecturers and from them, the video will be disseminated to students. It was effectively implemented during the practical workshop by all lecturers. This T&L video was applied explicitly to all semester one students in Mechanical Engineering Department, Politeknik Ungku Omar. (Muniandy & Veloo, 2011) and adding elements of effective audio and images help students learn and remain focused (Forbes et al., 2016). Through the use of video application techniques (Syaripuddin et al., 2019) (Kamlin & Keong, 2020) benefits must be identified in the use of video in learning. Consequently, the benefits of this instructional film were as follows;

i. This Teaching and Learning (T&L) video only took a 5-minute duration and is in acceptable size for downloads. It is convenient for students to share the video without compromising their internet data.

ii. Students could improvise the demonstration concept presented in the Teaching and Learning (T&L) by watching the video repeatedly.

iii. Students' psychomotor movement will automatically react with pre-captured motion via visualization, (Snowdon et al., 2008).

iv. Proper demonstration techniques shown by lecturers would benefit directly students in producing accurate geometry. The use of pictures, sounds, animations, and videos in teaching affects the intelligence of students in a certain field (Salsidu et al., 2018).

v. With proper skills, waste could be reduced tremendously and this will help sustainability in raw material consumption.

vi. This video would also be benefited all levels of the community out there who are involved in lathe machining and also for those who need a reference for the tool bit grinding process.

vii. Access to video content for an unlimited population of students

5. Conclusion

This T&L innovation video was strategically built by covering the whole aspect of the teaching and learning method. Its begins by highlighting the learning outcome, safety precautions, and personal protective equipment reminders. The order sequence also was planned in detail according to the right method and important labelling was also provided visually to help the students enhance their understanding. The way this video is presented makes it more simple, more practical, and easy to revise. It helps them more when it comes to the practical session along with the guidance of lecturers. Furthermore this T&L video not only benefited Politeknik Ungu Omar students but also all communities who pursue knowledge and lifelong learning. Future studies on the efficacy of this T&L video must be carried out so that the collected data can prove how well this T&L video has an impact on students or vice versa.

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