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Effect of Video vs. Book-Guided Tutorials on CAD Learning performance

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Abstract

This research aimed to investigate the effect of video vs. book-guided tutorials on CAD Learning performance of new CAD learners in terms of (time and accuracy) and psychological attitude (understanding, motivation and mental effort). 32 new architecture students participated in the study and were randomly assigned to two groups. The presentation of the CAD tutorial differed between the two groups according to the independent variables to be addressed (book and video). The research materials and tools represented in accomplishing the CAD tasks, which requires mastering some CAD skills prescribed by the computer design approach, such as drawing walls, doors, windows, ceiling, and 3D views. The results indicated that the use of video in CAD learning increases the learning time and enhances the accuracy of drawing more than the book. In contrast, the use of the book shortens the learning time, but at the expense of the accuracy of drawing compared to the video. The results also revealed that students were in favor of video capabilities for learning CAD lessons in terms of understanding, motivation and less mental effort to comprehend.

Keywords: *CAD, tutorials, time, accuracy, learning performance*

1. Introduction

In recent years, Computer Aided Design (CAD) software packages have been widely used in Architecture, Engineering and Construction (AEC). CAD has been hailed for its potential time-saving benefits, increased productivity and improved quality in design work. However, the successful learning of CAD does not come without proper training and the use of effective learning tools (Christopher and Ann [1], 1995; Hamade et al., 2005, 2008) [2,3].

In addition, CAD instructors usually complain that the teaching of CAD is not an easy task (Ahmed et al., 2004) [4] as CAD software is changing and frequently upgraded. This leads to a situation where instructors often learn about CAD software just prior to providing class demonstrations. It has also been suggested that students have different abilities of learning which makes it difficult to teach CAD-related technologies in a stand-and-deliver format (James and Michael, 2002) [5]. In general, most computer software packages are hard to learn, but little is known about how to help new users (Martin and Mendelsohn, 2000) [6]. In particular, CAD requires computer skills, as well as mental capacity, spatial vision and physical coordination. This is due to the initial difficulty and the need for continuous training as a result of the rapid obsolescence of the acquired knowledge. It seems that programmers often forget about the design, and the students seem to forget about the software. Emerging evidence suggests that most of the existing training methods of CAD applications do not fully take into account individual learning styles, needs and abilities, nor do they consider that students have different spatial visualization abilities (Ramsey et al., 2007) [7]. Ahmed et al. (2004) [4] claimed that to improve the learning process of 3D CAD, it is important to develop an understanding of students' learning styles and the concepts of spatial visualization skills.

Some studies indicated that the use of effective learning equipment such as pictures and learning sites is one of the keys to develop successful learning skills, especially for CAD learners (Triono, S and Nur Q., 2019) [8]. Another study presented by (Basma, Hussein and Marian., 2021) [9] confirmed that the use of an educational website in teaching CAD course led to the development of some CAD skills among industrial secondary school students such as (drawing a straight line, a circle, arcs, hatching) as well as solid objects like (cube and cylinder).

After the development in information and communication technology, many educational institutions have switched to using videos and manuals available to everyone on educational websites to facilitate and raise the efficiency of learning CAD. However, there are still those who complain about their inability to learn the CAD skills alone and without a teacher. However, there is little understanding about the effect of CAD learning equipment such as (books and videos) and their ability to transfer CAD instruction and skills to learners, in terms of enhance their

performance (time, accuracy and motivation). little research has been conducted to elucidate these issues. In general, learning CAD is a complex and difficult procedure and can be a daunting task for beginners.

Therefore, research is an important and necessary component to understand the impact of multimedia technologies on CAD learner performance by identifying the effects of popular educational media such as, guide book and educational videos. Test whether there is a different effect of these media on the performance and opinions of new learners. This will enable CAD teachers, designers and software developers to design an effective CAD learning material.

Recently, most educational materials for CAD learners are increasingly being presented in multimedia form. For example, graphics and words are both means of communication, mastering these compounds is the challenge to produce visualization CAD learning tools. Both require a new conceptualization of ideas.

A person may know what he wants to say, but he may not know how to express it. Most of the books available to teach AutoCAD depend on explaining information and commands through textual speech, annotated with pictures, for the purpose of consolidating the information and not forgetting it for the learners.

Also, the feature of the written steps explained in the book is very important to refer to at any time instead of browsing several videos for hours to retrieve an idea or a specific step in the program. The books also allow the ability to search for any point you want to refer to or even learn without reading the holl book. However, it remains indicative instructions on how to accomplish a task, such as drawing a line or a wall, but you cannot transfer the live side of the movement between the mouse and the screen, which is very important, especially for beginners.

On the other hand, videos are an important pillar of the educational process because they help convey information and knowledge in an enjoyable way, making the educational situation more interesting and adding an element of interaction between learners. Some CAD educators try to take advantage of video technology, and provide content, lessons, exercises, and tutorials on CD-ROM

and may be available on specialized websites that can supplement the training students receive in class.

While other CAD teachers teach CAD in lab practice periods, when teachers explain the process for a particular CAD program and students perform a series of exercises. In general, students have different learning styles and differ in the ways they take in and process information. Some students tend to focus on facts and data while others respond strongly to visual forms of information, such as pictures, graphs, and charts. However, there are others who make more use of verbal forms or written and spoken explanations. Some prefer to learn actively and interact while others work individually (Felder, 1996) [10]. Whereas, well-designed multimedia helps learners build more accurate and effective mental models than can be achieved from text alone (Shank 2005) [11]. Some studies indicate that access to educational videos improved students' experience in the flipped classroom much more, in terms of student performance, than those in the standard classroom (Steven K and Luz A, 2016) [12].

However, there are few studies on the effectiveness of multimedia characteristics in practice (time and accuracy) on CAD learning and its ability to impart knowledge or applied skills to learners and this is the main objective of this study.

The aim of my study was to investigate the practical effect of using video vs. book-guided tutorials on learning CAD skills for new learners in terms of shortening the learning period, drawing accuracy and psychological attitude about the effectiveness of these media.

To achieve this aim, this study will deal with the following objectives:

(i) Determine the different effects of instructional media (book versus videos) on the performance of new CAD learners.

This objective seeks to test whether the use of the book will shorten the time to complete the CAD task and enhance the drawing accuracy as opposed to the use of videos.

(ii) Evaluate the learner's attitude (as regards cognitive and affective-motivational tasks) in relationship to the multimedia presentations (book vs. video).

2. Materials And Methods

Experimental Method:

The study sample consisted of (32) students who were randomly distributed into two groups. The CAD lesson of the experiment was carefully designed to test the hypotheses of the study. This included the production of a commonly used educational CAD program to assess the effects of multimedia on the performance of new CAD learners. Therefore, several criteria were considered important in the selection of the experimental material, and the laboratory study was also approved to facilitated the control of the variables under investigation. Before carrying out the experimental study, a pilot study was conducted that was designed to examine the effectiveness of the experimental substance, and accordingly:

- The same model CAD lesson should be used for the two groups, but in two different forms of explanation (book and video) so that independent variables such as the time taken to complete the drawing, the accuracy of the drawing and learners attitude can be evaluate.
- Participants should not be familiar with CAD software.
- Each presentation requires a different sample group in order to assess the impact of multimedia for the purposes of comparing the two groups.

Measurements of practice achievement:

The experimental study of Koroghlanian and Klein (2004) [13] suggests that in order to measure the effectiveness of multimedia characteristics, two criteria should be used: the practice outcome component and an attitude survey item. Practice performance is measured by the accuracy of the drawing and the time taken to complete a specific CAD task. Ramon et al. (2007) [14], asserted that the best way to assess CAD learners is that teachers evaluate students through creating a practical exercise. So, we have evaluated the practical performance by measuring the time taken to complete a given exercise, along with the accuracy of the drawing, to measure a CAD learner's performance using different multimedia.

The time was measured per minute while the accuracy was measured out of 18 points. The CAD drawing model consisted of 18 items of walls, doors, windows, roof and three dimensional views. 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-1.

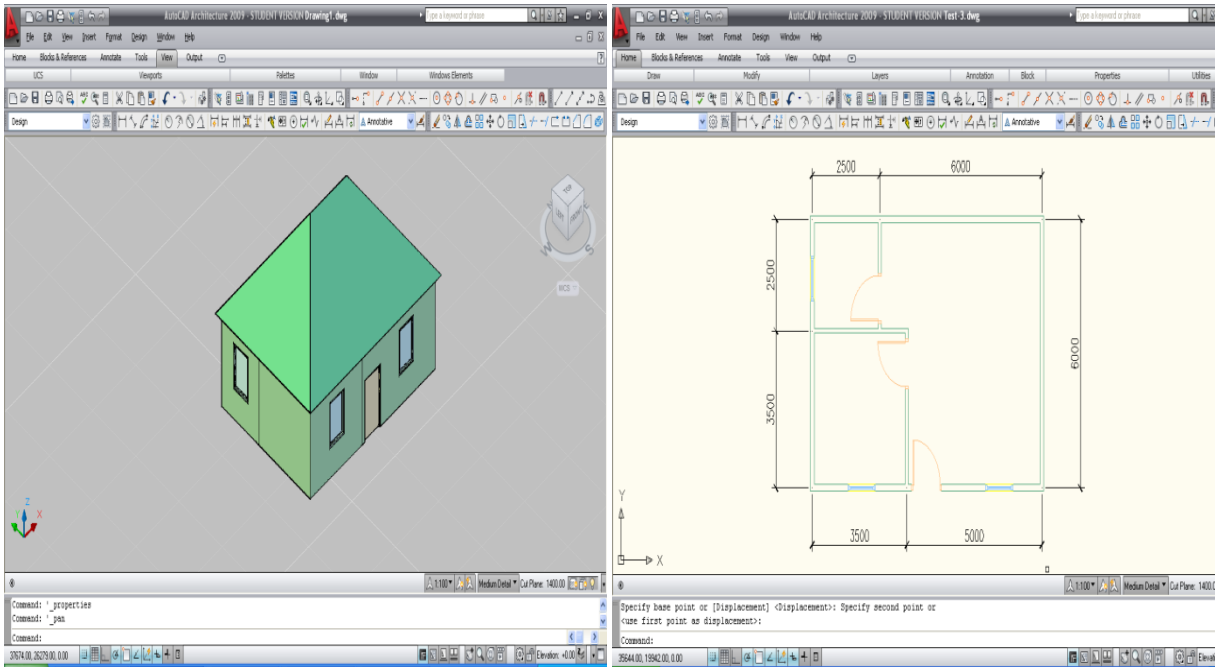

Figure-1

Attitude response:

The participant's cognitive, affective-motivational tasks were measured in a similar way to the method developed by Salomon (1984) [15] in order to measure the Amount of Invested Mental Effort (AIME). These involved the cognitive tasks, i.e. understanding - 'the information presented in this tutorial was easy to understand'; the mental effort 'I tried hard to understand the information presented in the tutorial'; interest and motivation, 'the multimedia presentation method motivates me and makes me concentrated on learning the CAD tasks'.

The resulting attitude aspects, components and statements are reported in Table-2.

3. Results

Table-1: practice achievement (time and accuracy) for (book vs. video).

Variables	Video	Book	Difference
Mean Time per minutes	41	28	31.7%
Mean Accuracy of 18 points	12	8	22.2%

Table-2: Attitude aspects, questionnaire components for (book vs. video).

Attitude Aspects	Attitude statements	Book	Video
Understanding	presentation was easy to understand	5	10
Mental effort	I tried hard to understand the information in this presentation	11	6
Motivation	I liked the presentation, it motivates me and makes me concentrate	4	11

4. Discussion

From Table-1, it was found that the group of students who used the guide book to complete the drawing task was faster in time than those who used video technology by 31.7%. While the accuracy of the drawing was higher by 22.2% in favor of the group of students who used video technology.

This may be due to the characteristics of the different media in terms of information delivery, as when using the book it is possible to access and retrieve the annotated written steps faster than browsing the video to accomplish the same task. However, the book cannot convey the kinetic interactive aspect of executing the required commands compared to the video, which negatively affected the accuracy of the drawing when using the book.

From Table-2, only 5 students out of 16, or 31.2%, of those who used the book found that the presentation made by the book was easy to understand, while 11 students, or 68.7%, confirmed that the presentation was difficult to understand. On the other hand, for the students who used video technology, 62.5% understood the presentation. Hence, it can be concluded that the presentation of CAD tasks by video is more understandable than the use of the book.

Regarding the mental effort to try to understand, 68.7 percent of the students who used the book made an extra effort to understand the presentation compared to 37.5% of those who used the video to accomplish the same task. The motivating factor was a clear indication that the students were more supportive of the video capabilities of learning CAD lessons than the book.

5. Conclusions

The results concluded that the CAD tutorials presented by the book mode shortened learning time much more than the video mode. However, the CAD tutorials presented by video mode enhanced drawing accuracy much more than book mode. Overall, the CAD tutorials presented by video mode had a significantly positive effect on the learner's attitude.

References:

1. Christopher, M., and Ann, M., 1995. Training in CAD: An Exploratory Study of Methods and Benefits. IEEE Transactions on Engineering Management, 42(4), 410-418.

2. Hamade, R.F., Artail, H.A. and Jaber, M.Y., 2005. Evaluating the learning process of mechanical CAD students. Computers and Education, 49(3), 640-661.

3. Hamade, R.F., Jaber, M.Y., Sikstrom, S., 2008. Analyzing CAD competence with univariate and multivariate learning curve models. Elsevier Inc. All rights reserved.

4. Ahmed, V, Mahdjoubi, L., Feng X, and Leach, M., 2004. The learning of CAD for construction: technical abilities or visual? International Journal of IT in Architecture, Engineering and Construction, 2(1), 7-18.

5. James, E. F., and Michael, A. D., 2002. Impact of Screen-Capture Based Instruction on Student Comprehension of Computer Aided Design (CAD) Software Principles. Journal of Industrial Technology, 18(1), 1-7.

6. Martin, M. S. and Mendelsohn, P., 2000. Cognitive load while learning with a graphical computer interface. Journal of Computer Assisted Learning, 16, 284-293.

7. Ramsey, F., Hassan, A., and Sverker, S., 2007. Correlating trainee attributes to performance in 3D CAD training. Journal of European Industrial Training. 31(2), 112-126.

8. Triono Subagio1, Nur Qudus2., Computer-Aided Drawing Learning Method to Improve Students' Cognitive and Psychomotor Aspects in Computer-Aided Drawing Competence, Copyright © 2019 The Authors. Published by Atlantis Press SARL.

9. Basma, Hussein and Marian., Using an educational website to develop some AutoCAD skills (two and three dimensional) among industrial secondary school students, the educational magazine for adult popularization, Faculty of Education, Assiut University, third volume, third issue, July 2021.

10. Felder, R. M., 1996. Matters of style. ASEE Prism, 6(4), 18-23.

11. Shank, P., 2005. The value of multimedia in learning [Online]. Avaliable at: <http://www.adobe.com/designcenter/thinktank/valuemedia/The_Value_of_Multimedia.pdf> [Accessed on 6 August 2008].

12. Steven, K. and Luz Amaya, B., Effect of Video-Guided Tutorials in a Standard Curriculum and in a Flipped Classroom for a 3D-CAD Course. c American Society for Engineering Education, 2016.

13. Koroghlanian, C. and and Klein, J.D., 2004. The effect of audio and animation in multimedia instruction. Journal of Educational Multimedia and Hypermedia, 13.

14. Ramon, R. G., Javier, S.Q., Ramon, G. S., Pedro I, A. P., 2007. Teaching CAD at the university: Specifically written or commercial software? Computers and Education, 49, 763–780.

15. Salomon, G., 1984. Television is "easy" and print is "tough": The differential investment of mental effort in learning as a function of perceptions and attribution. Journal of Educational Psychology, 76, 647-658.