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INSTRUCTIONAL SCREENCAST: A RESEARCH CONCEPTUAL FRAMEWORK

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ABSTRACT

The literature review indicates that the benefit of screencast as an instructional media has not clearly proved effective for all categories of students. This is due to the individual differences in processing the information. Inadequate screencast design will cause strain to students' cognitive process which might impede learning. This shortcoming can be reduced by imposing principles of reducing the external processing in screencast design. However, the exact design effectiveness of screencast also depends on the cognitive style and learning style of the students. The cognitive style will ultimately affect how information is processed in the students' memory structure. Students will also easily process the given information, if it is performed in accordance with their dominant learning style. Taken together, this article discusses the conceptual framework design of screencasts for instructional purpose.

Key words: Cognitive style, instructional media, learning style, screencast.

INTRODUCTION

Multimedia technology usage in the teaching makes learning process more fun as well as it facilitates understanding of a content more effectively (Fook, Sidhu, Nursyaidatul & Norazah, 2011). This process becomes more comfortable with the availability of Internet access that allows learning to be done online anytime and anywhere (Loch, 2011). This as a result has opened a new dimension to the process of distance learning which appeared to be beneficial for both instructors and students (Ahmad Zamzuri, Khairulanuar, Mohammad & Salman Firdaus, 2011).The effective teaching and learning process would obviously make the conveyed knowledge and skills more meaningful (Lloyd & Robertson, 2012) and this can be achieved sufficiently if suitable instructional media is used (Baghdadi, 2011).

One of the multimedia-based instructional media is screencast; the medium that will be the main focus of the conceptual framework design of this study. Screencast is a digital video that displays a part or the entire capture of the computer screen, where the narration or voice may be included to describe the activity on the screen (Udell, 2005). The use of screencast as instructional media in the teaching and learning process is important, especially in learning the use of a software application (Brown, Luterbach, & Sugar, 2008; Carr & Ly, 2009; Lloyd & Robertson, 2012). This is due to the screencast's capability in creating an identical presentation condition in every learning sessions (Carr & Ly, 2009). Thus, the use of screencast is perceived useful as an additional resource to aid students in learning the software applications independently and effectively (Ahmad Zamzuri et al., 2011).

Although screencast is beneficial for independent learning, its use has not been proven effective for all categories of students. This is because the perception of students in the process of selecting information needed for effective learning is different from one learner to another (Bailey, 2012). This is due to the students' dissimilar cognitive style in translating the obtained course contents into easy to understood information (Ahmad Rizal & Yahya, 2008; Renumol, Janakiram & Jayaprakash, 2010). In addition, the manner of information selection also depends on the learning styles of the students which was formed since their early childhood (Rosniah, 2007). Therefore, this conceptual framework will look at the impact of different multimedia elements in screencast presentations on learning of students with different cognitive styles and learning styles.

INSTRUCTIONAL SCREENCAST

Screencast is derived from the terminology used by Jon Udell in 2005, which refers to digital video presentation (Fancett-Stooks, 2012). It was widely used for all levels of students from the lowermost up to tertiary (Fraser & Maclaren, 2012; Winterbottom, 2007). Thus, screencast is an effective method in explaining the procedure of computer-based work, especially the features of particular software application (Brown et al., 2008; Carr & Ly, 2009; Lloyd & Robertson, 2012).

Findings from previous researches clearly indicate that screencast as an instructional media has positive impact on its users, which includes instructors or students at any level (Ahmad Zamzuri et al., 2011; Bailey, 2012; Budgett, Cumming, & Miller, 2007; Fancett-Stooks, 2012; Fraser & Maclaren, 2012; Kraft, 2009; Lloyd & Robertson, 2012; Loch, 2012; Mullamphy, Higgins, Ward, & Belward, 2010; Oehrli, Piacentine, Peters, & Nanamaker, 2011; Peterson, 2007; Pinder-Grover, Millunchick, & Bierwert, 2008; Rocha & Coutinho, 2010; Winterbottom, 2007). By using screencast, information can be delivered and processed effectively compared to conventional printed media (Lloyd & Robertson, 2012). The usage of printed media involves complex cognitive processes in the memory structure. This is because, printed texts have to compete with the illustrative presentations which have to go through the same visual channels (Mayer, 2005a). Therefore, by using screencast, the load of the working memory of the visual channel and the verbal channel can be minimized to facilitate learning more effectively.

However, the question arises is, will all the students from the same class will get identical benefits from the developed screencasts? This is because, from various screencast design, none are more prominent between one another, which might due to different cognitive ability of students (Oehrli et al., 2011). This happens because only limited information can be processed in the working memory at one time; based on the principle of limited capacity of working memory (Mayer, 2005a; Jong, 2010). Therefore, in order to reduce the load in the working memory throughout the learning process, instructional material developer must take into consideration on how to reduce external processing (Mayer, 2005b; Oud, 2009). External processing is the integration of the external information (extraneous material) with the essential information (essential material) in an instructional medium (Mayer, 2005b). By reducing the extraneous materials, students can focus in processing the essential material without being burdened with unwanted external information. However, the question arises again, whether the verbal assistance (narration and text) serves as extraneous material or essential material in achieving the objectives of the screencasts presentation, especially in learning software applications.

Basically, screencast presentations integrated with narration or text will facilitate the learning process (Oehrli et al., 2011). This elements serve as additional information in the

screencast to ensure effective learning (Fancett-Stooks, 2012). Thus, the inclusion of text along with screencast or screencast with recorded narration helps in emphasizing the understanding of software application (Fancett-Stooks, 2012). However, text can only contribute to learning improvement for students who tend to learn through visual or lack of learning through listening (Educause, 2006). This is contrary to a study by Bailey (2012), which stated that screencast gives an advantage to students who learn better by seeing and hearing from students who learn through reading. Bailey's (2012) study was supported by Nafaidilah (2012) who found that the use of narration in screencast application is necessary to ensure its effectiveness. However, Nafaidilah (2012) did not cover the effect of text or combination of narration and text in screencasts in her study.

Diverse modalities in screencasts can actually deliver a better understanding of learning than narration or text alone (Ozsvald, 2010). This can be done through the addition of subtitles or narration in the language that is easily understood by majority of users (Ozsvald, 2010). However, the study by Veronikas and Maushak (2005), did not support this assumption. Veronikas and Maushak (2005) found that there were no significant differences on the use of a combination of narration and text in the screencasts instead screencasts with narration or text only. This is because students tend to learn in a multimedia approach in diverse modalities to help them get a better understanding (Veronikas & Maushak, 2005). The question is whether the diversity of modalities in screencast really affects in improvement of practical skills of students, especially in learning software application?

The usage of screencasts with diverse modalities is said to have a positive impact, however, the imbalance of the effectiveness in learning a software application still exist (Bailey, 2012; Educause, 2006; Fancett-Stooks, 2012; Nafaidilah, 2012; Oehrli et al., 2011; Ozsvald, 2010; Veronikas & Maushak, 2005). This is due to the fact that its usage will provide a high load to the working memory or short-term memory based on the diversity of the information presented as text, graphics, audio and movement which will be processed simultaneously (Bétrancourt, 2005). Thus, by reducing the load of the working memory, the students' attention can be diverted to important information in the process of learning. As such, this framework will focus on the design of the screencast with various modality strategies in reducing external processing to assist in meaningful learning.

Cognitive Style and Learning Style

Beside the design aspects, cognitive style is an important element that needs to be considered in the study on the effectiveness of instructional media. This is because, most of the instructional media developers often assume that every students will learn in the same style (Riding & Sadler-Smith, 1997). This assumption has actually denied the importance of individual differences in cognitive style outlook (Riding & Sadler-Smith, 1997). Cognitive style is an individual approach in organizing and conveying information during the process of thinking consistently (Riding & Sadler-Smith, 1997). Cognitive style can also be described as an individual's personality dimension that influences the attitudes, values and social interactions (Zabedah & Wah, 2005).

Cognitive styles are categorized into two, which are Field Dependent (FD) and Field Independent (FI) (Witkin, Moore, Goodenough & Cox, 1977). FI individuals are found to be more likely to separate a bigger matter into smaller things (Azizi, Asmah, Zurihanmi & Fawziah, 2005). Thus, it will enable them to analyse the smaller components compared to FD individuals who view a component as a whole (Azizi et al., 2005). FI students are more individualistic and requires no external reference to process information (Chen, Magoulas, & Dimakopoulos, 2005). This is in contrast with FD individuals who are socially-orientated and influenced by the opinions of others and needs external support to process information

(Chen et al., 2005). However, both FI and FD cognitive styles are interconnected with specific abilities of students and often have a positive impact in computer-based learning (Hall, 2000). This was supported through research by Angeli and Valanides (2004), who found that the usage of text and visual modalities for FI students improved their performance in learning compared to FD students. This outcome was also supported by Jailani, Wan Mohd Rashid and Ahmad Rizal (2007), who found that the diversity of modality in the development of an instructional media is able to increase FI students' performance compared to FD students. Therefore, FI students are found to have more benefits than FD students through a complex mix of media in the instructional media (Chuang, 1999). However the study by Angeli dan Valanides (2004), found that FI students do not show significant effects of improvement on the performance compared to FD if the media only integrates the text. The question that arises is whether FI and FD individuals will show a different level of understanding in screencast learning methods.

The different cognitive styles is actually closely influence the learning depending on how the instructors convey information of their lesson (Ahmad Rizal & Yahya, 2008; Renumol et al., 2010). Students who fail to extract necessary information from the instructor will face problem in translating the received information into meaningful understanding. This consequently will be the factor of failure of students in the performance test. Thus, students with different cognitive styles will definitely limit the information that they have received and also processed. Therefore, instructional media such as screencast should be able to provide a positive impact on students with different cognitive styles, during the teaching and learning process (Renumol et al., 2010).

Beside cognitive style, the effectiveness of instructional media is also influenced by the students' learning style. Students' learning style refers to the different skills of individuals in processing information effectively (Mestre, 2012; Norasmah & Mohd Hasril, 2010). It is a particular individual ability to process, store and retrieve all the received information (Felder & Henriques, 1995). Thus, the developer of instructional media such as screencast should also take into consideration the aspects of students' learning styles in their design phase.

The formation of a students' learning style actually happens through the learning process that begins since early childhood (Rosniah, 2007). This formation process occurs naturally and continues until the formation of individual learning styles. Hence, instructors need to know their students' learning styles to help them get a better understanding of a topic that is being learnt (Alhosban, Fuad, Hamad & Mousa, 2011). This can be achieved if the instructor practices the teaching styles that matches the students' learning styles (Felder, 2010; Felder & Silverman, 1988), which would eventually lead to the retention of new information naturally in the memory structure (Bastable, 2008). The right usage of graphic processing, text and audio in screencast is seen to meet the needs of the dominant learning styles of students (Fancett-Stooks, 2012; Loch, 2012; Pinder-Grover et al., 2008; Rocha & Coutinho, 2010; Winterbottom, 2007). Therefore, it is important to carry out research to identify the appropriate strategies to address this issue.

Learning styles of a student can be identified through studies related to the learning style models including the learning styles model by Felder-Silverman (1995), Dunn and Dunn (1979), Kolb (1984), Honey and Munford (1982) and VARK (Visual, Aural, Read or Write and Kinesthetic) (2001). However, this study will concentrate on the VARK learning style, because this learning style is significant to the multimedia-based instructional medias (Norasmah & Mohd Hasril, 2010). Study by Yosep, Wawan Setiawan and Waslaludin (2012), also supported the usage of VARK learning style because they are more dominant in multimedia-based learning.

THEORITICAL FRAMEWORK

For the purpose of this study, the conceptual framework that was developed is based on the Cognitive Theory of Multimedia Learning (CTML) (Mayer, 2005a), cognitive style and learning style models. It is the multimedia principle in reducing the external processing (reducing extraneous processing) which puts strain on the working memory, namely, the Principle of Coherence, Principle of Signalling, Principle of Redundancy, Principle of Spatial Contiguity and Principle of Temporal Contiguity (Mayer, 2005b). Besides, the theory of cognitive styles is Field Independent (FI) and Field Dependent (FD) and VARK learning style.

Cognitive Theory of Multimedia Learning

CTML is based on students attempt to build a meaningful relationship between the words and pictures (Mayer, 2005a). This is grounded on the three principles of cognitive science, namely dual-channel assumption, limited capacity assumption and active processing assumption (Mayer, 2005a). The principle of dual-channel assumption refers to working memory that has auditory and visual channels. The principle of limited capacity assumption refers to the internal system with limited working memory. The principle of active processing assumption refers to the construction of knowledge in a meaningful way. When attention is given to the relevant material, the compilation of mental model structure in a coherent form is integrated with the existing knowledge to be registered in the long-term memory in schema form (Mayer, 2005a).

There are three memory storages in CTML, namely sensory memory, working memory and long-term memory. Sensory memory will store the presented media for only around 0.25 seconds. The working memory will select information from the sensory memory to be processed and integrated with the existing information. It processes the presented media and is generally in less than thirty seconds as well as can only process some part of media at a time (Mayer, 2010). Meanwhile, the long-term memory stores information in the form of a schema in an unspecified period of time.

The learning process will generally be restricted when the cognitive load increases as a result of the working memory capacity reaching its limit (Jong, 2010). To overcome this problem, Mayer (2009) has outlined twelve multimedia instructional principles namely, the Principle of Coherence, Principle of Signalling, Principle of Redundancy, Principle of Spatial Contiguity, Principle of Temporal Contiguity, Principle of Segmenting, Principle of Pre-training, Principle of Modality, Principle of Multimedia, Principle of Personalization, Principle of Voice and Principle of Image. Multimedia instructional principles according to Mayer (2009) can be categorized in three cognitive load frames as shown in Table 1.

Table: 1
The Framework of Cognitive Load and Instructional Principles

Framework of Cognitive Load	Principles Of Instruction
Reducing Extraneous Processing	Principle of Coherence Principle of Signalling Principle of Redundancy Principle of Spatial Contiguity Principle of Temporal Contiguity
Managing Essential Processing	Principle of Segmenting Principle of Pre-training Principle of Modality
Fostering Generative Processing	Principle of Multimedia Principle of Personalization Principle of Voice Principle of Image

The focus of this study is based on an outline of Reducing External Processing that involves five principles which is Coherence, Signalling, Redundancy, Spatial Contiguity and Temporal Contiguity. Thus, reducing the external processing is seen as the first process that should take place before the process of managing important processing to encourage the process of generative processing. This is because, this process occurs in the sensory memory before being processed in the working memory and subsequently in the long-term memory. These five principles are described and shown in Table 2.

Table: 2
Five Principles of Reducing the External Processing

Principles Of Instruction	Description
Principle of Coherence	Students will learn better if external elements are removed. ***Example:*** Issuing interesting but irrelevant statements or graphics used.
Principle of Signalling	Students will learn better if the signal to process the information is given. ***Example:*** Insert signals, signs or assertion of important information for students to show what to do and how to organize them.
Principle of Redundancy	Students will learn better if information is not provided within the same sensory channels. ***Example:*** Redundancy - print text and narration are presented simultaneously with the display screen. Non Redundancy - narration is presented simultaneously with the display screen.
Principle of Spatial Contiguity	Students will learn better if the printed text is near the graphics that corresponds to reduce the need for visual scanning. ***Example:*** The text is placed close to the same part of the illustration (on paper) or animation (on the screen).
Principle of Temporal Contiguity	Students will learn better if the narrative and animation displayed at the same time to reduce stake memory. ***Example:*** Narration and animation are presented simultaneously than either individually before presenting new text animation or animation before the new text.

Cognitive Styles

To produce meaningful learning, the development of instructional strategies should be student-centred rather than technology-centred (Mayer & Johnson, 2008). It is acknowledged that each student has different methods and styles in processing the information given. For that reason, the cognitive style of the students in the learning process is also different. As been discussed, cognitive styles of students are categorized into two, Field Dependent (FI) and Field Independent (FI) (Witkin et al., 1977). FI students are more individualistic and require no external reference to process information. This is in contrast with FD individuals who are socially-oriented and influenced by the opinions of others and need external support to process information (Chen et al., 2005). Table 3 shows the individual differences in FI individual cognitive styles compared to FD individuals cognitive styles in more detail.

Table: 3
Field Independent (FI) and Individual Field Dependent (FD) Individual differences

Field Independent	Individual Field Dependent
1. Fast isolate simple geometric form of complex geometric shapes	1. Facing the difficulty to discriminate
2. Can overcome the effects of background elements that interfere	2. Unable to overcome the effects of background elements that interfere.
3. Be analytical	3. Global Nature
4. Skilled in building the structure of a structure that does not have structure	4. Not skilled in building the structure of a structure that does not have structure
5. A short time completing task without much offense	5. Hours completing task but slightly more correct
6. Need help to focus on matters involving social	6. Has the advantage of social learning
7. Inclined to have personal goals and enforcement	7. Requires self-goal structure and enforcement
8. Less influenced by criticism	8. Easily swayed by criticism
9. Able to analyse situations and organize things	9. Looking globally and cannot organize things
10. More likely to solve problems without instructions from outside and outdoor observation	10. Need directions from outside to solve the problem

VARK Learning Style

The VARK learning style is the second underlying theory of this framework. VARK learning style is classified as students' learning styles in four different modes which are visual, aural (auditory), read / write, kinesthetic (Fleming & Baume, 2006). Fleming and Baume (2006), classifies in visual category, students prefer to learn through charts, diagrams and pictures. Aural category (auditory) is ideal for students who learn through discussions and listening. While in The read/ write category students can easily access information through reading the printed or written words, for example taking lecture notes. Finally kinesthetic category students learn better through touching, feeling, seeing and hearing as well as to do their own learning activities. With regards to this, the different cognitive styles and learning styles of students demand that instructional materials to be developed in a more student-centred manner.

CONCEPTUAL FRAMEWORK DESIGN

Based on the theoretical framework, the conceptual framework suggest screencast to be developed based on five principles to reduce external processing as in Figure 1. Through these five principles, the students' learning process will occur when they are able to focus to process essential information compared to processing both essential information and extraneous information simultaneously. Thus, by applying the principle of Coherence and Redundancy in the development of screencast, external information processing can be minimized. Once this external information is minimized, next, the students' focus and attention to essential information could be improved through the Signalling Principle and Spatial Contiguity Principle within an emphasis on the usage of appropriate images, text or language. Lastly, through the Temporal Contiguity Principle, the needs of students' working memory in processing important information before it can be transformed into meaningful information could be simplified by essential information presented simultaneously in the visual channel and auditory channel.

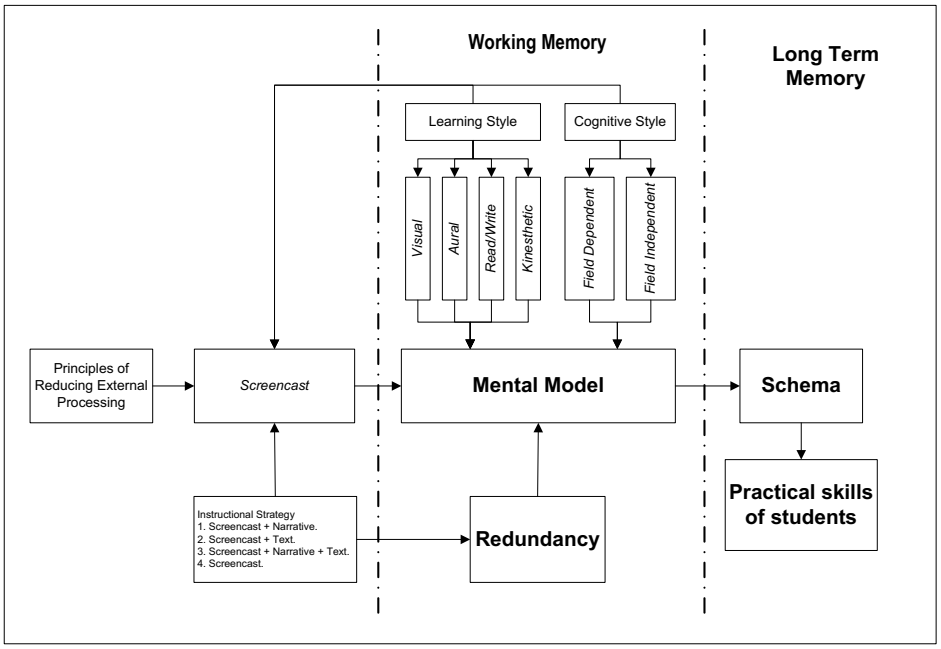

Figure: 1
Conceptual Framework for Screencast Research

Essential information from the screencast will go through the selection process of words and images. The sense of hearing will choose the sound of words in the form of narration and visual sense will select the images in the form of screencasts and the text displayed on the screen. Next, through the auditory channel and visual channel in working memory or short-term memory, words and images will be compiled to form a mental model which will be integrated with the existing knowledge of the students. The information from working memory or short-term memory which is integrated with the students' existing knowledge will then be stored permanently in the long-term memory in the schema form. The schema developed and stored in permanent basis in the long-term memory can be retrieved by the students in solving the problems given in the practical skill tests or assignments. The question arises, among the instructional strategies of screencasts, which can contribute maximum effects to the perfection of the students' mental model formation? Various modalities that were used in the screencast presentation are likely to influence the students' mental model formation. Thus, all four strategies suggested will probably may or may not

impose redundancy in the students' memory structures. This can be seen from inconsistent outcome of past studies Therefore, proper design of the screencasts can help in the formation of accurate mental models and it will affect the formation of meaningful schema in the long-term memory.

The formation of students' mental models is also likely related to their cognitive style. FI cognitive style students may not face problems in utilizing the four instructional strategies as they prefer to solve problems without external instructions and external observation. This is contrary with FD cognitive style students since they need specific and clear instructions to solve the problems given. The question that arises here, is whether the FI students will easily master the content of the delivered lessons compared to FD students, especially in mastering the software through any screencast presentation strategies? Thus, the different cognitive styles might produce different results for the four suggested instructional strategies of screencast.

Apart from the different cognitive styles, the formation of mental models is also likely to be influenced by students' learning styles. This is because, students learning styles has been formed at the early stages of childhood and subsequently forms their own learning styles until adulthood. Hence, a students' learning style will be influenced by their dominant learning styles either visual, aural (auditory), read/write or kinesthetic. The question is which are the students' dominant learning styles that are used mainly in learning the software? Therefore, by identifying the most dominant learning style, then, a more accurate result in the construction of effective instructional strategies can be delivered.

Finally, the load of the working memory or the short-term memory of students would be reduced through the use of appropriate principles of reducing the external processing in all four screencast designs. Thus, the adequate design approach of text and narration usage in the screencast should give maximum impact on students' learning. This will assist them in the formation of accurate mental models and then formation of perfect schemas in the long-term memory.

CONCLUSION

The use of screencast as an instructional material in the process of teaching and learning is important, especially in studying the use of a software application. It has the ability to create a delivery that equals the classroom lecture as well as useful additional resource in learning the application independently and effectively. Results from previous studies have acknowledged that screencasts can be used as an additional tool in teaching. However, its use has not been proven effective for all the categories of students in the same class. This is due to the students' own perception which differs in terms of the selection of the required information. It depends on the students' cognitive style and learning style in forming and translating the information into knowledge that could be easily understood. The conceptual framework developed in this study can be a useful guide in addressing this matter. However, the conceptual framework was developed merely based on literature reviews. Therefore, it is important to conduct related studies to further affirm the framework. The studies that look on the effects of various screencast designs on learning of students with different cognitive styles and learning style is important to be discovered. Specifically, study in looking on the relation and correlation between various screencast designs with various learning styles and cognitive styles must first be established. Studies in looking on the interactions between various screencast designs and various learning styles and cognitive styles are also important. Finally, experimental studies in determining the ideal screencast design for specific learning style and cognitive style are also important to further detail the conceptual framework developed.

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