

# Teachers' Perception of Using STEM Video for Teaching and Learning

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**Abstract:** Malaysia students' reluctance to choose Science-related stream for their secondary education starting the year 2015 to 2016 has affected the national education agenda. In Pelan Pembangunan Pendidikan Malaysia 2013-2025, the need for enhancing STEM is clearly underscored by many STEM initiatives being in the pipeline. Among the initiatives is the collaboration project between a public university, Universiti Teknologi Malaysia and Ministry of Education called STEM Video project which highlights the importance of STEM concept and relation to real-life application to ensure better critical thinking and concept knowledge acquisition. However, investigation on how teachers would react to the introduction of new technologies in classroom is very crucial. Hence, selected teachers from STEM background were invited to develop these videos and a survey was administered to identify 800 teachers' perception of using these videos for teaching and learning. Findings from the survey were analyzed and the study found that teachers in Malaysia believed that using STEM Video for teaching and learning would be beneficial and acceptable. However, their level of readiness were low and they reported their concerned over the limiting factors that could inhibit the success of STEM video implementation such as infrastructure and time constraint.

**Keywords:** STEM Education, Video-based Learning, STEM Video

## 1. Introduction

The increasing number of Malaysia students who refused to choose science, technology, engineering and mathematics (STEM) related courses for secondary education has drawn national's concern. Research shows that the number of students enrolling in Science-related courses is decreasing (Halim & Meerah, 2016) which may due to several factors such as lack of interest (Osborne, Simon & Collins, 2003) and perception that science-related subjects are difficult (Checkley, 2010). Studies found that the quality of teaching in science-related areas is also one of the determinants of students' interest in learning the subject (Osborne, Simon & Collins, 2003). Technology adoption has the potential to improve students' interest in STEM to create more engaging learning environment. STEM video project is one of the initiatives by Ministry of Education Malaysia to promote STEM learning and STEM concept understanding in a more engaging way. In Malaysia, teachers play an important role in classrooms as an individual who held the responsibility of selecting resources for teaching and learning including adopting technology-based tools such as video. However, teachers' readiness to adopt technology can be related to many factors such as attitude, competency, or confidence level. Development of videos for teaching and learning is costly and time-consuming hence teachers' attitude towards using video for teaching STEM is very important.

## 2. Research Background

### 2.1 Using Video for Teaching and Learning

Video has been used extensively in teaching and learning for many purposes. Traditionally, video is used to demonstrate or to show real-life examples (Kearny & Treagust, 2001) mainly because videos preserved the original settings of the intended examples. A video can be used to assist understanding

on complicated concepts (Wall, Higgins & Smith, 2005) or trigger a learning session by activating students' inquiry (Chan, Patil, Chen, Lam, Lau, & Ip, 2010). A recorded video can also serve as a reflection tool for teaching and learning where teachers can analyze teaching strategies to improve teaching methods. In teacher training, a recorded video allows pre-service teachers to narrow the gap between theory and practice by allowing pre-service teachers to reflect on the recorded teaching examples (Seidel, Blomberg, & Renkl, 2013) and improve their observation skills (Star, & Strickland, 2008). Similarly, video-based learning is very effective in high-risk education field such as medicine where students can learn more about the surgeon's technical skills from video (Mota, Carvalho, Carvalho-Dias, Costa, Correia-Pinto and Lima, 2018).

However, because development of videos is time- and cost-consuming, not many interactive videos were designed. Most videos were designed passively where students have to watch videos and reflect on the video content. Interactive videos are more beneficial for teaching and learning because they improve learning comprehension and retention (Hung, Kinshuk & Chen, 2018), enhance learning performance and learning satisfaction. More importantly, for subjects that include STEM content, an interactive video is very important to engage students in learning by allowing students to plan, monitor and evaluate their learning process (Delen, Liew, & Willson, 2014) and improve students' conceptual understanding about STEM. Vural (2013) found that, using question embedded video in online learning improved students' amount of interaction and time spent with the learning materials compared to traditional video. The increasing uses of online and offline videos for teaching and learning calls for more videos those are properly designed to improve students' learning engagement.

## *2.2 STEM Video for Teaching and Learning in Malaysia*

STEM video focusses on making STEM learning more interesting while ensuring that concept about science is explained in relation to students' real-life application. Universiti Teknologi Malaysia participated in MIT-BLOSSOMS Project in 2015 where BLOSSOMS project emphasized on teaching the abstract and difficult STEM concepts through a series of active learning activities and video segments termed as 'teaching duet' (Larson, 2009). The video builds from an architecture that is written based on STEM concepts that teachers perceived as difficult to explain or concepts that students frequently misunderstood. It consists of Introduction Segments, Activity Segments, Video Segments and a Teacher's Guide segment that tells teachers about how to use the video. Teachers developed the architecture based on the development process and later developed the videos through video shooting processes. Video segments and activity segments reiterate during the whole video duration (see <https://blossoms.mit.edu/videos>).

## *2.3 Teachers' Perception about Using Video for STEM Teaching and Learning*

Previous studies about BLOSSOMS videos show that BLOSSOMS videos can improve students' level of critical thinking and understanding about science concept (Hamizan & Zaid, 2014) yet to fully utilize and integrate these videos in Malaysia curriculum system is a challenge (Abdullah & Shukor, 2017). These videos can greatly shift teaching STEM paradigm in Malaysia schools but comprehensive understanding about teachers' perception towards using video technology for STEM teaching has to be carried out. Kumar, Rose and D'Silva (2008) found that Malaysian teachers' actual usage of computers was only at moderate level although they had undergone intensive computer training programs. When teachers perceived technology to be useful and that using technology would increase their productivity, their intention to use will be significantly increased. However, Malaysian teachers generally have high level of technology acceptance, but their readiness to use technology for teaching and learning purposes remains at low level (Ismail, Bokhare, Azizan & Azman, 2013).

Having access to technologies does not directly lead to technology implementation in classrooms (Cuban, Kirkpatrick, & Peck, 2001). In Malaysian classrooms, teachers play the central role for selecting the desired resources and have the autonomy to maneuver teaching and learning process in classrooms. For this reason, teachers' perception of using STEM video for teaching and learning is very crucial. Hence, to provide deeper understanding of teachers' intention to use STEM videos this study explores teachers' perception about STEM Videos based on its usefulness,

teachers' readiness, ease of use and teachers' acceptance towards using the video in their classrooms. These constructs were based on TAM model (Davis, 1989) which measures how users accept and use a technology. In TAM model, users' perceived usefulness and perceived ease of use are hypothesized to be the fundamental determinants of user technology acceptance. In detail, perceived usefulness is user's subjective belief that using a technology could improve job productivity and efficiency ease of use is user's belief that using a technology will be free of effort. In many studies, it was reported that perceived usefulness has direct and indirect effects towards behavioural intention. That is, a teacher has the tendency to use technology if he/she perceives technology to be a useful and meaningful way to work more effectively.

### **3. Research Methodology**

#### *3.1 Samples*

They were a total of 800 teachers being randomly selected to answer the questionnaire however only 680 questionnaires were returned. These teachers were randomly selected to attend a seminar that introduced the teachers to STEM Videos. In this study, the selected teachers teach Science, Mathematics, Engineering or Technology-related subject in secondary schools and were experienced teachers with most teachers having more than 10 years of working experience (69.21%) and at least 25% teachers have 6 to 10 years of teaching experience while other teachers have 1 to 2 years and 3 to 5 years teaching experience respectively. While majority of the teachers were mostly computer literate (75.6%), only small percentages did not know about using the combination of Microsoft Office (5.3%), Web Browser (7.7%), Social Network (2.7) and any two skills (8.6%).

#### *3.2 Instrumentation*

A questionnaire was developed to identify teachers' perception of using STEM Video for teaching and learning. The set of questionnaire contains Likert Scale items and open ended questions in the following six (6) sections; Section A: Demographic Information, Section B: Teachers' perception to use STEM Video as one of the tools for teaching and learning based on their level of readiness, Section C: Teachers' Acceptance to use STEM Video, Section D: Teachers' Perception to use STEM Video based on its usefulness, Section E: Teachers' Perception to use STEM Video based on its ease of use, and Section F: Suggestion and Recommendation. The reliability of the items in the questionnaire was tested to find Cronbach alpha value where items for level of acceptance ( $\alpha = 0.905$ ), perception based on usefulness ( $\alpha = 0.937$ ), perception based on ease of use ( $\alpha = 0.904$ ) have good internal consistency while items in level of readiness are moderate ( $\alpha = 0.791$ ).

#### *3.3 Research Procedure*

A survey approach was used in this study administered among teachers in six series of seminars around Malaysia. In every seminar teachers were grouped into smaller groups and assigned one STEM Video to be reviewed. After watching the STEM Video, they have to answer the questionnaire investigating about their perception on using STEM Video for teaching and learning. The collected data were analyzed using IBM Statistical Package for Social Science (SPSS) version 22. Findings were described based on descriptive statistics such as mean and frequencies.

### **4. Findings and Discussions**

This section draws together the quantitative data gathered from all participants, along with data from participants' comments and suggestions to provide a better understanding about teachers' perception. Overall descriptive statistics indicate the moderate nature of the perceptions of the surveyed teachers on the level of readiness (overall mean = 3.89), on the level of acceptance (overall

mean = 3.91), on perceived usefulness (overall mean = 3.79), but slightly high on perception on ease of use (overall mean = 4.01).

#### 4.1 Teachers' Perception to use STEM Videos based on Level of Acceptance

Generally, teachers accept the use of STEM video in the future and have the tendency to promote STEM video for others to use but agreement to use STEM video regularly is quite low. However, they believe that STEM video provides more interactive teaching and learning (see Table 1). This is in line with studies by Ismail et al (2013) who found that Malaysian teachers welcome any new technologies in their classroom but that does not necessarily indicate that they are ready to use the proposed technology.

Table 1

*Teachers' perception to use STEM videos based on level of acceptance*

No	Item	Min	Max	Mean	Standard Deviation
B1	I am interested in developing and using information in STEM Video	1.00	5.00	3.76	0.82
B2	I will use STEM Video in the future	1.00	5.00	4.04	0.70
B3	I plan to use STEM Video regularly	1.00	5.00	3.64	0.82
B4	STEM Video makes teaching and learning more interactives	2.00	5.00	4.14	0.72
B5	Teaching with STEM Video encourage students to give more attention to me	1.00	5.00	3.79	0.82
B6	Teaching with STEM Video is simple	1.00	5.00	3.93	0.76
B7	Using STEM Video did not bores me	1.00	5.00	3.88	0.80
B8	I intend to inform and show others about STEM Video	1.00	5.00	4.09	0.69

#### 4.2 Teachers' Perception of using STEM Videos as one of the tools for teaching and learning based on Level of Readiness

Abdullah and Shukor (2017) stated that integrating STEM video in Malaysia curriculum is a challenge due to time-constraint and current exam-oriented system which limits teachers' possibilities to use other reference materials for teaching and learning than textbooks. This study found that teachers' level of readiness to use STEM video is quite low (refer to Table 2). As shown in previous section, teachers' level of acceptance on using STEM video is generally moderate but they seems to be not ready to use STEM video for teaching and learning. However, teachers believe that STEM video improves their own understanding about STEM related concept. This is an important indicator of the quality of video content in STEM video which can promote teachers' understanding about Science, Maths, Engineering and Technology content and concepts.

Table 2

*Teachers' perception to use STEM videos based on level of readiness*

No	Item	Min	Max	Mean	Standard Deviation
E1	I am willing to use STEM Video for strengthening students' understanding in Science or/and Maths concept	1.00	5.00	3.65	0.81
E2	I am willing to use STEM Video for teaching tool for a teaching session	2.00	5.00	3.83	0.68
E3	I am willing to use STEM Video additional information to improve my own understanding about STEM related concept	2.00	5.00	3.86*	0.67
E4	I am willing to use STEM Video to increase student interaction in STEM class through activities in STEM video	1.00	5.00	3.79	0.69
E5	I am willing to use STEM Video to replace my teaching method related to STEM	1.00	5.00	3.54	0.83

#### 4.3 Teachers' Perception to use STEM Videos based on its Usefulness

Although teachers generally accepted the use of STEM videos for teaching and learning, they did not strongly agree that STEM video allows them more time and freedom to observe students' learning activity. They strongly believe that STEM video could serve as an important tool to help them with teaching concepts in STEM (refer to Table 3). In a multimedia supported learning environment, teachers' role become more complex because they have to manage the learning environment, scaffold activities, monitor progress and provide feedback as well as assessing students' performance (Kumar et al, 2008) leaving teachers very little room and freedom to observe students' learning. Such perception is very common where teachers often believe that they were expected to be the knowledge provider and facilitation can only be carried out whenever instructions have been delivered.

Table 3

*Teachers' perception to use STEM videos based on its usefulness*

No	Item	Min	Max	Mean	Standard Deviation
C1	STEM Video will enhance the effectiveness of my teaching process	2.00	5.00	4.01	0.68
C2	STEM Video will improve my efficiency of teaching concept that is difficult to understand	2.00	5.00	4.05	0.72
C3	STEM Video will allow me to easily observe student learning activity	2.00	5.00	3.93	0.73
C4	STEM Video will allow me to easily manage my teaching	1.00	5.00	3.91	0.74
C5	Learning activities in STEM Video will make my teaching more meaningful	1.00	5.00	4.00	0.69
C6	STEM Video makes it easier for me to teach STEM concept	2.00	5.00	4.02	0.71
C7	STEM Video as a useful tool in teaching and learning STEM	2.00	5.00	4.12	0.68
C8	Overall, I find that STEM Video as beneficial for my teaching	2.00	5.00	4.09	0.65

#### 4.4 Teachers' Perception of using STEM Videos based on its Ease of Use

Teachers were introduced to STEM videos by demonstration and they have lack of experience in using STEM videos. This setting has greatly affected teachers' perception about using STEM video based on its ease of use. Findings show that their belief that using STEM video is free of effort is at low level. This is reflected in item D1 (mean = 3.65) indicating low agreement (refer to Table 4). It can be due to their low computer teaching efficacy. Computer teaching efficacy is related to teachers' evaluation of their capability to teach with computers and their personal belief in using computers as an effective teaching tool to improve students' performance in learning. Wong et al (2012) found that Malaysian teachers' computer teaching efficacy can have significant effect on teachers' intention to use computer technologies in classroom. Similarly, lack of time to fully watch STEM video during demonstration (in seminar) probably affected their belief that they have to frequently watch the Teacher's Guide to fully understand the content of STEM video (mean = 3.54). But, it clearly shows that teachers believe the availability of Teacher's Guide segment in STEM video is important as it would assist teachers to use STEM video in the classroom (mean = 3.94).

Table 4

*Teachers' perception to use STEM videos based on its ease of use*

No	Item	Min	Max	Mean	Standard Deviation
D1	I find that it is easy to fully utilize STEM Video	1.00	5.00	3.65	0.81
D2	I find that STEM Video allows flexibility to interact with students and other teachers	2.00	5.00	3.83	0.68
D3	I find that STEM Video allows flexibility to interact with	2.00	5.00	3.86	0.67
D4	I did not get confused when I use STEM Video	1.00	5.00	3.79	0.69
D5	I did not need to consult teachers' guide frequently when using STEM Video	1.00	5.00	3.54	0.83
D6	I can fix the problem of understanding STEM related concept when using	1.00	5.00	3.89	0.70

	STEM Video				
D7	STEM Video provides helpful teachers' Guide in assisting the usability in the classroom	1.00	5.00	3.94	0.71
D8	Interacting with STEM Video did not require a lot of my mental effort	1.00	5.00	3.72	0.77
D9	Overall, I find it easy to teach using STEM Video	1.00	5.00	3.89	0.72

## 5. Conclusion

Teachers' acceptance and readiness to use technology is very important due to the autonomous role that they play in the classrooms. When teachers were introduced to STEM videos in a series of seminar, this study found that Malaysian teachers believed that using STEM Video for teaching and learning was acceptable and they perceived STEM video as beneficial for teaching and learning as well as for themselves. However, they found it as quite a challenge to use it in the classroom due to several infrastructure and other limiting factors. The limiting factors could lead to very slim chances that the teachers will have the intention to use STEM videos if the existing barriers were not mitigated.

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