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The effectiveness of object segmented and non-object segmented instructional video for on-job practical skill training

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Abstract: *Instructional video as training aids allows proactive increases the understandings video content. This Empirical of effective type of instructional video study examined to overcome the current text and picture form practical skill training aid used. This method is inadequate and difficult to be visualized by the hard disk assembly operators during the training session. As results the assembly method skills vary based on their understanding and these risks the output yield. A single group pretest and posttest design is used for the study of effectiveness of instructional video types on skill outcome and operators motivation in on-job practical skill. Two type of video studied: object segmented and non-objected segmented instructional video. Results of the experiment showed that the value of instructional video for learning effectiveness was contingent upon the object segmented instructional video. The operators that used object segmented instructional video achieved significantly better learning performance and a higher level of learner confidence than those in non-objected segmented instructional video. The findings suggest that it may be important to isolate the background in the instructional video in order to increase learners focus.*

Keywords: *Effectiveness, Instructional Video, Non-Object Segmented, Object Segmented, On-Job Practical Skills.*

I. INTRODUCTION

Learning provides 'intellectual growth that leads to scientific reasoning, abstract thought, and formal operations' (O'Loughlin, 1992). As information technologies like virtual workspaces and digital libraries have developed, they have added new environments for teaching and learning and have given rise to new areas for research. Learning enhanced by information technologies is gaining momentum. This is partially in response to the demand for reduction in time-to-competency in the knowledge-based economy, encouraged by demanding competition and globalization. Many companies need to offer effective practical skills training to employees and business partners to ensure that they acquire new skills in a timely manner.

Today, videos are widely used to provide instructional practical skills training. One reason for this trend may be due to the assumption that multimedia information helps people learn better. Video is a rich and powerful medium being used in teaching and learning. It can present information in an attractive and consistent manner. People enjoy videos, prefer video based learning materials, and believe that videos are more effective regardless of the mode, format or their type. One popular example of this growth is the YouTube reception throughout the global market.

There are many types of videos gaining market share, and more significantly a diverse supportive user base. The object segmented and non-object segmented instructional video is all about how the use of the foreground and the background of a video and its effectiveness.

The object segmented is to delineate the boundaries of all moving and static objects occurring in an arbitrary video (Brendel and Todorovic, 2009).The non-Object segmented video is a series of video frames are run in succession to produce a short, animated video (Muybridge, 1870).

This study is about the preference and the focus of user in an instructional video which leads to the effectiveness of the video.

The study is to measure the effectiveness of object segmented and non-object segmented instructional video for on-job practical skills training; assembling a hard disk drive without flaw. This research focusing on the hard disk assembles methods using object segmented and non-object segmented instructional video as training tool.

II. PROBLEM STATEMENT

Assembling hard disk is almost critical process. The assembly skill plays major role in determining the production yields output. Without proper training and standardization this output yield can easily be jeopardize due the large number of operators involved in the assembly line; which is operates 24 by 7. The current text & picture form practical skills training aid is insufficient and hard to be visualized by the operators during the training session. As results the assembly method varies by on their understanding and this risk the output yield. A proper practical skills training in aid is essential to provide a same training over and over again as refreshment

to current existing operators and for the new operator. It's crucial that the actual workstation must be shown in the training aid to make the audience or operators. This to make them familiar with the working environment before the actual hands on session occurs. To overcome this issue an instruction via video is the best tool.

Hampton (2002) sees video as "a successful medium because it links the audio and the visual together to provide a multisensory experience for the learner." He observes that video makes it possible for the learner to play, replay, pause and rewind to specific sections of the lesson and further contends that "because practice and rehearsal is so important in developing competency, video is particularly well placed".

However the effectiveness of the instructional video must be measured and studied prior to the implementation. The concentration and the audience focus on the video also must be studied. This driven by noise/distraction that that can be capture during the video recording. Therefore it's vital to study two types of videos; object segmented instructional video and non-object segmented instructional video. Since, There is not much is literature regarding empirically documented works about the instructional effectiveness of video object segmented instructional video and non-object segmented instructional video approaches for the teaching on-job practical skills to operator to perform a task.

This void in literature needs to be filled in order to increase our understanding of the effectiveness of the object segmented instructional video and non-object segmented instructional video used in teaching on-job practical skills. This study was undertaken to provide feedback regarding the comparative instructional effectiveness of the two approaches to teaching practical on-job skills to operators, while at the same time attempting to fill the identified gap in literature.

III. OBJECTIVE

The main objective of this study is to measure the effects of the object segmented versus non-object segmented instructional video materials for the training of on-job practical skills in assembling a hard disk in an electronic company in Kulim, Kedah.

Specifically, this study is designed to compare the level of learning and practical skill acquired when two type of different instructional video is used.

In this study the term non-object segmented video refers to a typical conventional video. It displays moving visual images created by 'photographing actual scenes with a motion picture camera' (Francesco, 1999).

Whereas, the object segmented video refers to moving images which are displayed after the foreground or the object is isolated from the background. It emphasizes on what actually wanted to be shown on the screen and discards unwanted the noise which is the background (Brendel and Todorovic, 2009).

The specific objectives of this research are:

3.1 To investigate the effects of two different type of instructional video (non-object segmented and object segmented instructional video) by conducting experimental study with operators which access their skill level before and after the engaging of the instructional video.

3.11 RESEARCH QUESTION 1: Is there any significance different in the skill score between the two types of the instructional video?

- Hypothesis 1: There is no significance different in skills score between the two types of instructional video.

3.2 To conduct a perceived motivation test which accesses the operator's learning experience after the engaging of the two different type's instructional video.

3.21 RESEARCH QUESTION 2: Is there any significance different in operators perceived motivation score between the two types of instructional video?

- Hypothesis 2: There is no significance different in operator's perceived motivation score between the types instructional video

IV. RESEARCH FRAMEWORK

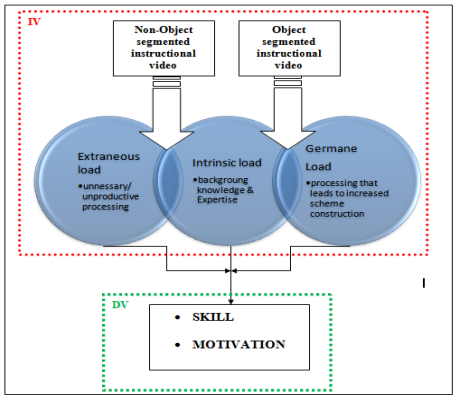

Figure 1: Research Framework

The research framework above is developed by adopting Sweller's cognitive theory (1988). This research framework is designed based on the hypothesis of this study. For example a combination of extraneous and intrinsic load contributed by the non-objected segmented instructional video leads to information loss due the noise in the instructional video. On the other hand the combination Intrinsic and Germane load contributed by the objected segmented instructional video leads to effective learning as information is well stored in the brain.

Andrews, (2009) stated that the background or low-level noise in the home, work or school often disrupts people's concentration. Pervious study also has shown that the human memory process Information in working memory is stored primarily is only about 7 bits of information (Appleby, 2011). Therefore unwanted information or noise should be avoided to prevent overload in the memory (e.g. Object or people in the background of an instructional video), in order for effective learning to occur and to increase the skill level plus motivation.

V. LITERATURE REVIEW

5.1Instructional Videos And Learning

According to Lin and Hsieh (2006), "multimedia has become a mainstream information platform adopted in most computer aided training systems". In today's age, instruction that is transferred through computers is often presented using this means of information transfer. The technology allows for Differentiation as information can be transferred visually, audibly, and even kinesthetically to meet the needs of unique learners and specific desired outcomes. Multimedia can be especially beneficial to English language learners and students with disabilities or special needs (Cisco Systems Inc, 2008).

Furthermore Aragon and Zibrowski (2008) found that instructional videos were beneficial in allowing students to view fine details of procedures. Often in a live demonstration, the users are divided into small groups to observe an instruction from a distance. This method is difficult for the users to learn the complex steps. Therefore, they often have to take turns to view the demonstration in close-up. It's not possible for them to absorb the entire procedure. The usage of the instructional video it has become possible for the user to observe the demonstration from close-up viewpoint. This is also ideal for students with visual disabilities as images and text can be enlarged on a computer screen (Lam, 2005).

5.2cognitive Load Theory

The Cognitive Load Theory is instructional theories that start from the idea that our working memory is limited with respect to the amount of information it can hold, and the number of operations it can perform on that information (Gerven, 2003). Learners ought to be encouraged to use limited working memory efficiently, especially when learning a difficult task (Gerven, 2003). Reorganization of the role and the limitation of working memory will help develop quality instruction (Cooper, 1998). It's an instructional designer responsibility to find ways to help the optimization of the working memory. The important part of the theory is the relation between long-term memory and working memory, and how an instructional material interacts with this cognitive system (Ayres, 2006).

It's vital the information received should a very important and the noise should be discarded for effective learning to happen. According to Chipperfield (2006), the more extraneous load the less room for germane load. As an instructional designer, its essential is to minimize the amount of extraneous loads when developing instructional design and maximizes germane load for schema formation to take place.

For instance, the germane load will help in building new complex schema in a consecutive way. It assists the learner to become an expert from novice level. Germane load works by self effort to gain knowledge and remember information learned.

However, the extraneous cognitive load does not contribute to learning (Chipperfield, 2006). It's an outcome of the method in which to-be-learned information. Though, this can be altered via instructional design by enhancing the organization, chunking, and presentation techniques of to-be-learned information, using addition aids, and providing specific learning instructions.

On the other hand, the total amount of cognitive activity that is imposed on working memory at an instance in time is called cognitive load. The number of items that needs to be attended is the major factor that contributes to cognitive load.

Finally, the way of information arrangement in long-term memory that enables to solve a certain group of problems and at the same time save working memory by chunking information elements and production rules into a whole is called cognitive schemata. It facilitates transfer of performance of an acquired knowledge (Gerven, 2003). The difference between an expert and novice schema is based on their ability to categorize problems using schemas stored in long-term memory (Chipperfield, 2006).

5.3 Segmentation In Learning

Many animations impose a high cognitive load due to the transience of information, which often hampers learning. Segmentation that is presenting animations in object pieces (i.e., segments), has been proposed as a means to reduce this high cognitive load. The expertise reversal effect shows, however, that design measures that have a positive effect on cognitive load and learning for students with lower levels of prior knowledge, might not be effective, or might even have a negative effect on cognitive load and learning for students with higher levels of prior knowledge. This experiment with animated worked-out examples showed an expertise reversal effect of segmentation: segmented animations were more efficient than normal animations (i.e., equal test performance with lower investment of mental effort during learning) for students with lower levels of prior knowledge, but not for students with higher levels of prior knowledge (Spanjers, 2011).

5.4 Object Video Segmentation

Object Video segmentation is a well-studied area of research, resulting in a variety of applications and techniques to put the presented work in context and provide focus to the reader, a selection of research relevant only to the post-production application of segmentation is given. Video segmentation is to enable content-based representation by extracting objects of interest from a series of consecutive video frames "Interactive video cutout "by Wang et a, (2005).

VI. METHODOLOGY

Quantitative method is mainly used in analyzing effectiveness type instructional video used. A single group pretest and post design has been implemented in this research.

6.1 Data Source And Instrument

The skill level of participation is gathered by using instrument which is distributed among the Hard disk assembly operators. The purpose is to gather data that sufficient regarding what they do understand and don't understand regarding the hard disk assembly procedure method before and after they have gone through the instruction medium. For this study two set of sets will used. The data from the following method will be collected and analyzed.

- Skill measurement : Pretest vs. Posttest
- Motivation measurement : Questionnaire

6.1.1 Skill measurement (Pretest vs. Posttest)

The samples which are 42 operators have been divided into two groups. A total 42 set of test paper equally divided into two groups and distributed to two groups of samples. One group will represent the object segmented instructional video users and the other group will be non-object segmented instructional video users. This sample size is representing the current four shift group operator consist of 48 people at time of this study.

Each group members are equally selected and segregated into two groups based on their duration of service years, education level, position ranking and gender. This done in prior to ensure both group members are equally balanced and no bias will occur during data collection.

The test will take place prior to the usage of the courseware (Pretest) and after the usage of the courseware (post test) to test the improvement of motivation and effectives of their skill through this courseware.

6.1.2 Motivation measurement (Questionnaire)

A self-completion questionnaire was also used for the study to. Likert-scaled instrument that was designed to assess motivation by (Keller, 2006) and use of learning strategies by operators. The motivation scales tap into three broad areas: Questionnaires are easy to administer, user-friendly, and fast to score. Therefore, it takes relatively little time for the respondents and researchers to complete and score the questionnaires. Additionally, similar user-acceptance and effectiveness studies have used researcher-designed self-completion questionnaires for data collection (King & He, 2006; Legris, Ingham, & Collerette, 2003; Schepers & Wetzels, 2007; Turner et al., 2010).

6.2 Population And Sampling

This study is the carried in an electronic company in Kulim hi-tech park, Kedah. According to the latest list from Human Resource Department of this company there is a total of 2290 operators working here is this company. This operators are working pattern are distributed into 4 shift groups; A, B, C and D to cater the output needs and run production by 24 by 7.

However, only a sum 48 operators is considered the total population of this study. This is due to only 48 people are in involved directly in this hard disk assembly process. There are 12 operators in each shift

groups. A total of 42 operators are selected as sample to carry out this study. Based on the sample size calculator below this sample has confidence interval 5.4

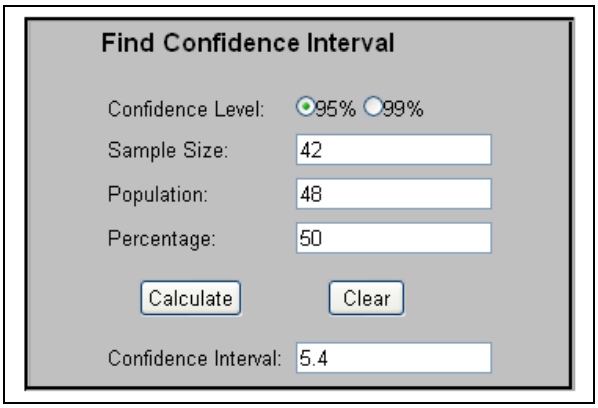

Figure 2: confidence interval

$$s = X^2NP(1-P) \div d^2(N-1) + X^2P(1-P).$$

s = required sample size.

X^2 = the table value of chi-square for 1 degree of freedom at the desired confidence level (3.841).

N = the population size.

P = the population proportion (assumed to be .50 since this would provide the maximum sample size).

d = the degree of accuracy expressed as a proportion (.05).

Figure 3: confidence interval formula

This sample size is calculated based on the studies of 'Determining Sample Size for Research Activities' by Krejcie and Morgan (1970), the sample size in population. Therefore based on the calculation formula above; 42 operators are indentified and selected for this study purpose are considered enough for this study.

6.3 Factorial Design Of The Study

	NON-OBJECT SEGMENTED VIDEO	OBJECT SEGMENTED VIDEO
Operators	X	X

Figure 4: factorial design

The pretest and post test measures the operators to skill score of the effectiveness the two type of instructional video. The design will be tested on two independent variable; Non-object segmented instructional video and object segmented instructional video. The achievement of the operators will be recorded to determine the effectiveness of the treatment.

$O_1 \rightarrow X_1 \rightarrow O_3$ +IMMS
$O_2 \rightarrow X_2 \rightarrow O_4$+IMMS

O_1, O_2 → Pretest
O_3, O_4 → Posttest
X_1, X_2 → Treatment
IMMS = Motivation

Figure 5: Quasi experimental single group of pretest and posttest design

6.4 Research Procedure

The Pretest/ posttest and questionnaire were crafted plus designed to fulfill the study needs. The Questionnaire was developed using Ms Excel instead of MsWord to ease the construct process.

The courseware prototype was devolved using Author ware platform. The design factor was as simple as possible.

STEP 1: For the purpose of content validity the prototype (both hardcopy and digital) is sent to an expert in Korea for evaluation. The evaluation is done through email communication and over the phone.

STEP 2: four the purpose of pilot test four operators are selected based on their number of service years. Two operators are seniors and another two operators are juniors. The operators feedback was done in a room together with the engineer so that they are comfortable talking to designer. Explained the objective of this evaluation session and ensure them this design is to help them. Once they are comfortable, evaluation the prototype started. These operators will be excluded later in the real testing.

At the end of the prototype evaluation got their input or feedback regarding the courseware prototype. The respondent verbally expressed that they are looking forward for the actual instruction courseware.

STEP 3: Sample selection and segregation into two group equally to avoid any inhomogeneous.

STEP 4: Pretest is given to the samples, in order to compare improvement via post test after the usage of the cost. This ensures the cause effect is smooth and reliable.

STEP 5: The course practical skills training is conducted and given to try out by operators for 2 days to get engage in order learning to occur.

STEP 6: A post is given to sample to indentify the improvement on skill before and after the course ware usage. The questions are same as the pretest but it's randomized.

STEP 7: A set questionnaire is given measure the motivation level after the usage of the courseware.

STEP 8: Data gathered through the pretest ➔ post test and the questionnaire is analysis using SPPS.

STEP 9: The finding is explained in detailed form for the current and future studies.

VII. DEVELOPMENT

The development part is considered most crucial as the study results and finding merely rely on this. Everything about the studying is based on the effectiveness of this developed instructional courseware. The usability and feasibility must be emphasis in order to achieve the desired target or goal.

7.1 DEVELOPMENT PHASES

ISD model is meant to provide the; who, what, when, where, why, and how of a learning program occurs. The approach is to obtain the overall sight of the learning process.

It is characterized by an orderly process for gathering and analyzing collective and individual performance requirements, and by the ability to respond to identified training needs. The application of a systems approach insures that learning programs and the required support materials are continually developed in an effective and efficient manner to match the variety of needs in a rapidly changing environment. (Branson, 1975)

Basically the Addie model was adopted due to the Flexible guideline and is considered an effective project management tool. Below are phases or stages involved in constructing this Instruction Design courseware for the objected segmented and Non-Object Segmented instructional video.

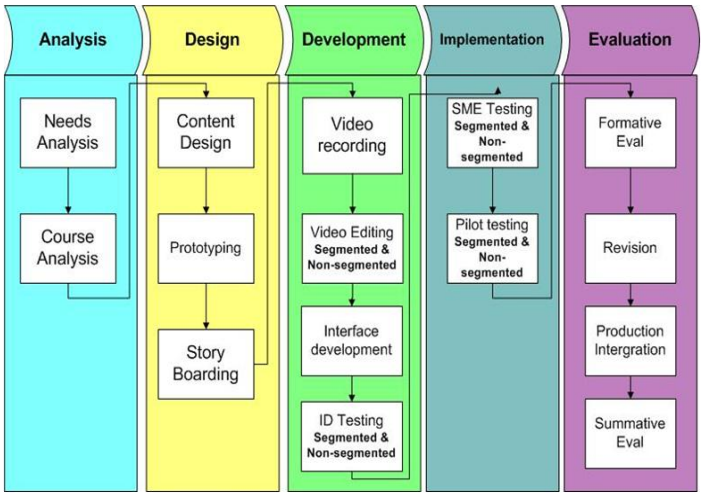

Figure 6: Adopting Addie model in the research

7.1.1 Analysis:

Identify the goals and objectives, the operator's needs, prior knowledge and any other relevant characteristics. The Analysis also includes the learning environment, constraints and delivery methods.

7.1.2 Design:

An organized development of specifying the learning objectives are created. A thorough storyboards and prototypes are prepared. The look and feel, graphic design, user-interface and content are determined here.

7.1.3 Development:

Actual formation of the content and learning materials based on the design phase is being created.

7.1.4 Implementation:

The plan is executed and the procedure for practical skills training the operator and trainer is developed. Materials are delivered or distributed to the operators & SME. After delivery, the effectiveness of the training materials is evaluated.

7.1.5 Evaluation:

There are 2 type of evaluation formative and summative. Formative evaluation is carried out in each stage of the process. Summative evaluation is to obtain feedback from the Operators & Subject Matter Expert.

VIII. FINDING, ANALYSES AND RESULTS

8.1 Skill Analyses

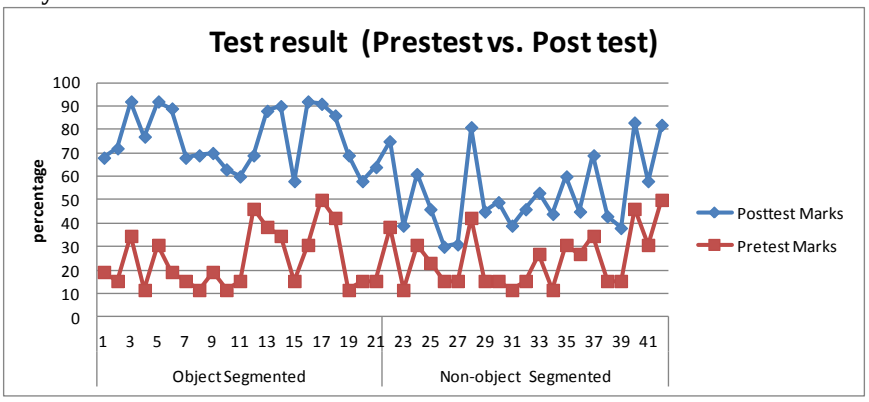

Chart 1: Pretest and Posttest results

The pretest and posttests scores were checked for the objected segmented instructional video user and the non-objected segmented instructional video user and plot in the above chart; chart 1. It is clear that the Object segmented instructional video treatment group operator did well in the post test.

Table 1 shows the means and standard deviations of learning outcomes of users in different experimental groups. The independent sample T-test was performed with differences between pre and posttest scores. The results indicate that there is significant difference among the group means in the post test. Whereas the pretest indicates no huge difference in term of mean value (Table 2).

Table 1: *Means and standard deviations of the posttest scores.*

	Treatment_type_video	N	Mean	Std. Deviation	Std. Error Mean
Posttest_Results	Object Segmented Video Users	21	75.4762	12.53243	2.73480
	Non-Object Segmented Video Users	21	53.1905	16.51550	3.60398

Table 2: *Means and standard deviations of the pretest scores.*

	Treatment_type_video	N	Mean	Std. Deviation	Std. Error Mean
Pretest_Results	Object Segmented Video Users	21	23.9524	12.56374	2.74163
	Non-Object Segmented Video Users	21	24.8571	12.14613	2.65050

Results of independent sample test of posttest are shown in Table 3; they show that the posttest of the object segmented video user learning group was significantly higher than that of the Non-object segmented video user learning group.

Table 3: *Independent sample test of posttest results*

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Posttest_Results	Equal variances assumed	1.242	.272	4.926	40	.000	22.28571	4.52414	13.14210	31.42933
	Equal variances not assumed			4.926	37.298	.000	22.28571	4.52414	13.12141	31.45002

As a result, hypotheses H1 not received support. Furthermore, there was no statistically significant difference in the post-gain between the Non-objects segmented instructional video user learning group. This indicates that the object segmented instructional video content may possibly help operator/users enhance understanding of the material and achieve better performance, While Non-object segmented video user may have modest outcome.

There is significance different in skills score between the two types of instructional video in the post test.

Table 4*: Independent sample test of pretest results*

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Pretest_Results	Equal variances assumed	.148	.703	-.237	40	.814	-.90476	3.81336	-8.61185	6.80233
	Equal variances not assumed			-.237	39.954	.814	-.90476	3.81336	-8.61213	6.80260

On the other hand, there was no significant different in skills score between during the pre test that was carried prior to the instructional video study being conducted. This can be seen on the Table 4. The Sig. (2-Tailed) value is 0.8; this concludes that there is no statistically significant difference between mean objected segmented instructional video user and the non-objected segmented instructional video user during the pretest phase.

8.2 User Motivation Analysis

Of the 42 suitable participants, all the 42 (100%) completed the IMMS at least once. A one-way between subjects ANOVA was conducted to compare the effect objected segmented instructional video user and the non-objected segmented instructional video user to find the significant of the motivation level. Four subscale measured is Attention, Relevance, Confidence and satisfaction.

Table 5: *Between group one-way ANOVA result for subscale attention*

ANOVA

Attention

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.047	1	.047	.812	.373
Within Groups	2.298	40	.057		
Total	2.345	41			

Based on the table 5; There was a not significant effect of types of Instructional video on the Attention given at the $p<.05$ level for the two conditions $F(1, 40) = 0.812$, $p = 0.373$].

Table6*: Between group one-way ANOVA result for subscale relevance*

ANOVA

Relavance

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.001	1	.001	.022	.882
Within Groups	1.715	40	.043		
Total	1.716	41			

Based on the table 6; There was not a significant effect of types of Instructional video on the Relevance of the material at the p<.05 level for the two conditions F (1, 40) = 0.022, p = 0.882].

Table 7: *Between group one-way ANOVA result for subscale confidence*

ANOVA

Confidence

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.572	1	.572	16.944	.000
Within Groups	1.350	40	.034		
Total	1.921	41			

Based on the table 7; There was a significant effect of types of Instructional video on the confident of the users at the p<.05 level for the two conditions F (1, 40) = 16.944, p = 0.0001].

Table 8*: Between group one-way ANOVA result for subscale satisfaction*

ANOVA

Satisfaction

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.126	1	.126	2.702	.108
Within Groups	1.865	40	.047		
Total	1.991	41			

Based on the table 8; There was not a significant effect of types of Instructional video on the user satisfaction at the p<.05 level for the two conditions F (1, 40) = 2.702, p = 0.108].

Based on output result, hypotheses H2 received support. Overall, there was no statistically significant difference in term of motivation level operators (Attention, Relevance and Satisfaction) between the Non-objects segmented instructional video user learning group. However is significant different fount in term subscale confidence. The motivation level between the object segmented instructional video Non-object segmented video users is not vary.

IX. CONCLUSION

This has reported results with deploy teaching Objected segmented instructional video. This study demonstrated that using an Objected Segmented Instructional Video into learning is sufficient to improve learning. These tents to help the end-user to absorb information as much as possible by discarding the noise "background" in the video. However it's found there is not much difference in the motivation level of both type users. Only the subscale confident level of the object-segmented instructional video user is higher. This is driven by the factor of under occur in them. It suggests that object-segmented instructional video can be a valuable means to improve learning effectiveness in on-job practical skills due the isolated background and foreground object increasing the focusing level of audience.

There are certain factors that limit this research. The study on the Object segmented and non-object segmented instructional video is exclusively designed and in-focused on the hard disk assembly method in an electronic company in Kulim, Kedah. It's unsure whether this study it's capable or effective for other industry or field. Not all studies can be copied and applied to other areas or field. At least a minor modification is needed to suit the need. Furthermore the limited sample size data generally support the validity of IMMS scores. Precautious and further study of the IMMS are necessary with higher sample size.

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