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Effectiveness of Rehearsal Mechanism on CAD Learning Performance with Using Interactive Multimedia

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ABSTRACT

This study was seeks to examine the effects of the rehearsal mechanism on the new CAD learner's practice performance (PP). An attempt was made to establish if rehearsing the CAD information increased the learners' retention and improved their practice performance over those who did not rehearse. 29 new CAD learners were the participants in this study and were randomly divided into approximately two equal groups. Group one had rehearsed the CAD information over time (three times during one week only), while the other group did not rehearse the CAD information at all. Both groups were asked to created identical CAD tasks by following the same CAD multimedia presentation of an interactive media of 'audio and animation' modes. The results indicated that the rehearsal mechanism shortened the learning time and enhanced drawing accuracy, in contrast to the non-rehearsal option.

Keywords: *Rehearsal mechanism, CAD, STM, LTM, PP.*

1. Introduction

Most human information processing theories deal with how people receive, store, integrate, retrieve and use information. Matlin [1] defined the memory as 'the process of maintaining information over time'. Memory is an organism's ability to store, retain, and subsequently retrieve information, that is, the mental processes used to encode, store and retrieve information. Encoding takes many forms: visual, auditory, semantic, taste and smell.

Storage refers to the amount of information that can be held in the memory, while retrieval refers to the processes by which information is 'dug out' of memory, and includes recognition, recall, and reconstruction Statt [2].

Atkinson and Shiffrin [3] proposed a multi-store model or multi-memory model, this being a psychological model, as a proposal for the structure of memory. They proposed that human memory involves a sequence of three stages: Sensory memory (SM); Short-term memory (STM) and Long-term memory (LTM). The progress of information through these stores is often referred to as shown in Figure-1. According to multi-memory theory , short-term memory (STM) is the process of holding small amounts of information to be immediately used, it is assumed that the storage of information in the Long Term Memory (LTM) is determined by the processing of information in the Short Term Memory (STM). Information is detected by the sense and enters the Sensory Memory (SM). If attended to, this information enters the STM and the information will transfer from the STM to the LTM only if that information is rehearsed. Rehearsal means that the process of consciously repeating something in the mind in order to hold it in the STM long enough for it to transfer into the LTM. Consequently, if rehearsal does not occur, information is forgotten and lost from the STM through the processes of displacement or trace decay.

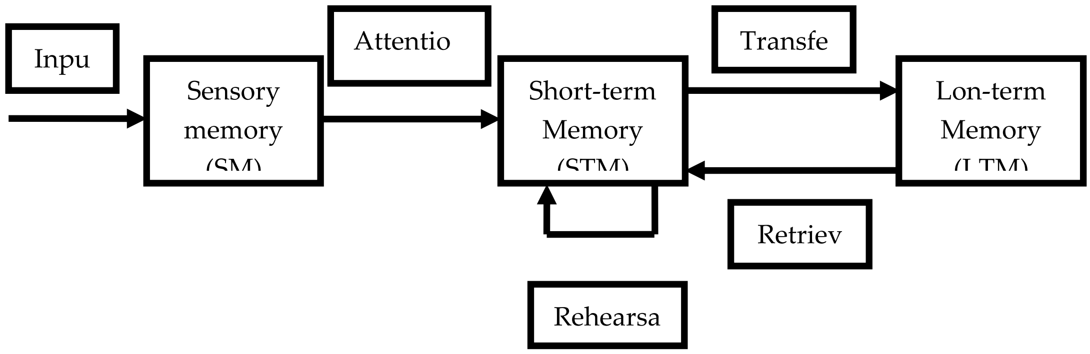


Figure 1: Multi-store model, Atkinson and Shiffrin [3].

Learners may also comes with different levels of preparedness for learning because of differences in cognitive capacities therefore, rehearsal is the efficient mechanism by which information eventually reaches long-term storage where it can be retained and maintained. Matthew et al [4] concluded that incremental rehearsal led to significantly more facts being retained comparing with traditional drill, for efficiency as measured by number of mathematics facts retained per instructional minute, while Sudirman and Ni [5] concluded that rehearsal technique was effective in improving English vocabulary of eleventh grade student.

In other hand, various studies indicated that, interactive multimedia is one of the most promising technologies at present and has the potential to revolutionise the way we work, learn and communicate. Interactive multimedia programs take the idea of learning and doing, and not simply watching. Interaction is the major difference between traditional instruction and instruction delivered by multimedia. With interactive multimedia programs, the learning process becomes active, not passive and it ensures that users are doing, not simply watching.

Luther [6] defined the interactive multimedia as 'an information system that includes a combination of text, graphics, sound, video and animation sequences packaged together to form an interactive visual/audio presentation of information and knowledge'. Therefore, interactive multimedia can be used to support employee training, to serve as a reference tool and to provide dynamic presentations.

One major advantage of interactive multimedia systems is the degree of learner control. Learner-controlled instruction allows the student to study material at a pace that suits his/her needs. Students are therefore under less pressure to perform within certain time limits. Learners can choose a logical route through the instructional material that is meaningful to them. Coinciding with this, Wolfgram [7] states that 'people only remember 15 percent of what they hear and 25 percent of what they see, but they remember 60 percent of what they interact with'. Whether interaction comes from teacher, peers or the learning materials themselves, it is the interaction and the level to which that interaction is unique that results in learning.

Therefore, various combinations of these media and technologies can indeed be used to provide an effective CAD learning environment in relation to reducing the CAD learning time as well as increasing the learner's retention/motivation. Several studies have highlighted the benefits of multimedia in different situations: Zenger and Uehlein [8] reported that with e-learning, learners needed 40 to 60 percent less learning time compared to those with the instructor-led training of traditional teaching, another found that interactive technologies reduce learning-time requirements by an average of 50 percent and there is strong evidence that computer-based training requires less time for training compared to instructor-led training Miller [9].

Thus, CAD learning instruction should be represented using two modes visual and variable for example (audio and animation) rather than a single mode. This can enhance the performance of the working memory and reduce the cognitive load; it also has the potential to improve the CAD learner's performance. In addition, rehearsal the learning mechanism would help to improve the storage and retention processes of CAD learning instruction. Therefore, it is critical to examine the effects of the rehearsal learning mechanism on CAD learning performance with using an interactive multimedia mode of `audio and animation, which the main aim of this research.

2. Materials and Methods

The experiment was intended to examine the differences between the rehearsal versus the non-rehearsal mechanism for CAD learning time and drawing accuracy. Therefore, the proper technique can be used is based on the comparison of the means scores of the two groups on a given variable (Independent Samples T Test) as shown in Figure-2, Oliver and Mahon [10] also indicated that the t-test is a common and powerful parametric test to compare the paired sample and to determine whether there are statistically significant differences between the two independent samples.

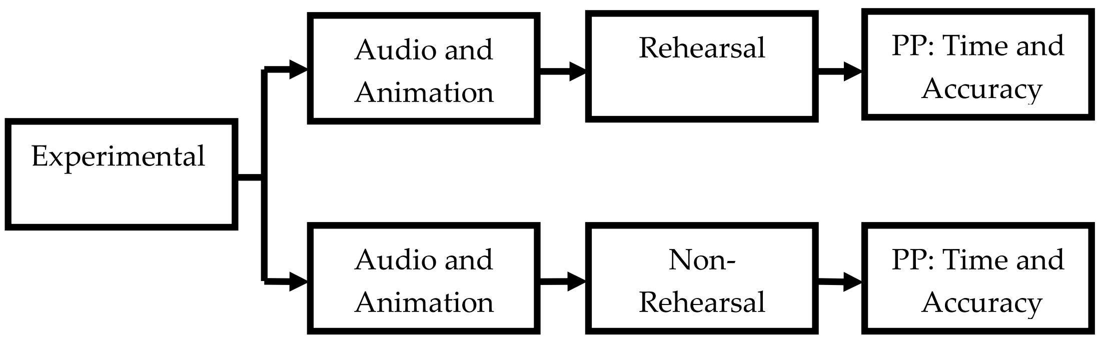


Figure 2: Investigation technique to appraise the effects of the rehearsal mechanism on the CAD learner's performance.

The CAD tutorial was created by AutoCAD Architecture 2014 and the dynamic presentation was recorded from the CAD software screen using Camtasia screen recorder software. The participants were therefore able to stop, forward and rewind the tutorial. The CAD drawing model consisted of 18 items of walls, doors, windows, dimensions and writing. Each point of accuracy was measured by a correct drawing item in terms of the dimension and position in reference to a model drawing as shown in Figure-3, the time was measured per minute.

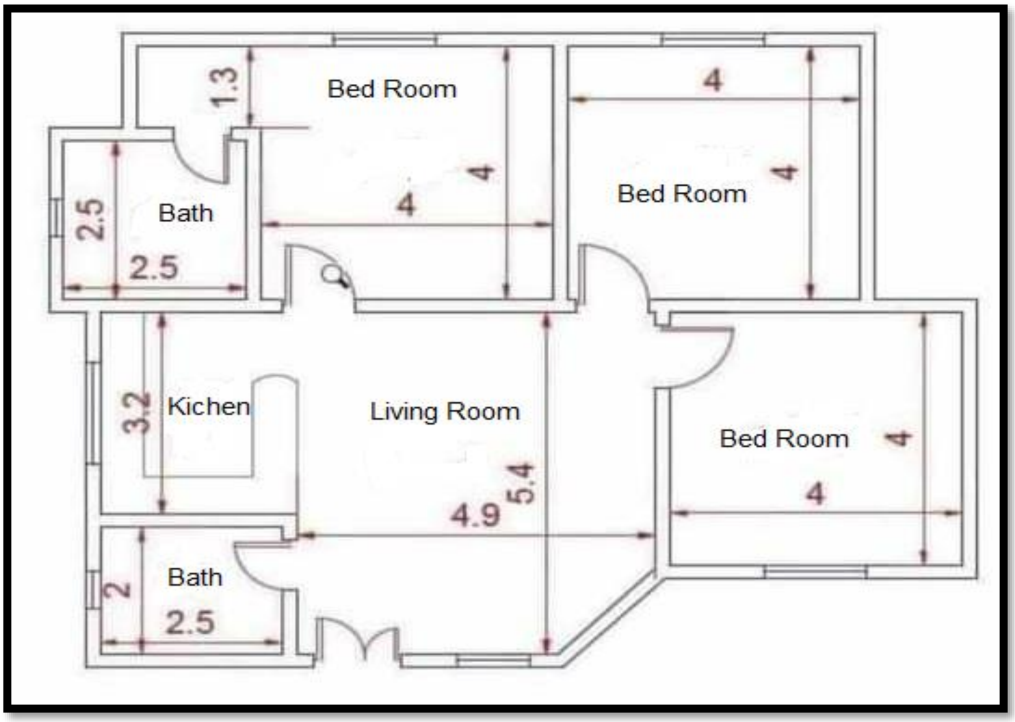


Figure 3: CAD drawing model.

Twenty-nine students were randomly assigned to be treated with two different learning mechanisms (rehearsal and non-rehearsal). This sample was divided almost equally into two groups to explore the significant differences between the rehearsal and non-rehearsal mechanism on CAD learning performance. The time was measured per minute while the accuracy was measured out of 18 points.

Group one had rehearsed the CAD tutorial over time (three times during a week) while the other group had not rehearsed the tutorial at all. After one week, both groups were asked to create the same CAD task which presented with a same format 'audio and animation'. The time taken to perform the task and the drawing accuracy were then measured to assess any difference in the participants' performance regarding to the use of rehearsal mechanism. Following this, an Independent Samples T-Test was used to explore any differences (Table-1).

3. Results and Discussion

Table 1: Independent Samples Test: Effects of the Rehearsal versus the Non-rehearsal mechanism on the CAD learning time and drawing accuracy.

	Levene's Test for Equality of Variances	t-test for Equality of Means

		F	Sig	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Time: Minutes	*Equal variances assumed	3.319	0.08	-3.37	27	0.002	-3.786	1.123	-6.089	-1.483
*Equal variances not assumed				-3.42	23.80	0.002	-3.786	1.105	-6.068	-1.503
Accuracy: Out of 18 points	*Equal variances assumed	0.504	0.48	5.244	27	0.000	2.076	0.396	1.264	2.889
*Equal variances assumed	not			5.208	25.26	0.000	2.076	0.399	1.256	2.897

From Levene's Test for the Equality of Variances (Sig. is greater than 0.05), we can assume that the variances for both time and accuracy are approximately equal, with p = 0.08 and p = 0.484 respectively.

From the Independent Samples T-Test at equal variances line, it can be seen that there was a significant difference between the two groups in both time and accuracy (the significance was less than 0.05). It is therefore possible to say that there is a significant difference between the rehearsal and the non-rehearsal groups: learners who used the rehearsal mechanism required significantly less time and demonstrated a higher drawing accuracy than those who underwent the non-rehearsal approach.

Table 2: Statistical description for the effectiveness of the rehearsal vs. non-rehearsal approach for the new CAD learner's performance (time and accuracy).

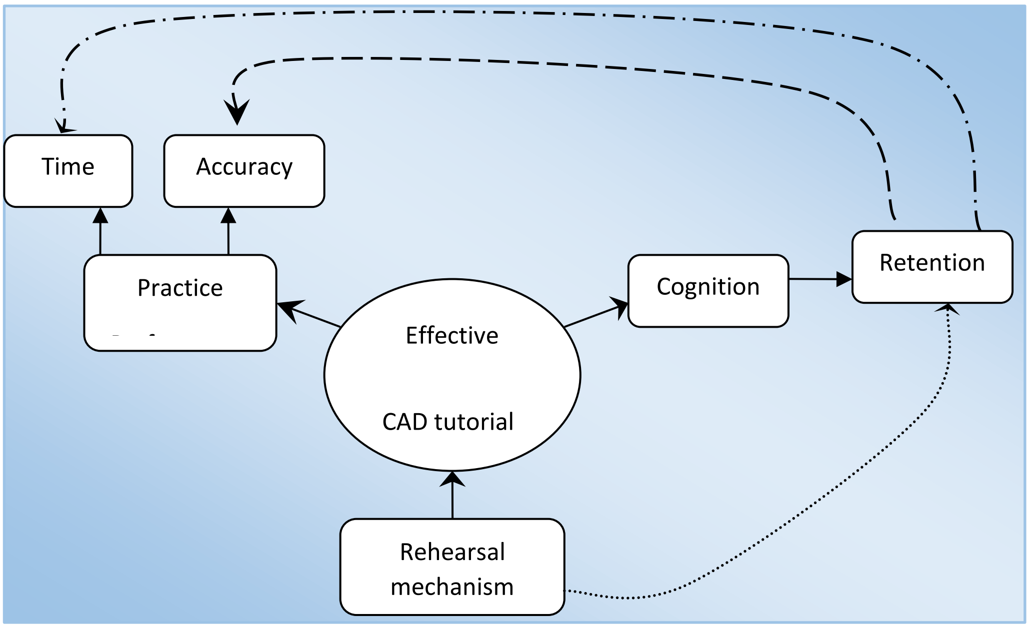
	Mechanism	N	Mean	Std. Deviation	Std. Error Mean
Time: Minutes	Rehearsal	14	28.21	2.259	0.604
	Non-Rehearsal	15	32.00	3.586	0.926
Accuracy: Out of 18 points	Rehearsal	14	16.14	1.167	0.312
	Non-Rehearsal	15	14.07	0.961	0.248

The time taken and drawing accuracy were recorded for each participant, while the mean values of time and accuracy were compared using two-tailed t-tests; the statistical significance was set at $p < 0.05$. It could be seen that the rehearsal mechanism of the multimedia presentation had a statistically significant main effect on the learning time and drawing accuracy. The participants with a rehearsal mechanism spent less time on learning, with SD = 2.259, p = 0.002, and scored higher in accuracy compared to the others who did not rehearse, with SD = 1.167, p<0.001 as shown in Table-1 and 2.

Due to the rehearsal mechanism of CAD information over a period of time, CAD information was transferred from the Short-Term Memory (STM) to the Long-Term Memory (LTM), which led to an increase in the retrieval rate of the CAD information and an improvement in the participant's performance, as demonstrated in Figure-4.

This result provided evidence to support the claim, put forward in the models of Atkinson and Shiffrin [3] , whereby information will transfer from (STM) to the (LTM) only if that information is rehearsed. However, other significant results were not found in the participants' practice achievements.

Overall, the evidence demonstrated that the rehearsal mechanism shortened the learning time by about 12.5 percent and enhanced the drawing accuracy by about 15.5 percent, in comparison to the non-rehearsing participants, as shown in Table 2. This result confirmed the hypothesis, which predicted that the means of learning time for rehearsal and non-rehearsal groups are significantly different. It also confirmed hypothesis, which envisaged that the means of CAD drawing accuracy for rehearsal and non-rehearsal groups are significantly different.



Rehearsing increased learner's retention.
Scored higher drawing accuracy than non-rehearsal participants
Spent less learning time in practice achievement

Figure -4: Relationship between rehearsal mechanism and learner's retention relating to practice performance

4. Conclusions

By comparing the two groups for time and accuracy (statistical description, Table 2), it is evident that the learners who had rehearsed the CAD tutorial required, on average, less time than those who did not rehearse. Moreover, the mean (accuracy) for the 'rehearsal' group was higher than that of the 'non-rehearsal' group. In short, the learners who had rehearsed the CAD tutorial spent less time, on average, and scored higher with accuracy (12.5 and 15.5 percent respectively) in comparison with those following the non-rehearsal approach.

References

[1] Matlin, M. W. (2005). Cognition. Boston, MA: Ryan Flahive.

[2] Statt, D. A., 2003. A Student's Dictionary of Psychology. Psychology Press.

[3] Atkinson, R., and Shiffrin, R., 1968. Human memory: A proposed system and its control processes. In Spence, K., and Spence, J., eds., The Psychology of Learning and Motivation, 2, Academic Press, New York.

[4] Matthew, K. Burns, N. Aguilar, L. Preast, N. Taylor, and Allison, D. University of Missouri., 2019. Comparing the Effects of Incremental Rehearsal and Traditional Drill on Retention of Mathematics Facts and Predicting the Effects With Memory., American Psychological Association, Vol. 34, No. 5, 521–530.

[5] Sudirman, W, and Ni, W., 2014., The effectiveness of using rehearsal technique in improving english vocabulary achievement:an experimental study of eleventh grade students in academic year 2013/2014., by Elihermawati (EID 010 005), elihermawati92@yahoo.com., university of Mataran.

[6] Luther, A. C., 1992. Designing Interactive Multimedia. New York: Batam Books.

[7] Wolfgram, D. E., 1994. Creating multimedia presentations. Indianapolis: Que.

[8] Zenger, J., and Uehlein, C., 2001. Why Blended Will Win, T+D (formerly Training and Development Magazine), ASTD, August 2001, p. 57.

[9] Miller, R. L., 1990. Learning Benefits of Interactive Technologies. Multimedia and Videodisc Monitor, February, pp. 14.

[10] Oliver, D., and Mahon, S.M., 2005. Reading a research article part II: Parametric and Nonparametric Statistics, Clinical Journal of Oncology Nursing, 9(2), 238–240.