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## The Use of Computer-Based Tutorial to Augment Teaching and Learning of Computer Software Application: A Case Study of Rhinoceros 3d Software

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### **Abstract:**

*Computer-based tutorials is a new technology gaining grounds in the teaching and learning of computer software applications and has given birth to self-paced learning. Self-paced learning has taken a different turn in recent times as computer technology is advancing and the interaction possibility of computers and humans is becoming easier. This study seeks to use computer-based tutorials to teach and learn Rhinoceros 3D software computer application. Qualitative research method was employed to explain and describe the various steps involved in the development of the tutorials based on Rhinoceros 3D software application. The final product which is packaged on a CD-ROM was tested through the use of empirical research. Questionnaire were administered to the final year students of the Department of Integrated Rural Art and Industry, KNUST after a purposive sampling was used. The study discovered a type of computer-based tutorial known as interactive video tutorial can be effectively used to teach and learn Rhinoceros 3D software. The computer-based tutorial has come to stay and should be used to augment the traditional way of teaching and learning.*

**Keywords:** *Computer-based tutorial, interactive video tutorial, Rhinoceros 3D software application*

### **1. Introduction**

Computer is currently a major tool for executing our works but being able to effectively use the software application is a matter of concern. Some students in the Integrated Rural Art and Industry (IRAI) department of Kwame Nkrumah University of Science and Technology (KNUST) though are taught the 3D Rhinoceros software application attribute their failure to the complex nature of the software application and without enough time to practice it. For that matter, it calls for self-paced learning and extra teaching and learning, hence the development of computer-based tutorial to augment the traditional way of teaching and learning the Rhinoceros3D software application in the department.

Computer-BasedTutorialcomes in diverse forms such as Computer-Based Training(CBT),Computer-Aided Instruction/Computer-Assisted Instruction(CAI), Interactive Video Tutorial, audio visual, multimedia etc. The computer-based tutorial is a type of education in which the student learns by executing special training programs on a computer. It is especially effective for training people to use computer applications because the computer-based tutorial program can be integrated with the applications so that students can practice using the application as they learn.

(<http://www.webopedia.com/TERM/C/CBT.html>\_assessed on 27th March, 2009, 10:02am).

Computer-based tutorial programs are interactive and can illustrate a concept through attractive animation, sound and demonstration. They allow students to progress at their own pace and work individually or problem solving in a group. It captures the students' attention because the programs are interactive and engage the students' spirit of competitiveness to increase their scores. Considering the kinds of computer-based tutorial, interactive video tutorial was adopted to develop the tutorial based on Najjar (1996) citing Fowler (1980) that," interactivity can be thought of as mutual action between the learner, the learning system and the learning material". The tutorial was tailored for Rhinoceros 3D considering the students, software applications and the computer systems.

Interactive video tutorial is a true teaching and learning material that is not forced on the learner but rather, is an activity the learner does himself or herself .From another dimension, interactive video tutorial has come to strengthened self-paced-learning. Self-paced-learning can be said to be a form of learning where it is done personally at the time and comfort of the learner. The final product which is packaged on the CD-ROM is programmed in a way that the user can access the interactive video tutorial without an instructor

and therefore can be used at the comfort of the user. Najjar (1996) elaborate that “computer-based multimedia instruction allows the learner to personally set the pace of learning while traditional classroom instruction does not”. Self-paced learning is probably a more effective way to learn because the learner can move on to new material when the learner is ready.

Wittrock (1989) states that in order for learning to occur, “learners must be, at a minimum, mentally active in the learning process”. All computer-based instructional systems can mentally engage learners by directly involving them in learning. But because of the added dimension that video offers, interactive video tutorial surpasses other computer-based tutorial, based on its ability to involve the learner and engage him or her in a two-way dialog.

Ippa and Anderson (1988) says, well designed interactive video lessons invite learners to interact with the visuals by enabling them to interrupt, identify sequence, and select from alternative actions. Students can interrupt visual scenes when they identify problems in the scenario. They can stop sequences if they can't follow the logic or get lost. They can practice with concepts by matching pictures to words, identifying critical visual elements of concepts, or matching sounds to words. For sequencing activities, learners can select appropriate psychomotor sequences or select options and be shown consequences visually and dramatically. The inducement from Ippa and Anderson (1988) helped in a careful plan of the learning sequence (tuition plan). The demonstration of the interactive video tutorials based on the various topics made use of pictures, videos, texts and sounds for the teaching and learning of 3D Rhinoceros software application.

Rhinoceros 3D is a stand-alone, commercial NURBS-based modelling tool, originally developed by McNeel & Associates (2001) as a plug-in for Autodesk's AutoCAD. Rhinoceros 3D has its icon as the representation of the head of hippopotamus, commonly used for Industrial design, architecture, Marine design, Jewelry design, Automotive design, CAD / CAM, rapid prototyping, reverse engineering as well as the multimedia and graphic design industries. (<http://www.autofieldguide.com/articles/090409.html>. assessed on Dec., 12th 2008, 1:12pm). Rhinoceros 3D application has the capacity to create, edit, analyze, document, render, animate, and translate NURBS. According to McNeel & Associates (2001), NURBS (Non-Uniform Rational B-Splines) are mathematical representations of 3D geometry that can accurately describe any shape from simple 2D elements (line, circle, arc, or curve) to the most complex 3D organic free-form surface or solid. Wigstaff (2004) sees NURBS over the years as the considered standard modeling format for film and studios works. Ratner (2003) agrees with McNeel & Associates that NURBS are flexible lines of a higher mathematical order than splines (flexible line segments defined by edit points or vertices) and control vertices defines the shape of NURBS. He also added that NURBS is an embodiment of patch modeling. NURBS excel in the capability to accurately define curves, surfaces containing complex compound curves and very intuitive for texture mapping. Because of their flexibility and accuracy, NURBS models can be used in any process from illustration and animation to manufacturing.

(<http://www.rhino3d.com/features/?PageSpeed=noscript>. Assessed on May, 12th 2014, 7:50am). Rhinoceros 3D software provides users with the ability to generate photo-realistic depictions of their designs before production. This gives the user the opportunity to see the outcome of the final product in advance, allowing the user sufficient time to make changes and adjustments that will ultimately save valuable time and money.

There is plug-ins to the Rhinoceros 3D application which makes it all-inclusive computer aided design (CAD) software for industries. This plug-ins includes Flamingo (a raytracing rendering plug-in), Penguin (non-photorealistic rendering), Bongo (animation), V-Ray (rendering plug-in) and hundreds of third-party plug-ins available in the markets. Rhinoceros 3D has the ability to import and export over 30 different file formats, meaning it is compatible with most of today's popular design software. Its versatility has made it a convenient tool for converting files between multiple design programs within the workspace. According to McNeel & Associates (2001), Rhinoceros is becoming increasingly popular amongst many different industries because, like many similar modeling applications, Rhinoceros 3D features a scripting language called Rhino Script based on Visual language and its diversity, multi-disciplinary functions, and relatively low cost. The various formats available allow Rhinoceros 3D to act as a 'converter' tool, bridging a gap between programs in a design workflow for example objects can be modeled in Rhino and later exported to 3D Studio Max or other CAD software for rendering and animation. (<http://www.autofieldguide.com/articles/090409.html>. assessed on Dec., 12th 2008, 1:20pm). In this study, the tutorial focused its developments on the Rhinoceros 3D software application because it is embodied in the curriculum of the third and final year students of Integrated Rural Art and Industry, KNUST. The study developed and tested interactive video tutorial on Rhinoceros 3D. For an effective testing of the tutorial, the final year students were purposively sampled because of their exposure in the Rhinoceros 3D software application.

## 2. Methodology

This research is a qualitative type which employed descriptive and empirical research. The descriptive method helped this research treatise the accurate type of computer-based tutorial and the step by step process of executing the tutorial. The use of the developed tutorial caused a change in the teaching and learning of Rhinoceros 3D software application and for that matter making the study an empirical type.

The working procedure started with the setting up of the basic hardware components and the secondary hardware components which include headphone with microphone attached. The microphone with the help of the camstasia v3.0 software captured the video and sound. The headphone and computer monitor helps to hear and see feedback respectively.

Development of the Interactive video tutorial went through the following procedures; the Interface design, Tuition plan (Course outline), Writing of Narrator's script, Capturing of video and sound, Editing, Exporting the Edited Video and sound Files, Packaging of the captured videos and sounds into the interface, Effects, Labeling and Writing of CD-ROM.

### 2.1. Interface Design

Development of the tutorial on the various topics was packaged into the interface design. The factors which influenced the interface design were colour scheme, Size of the screen (screen resolution), Standards window features and Control tabs. The interface design was integrated into Camtasia Theater software application as shown in Fig. 1.

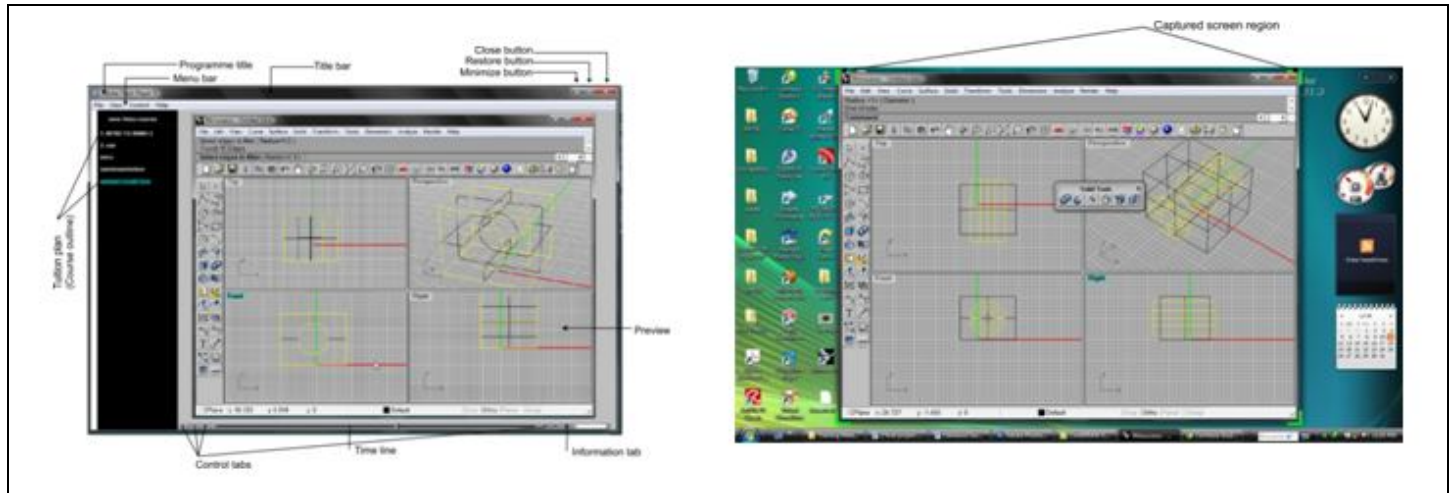


Figure1: Labeled Interface Design

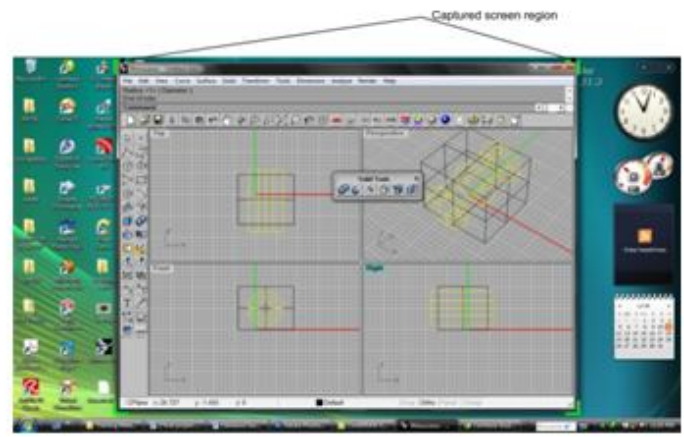


Figure 2: Captured Screen Region (Marks in Green)

### 2.2. Tuition Plan (Course Outline)

The Interactive video tutorial based its curriculum on Rhinoceros 3D software training manual levels 1 and 2 from McNeel & Associates (2001). The tuition plans are, Introduction to Rhinoceros 3D software, Rhinoceros 3D interface, Tools, Commands and options in Rhinoceros 3D software, Understanding the 3D concept in Rhino, Create basic graphic objects (lines, circles, arcs, curves, rectangle, polygons, ellipse, solids and surfaces), How to project curves into surfaces, How to save, import, export and print Rhino files, How to give dimensions to a model, Rendering. The tutorials carefully sampled four models and demonstrated how to model them, featuring specific objectives. These models include, Sample model 1 (First Model), Sample model 2 (Candle holder), Sample model 3 (V Block object), Sample model 4 (Flower vase), Rhino gallery (works modeled and rendered in Rhino 3D by the tutor), References.

### 2.3. Writing of Narrator's Script

The narration was based on free flow with little written scripts. The scripts were in forms of listed points and definitions were explained.

### 2.4. Capturing of Video and Sound

The on screen capturing of video, sound and editing was done with the help of Camtasia Studio 3.0 alongside with the tuition on Rhinoceros 3D. The region that the screen captured was set to take the size of the Rhinoceros 3D window size as shown in Fig. 2. The narration was done into a microphone, while the demonstration was done on screen and were captured by Camtasia Studio 3.0 software application.

### 2.5. Editing

The captured videos and sounds were edited with the same Camtasia Studio 3.0. Portions of the recordings that were blank were highlighted and cut out (Rough cuts) as shown in Fig. 3 and places that were not clear were re-recorded.

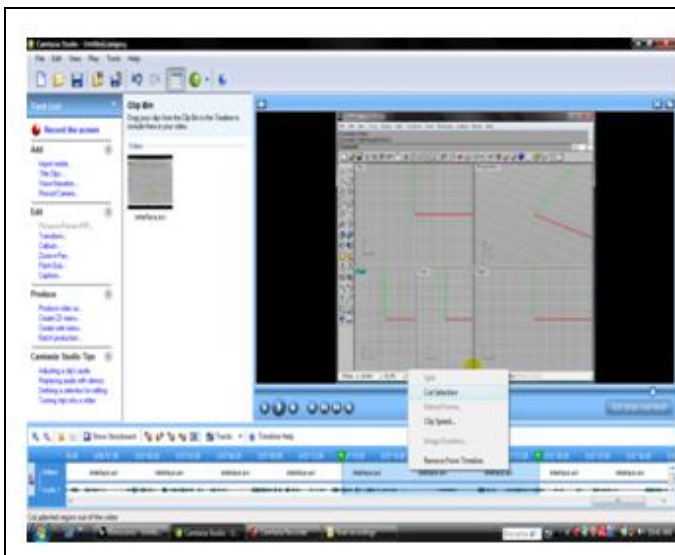


Figure 3: Rough Cuts in Camtasia Studio 3.0

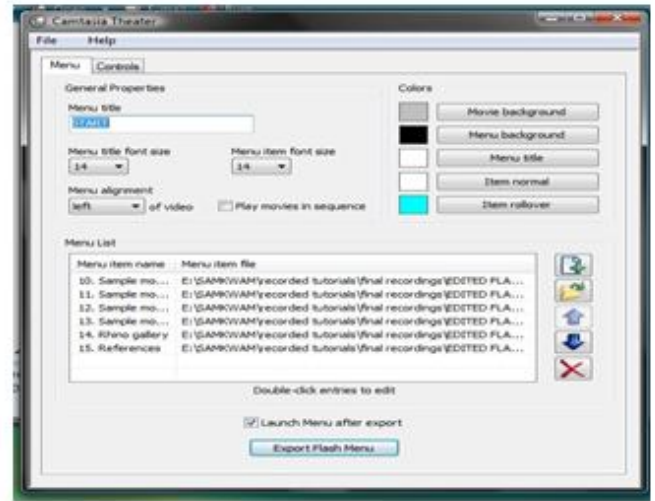


Figure 4: Packaging the Micromedia Flash Files into the Interface

2.6. Exporting the Edited Video and Sound Files

The various edited video files were exported into Micromedia Flash file because of its compatibility with Camstasia Theater software for the packaging of the interface. The audio files were also exported into mp3 file format.

2.7. Packaging of the Captured Videos and Sounds into the Interface Design

The exported video and sound files which are now in Micromedia Flash formats were imported into Camtasia Theater 3.0 and arranged to follow the tuition plan as shown in Fig. 4. Other settings such as the colour of the text, backgrounds of the interface and Mouse over effect (Item rollover) were considered.

2.8. Effects

Effects were used to enhance the teaching and learning process of the tutorial. Some of the effects used were Mouse over effect (Item rollover) and Mouse highlighter. In the interface, when the mouse pointer moves over an item, it changes its colour. This gives an indication to the user that the mouse pointer is over the command or item. This aids precision in the use of the Interactive video tutorials. The mouse highlighter was used to locate the mouse pointer as shown in Fig. 5. This helps the user to follow the demonstrator’s mouse pointer. A click on the mouse buttons informs the user about the mouse activities such as a click, double click and right click in the demonstration.

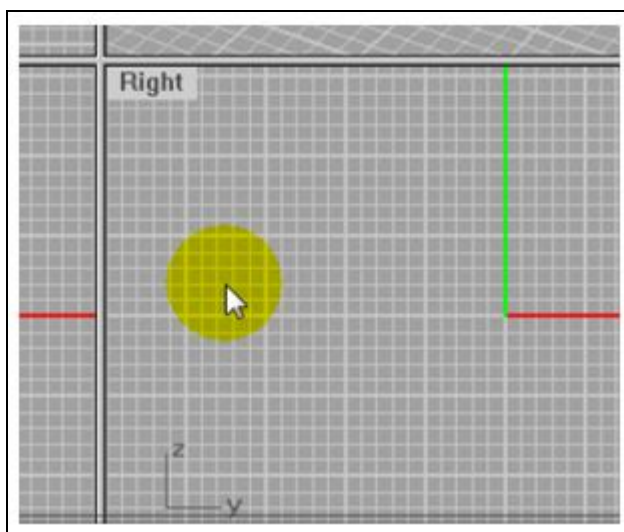


Figure 5: Mouse Highlighter



Figure 6: CD-ROM label

2.9. Labeling and Writing of CD-Rom

Various rough sketches were done and finally arrived at one of the design. The final sketch was then developed and polished in Corel Draw X4® for aesthetic appeal as shown in Fig. 6 and 7. The CD-ROM label contains the title of the CD-ROM and the name of the



tutor. The final product of the Interactive video tutorials were written onto the printed CD-ROM with Nero software application and finally packaged into a CD-ROM case, as shown in Fig. 7 and presented as the final interactive video tutorial.



Figure 7: CD-ROM Case

### 3. Results and Discussion

The detailed study or examination of the tutorials was done in order to discover its effectiveness by purposively sampling 50 views of IRAI final year students through questionnaires. The following bar charts demonstrate the results of the findings as it gather the views on how effective the developed tutorial works. The findings were based on the following: The interface usability, Interface design, Work flow (navigation), Sound quality, Audibility of the narrator, Synchronization of video and sound, Can the tutorials teach?, Can the tutorials be learnt?

The interface usability findings seek to know if the developed tutorials are user friendly. FROM Figure 8, the majority being 26 students (52.0%) graded the interface usability of the tutorials as very good. Out of 20 students and 4 students representing 40% and 8.0% responded good and excellent respectively. Nobody responded to poor, because the tutorial is simple and straight forward. Complex video tutorial makes the study of the tutorial very cumbersome and therefore simplicity should be given the necessary consideration. The result also shows that 48.0% and 44% of the students graded the interface design of the software as very good and good respectively (Figure 9) whiles 4 students representing 8% said it was poor. Interface design, is about the general appearance. Even though none responded to excellent, majority agreed on very well which makes the interface design an average one?

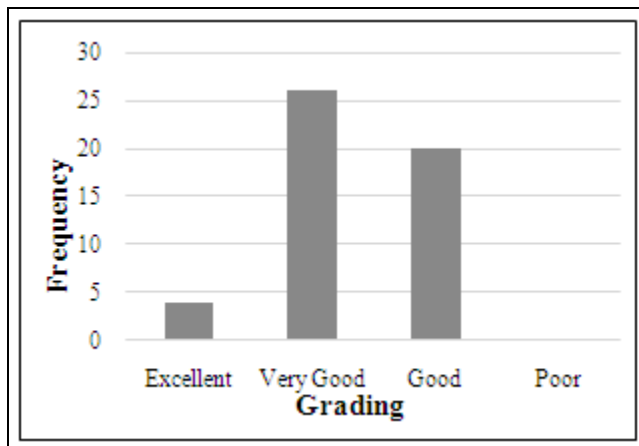


Figure 8: Interface Usability  
Source: Field Data 2012

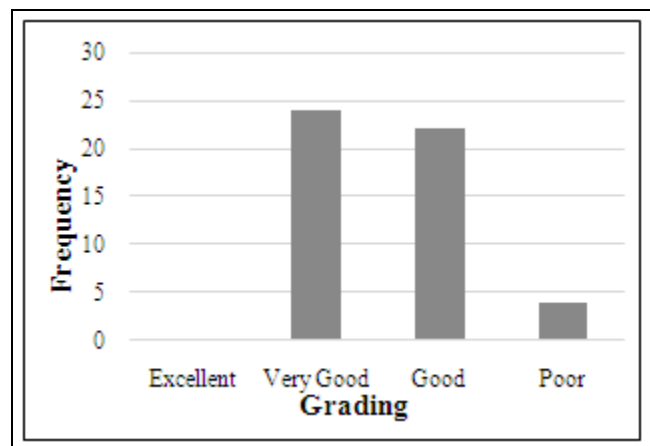


Figure 9: Interface Design  
Source: Field Data 2012

Navigation seeks to know if the students were able to move through the interactive video tutorial effortlessly. From Figure 10, 12% of the students graded the navigation aspect of the tutorials excellent whiles 28 students (56%) responded very good. 28% and 4% graded the work flow of the tutorials as good and poor respectively. The study further shows that majority of the students (96%) gave positive grades of the interface usability because the tutorials made use of basic buttons such as play, stop, time line which can be toggled front and back. The topics (curriculum) are outlined on the left to be accessed by double click or enter from the keyboard.

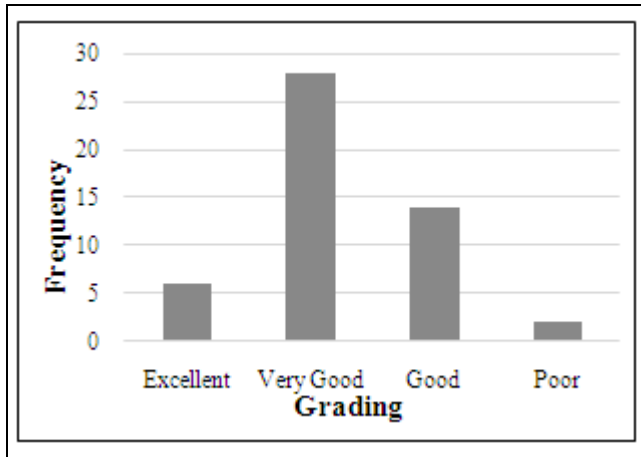


Figure 10: Work Flow (Navigation)  
Source: Field Data 2012

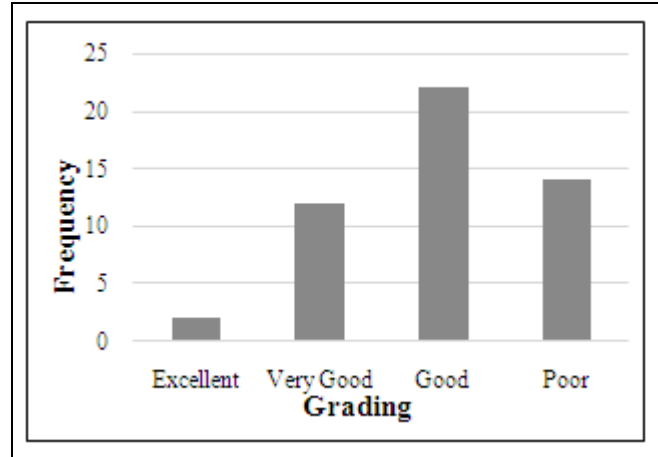


Figure 11: Sound Quality  
Source: Field Data 2012

Sound quality talks about the clarity of the sound of the video tutorials. According to the study, 2 of the students which were 4.0% said the sound quality of the tutorials was excellent. Furthermore, 12 students (24.0%) also graded it as very good, 22 students (44.0%) and 14 students (28.0%) graded the sound quality of the video tutorials as good and poor respectively as shown Figure 11. The feedback indicates that the sound quality has an average performance.

Audibility of the narrator considers the fluency of the English language, correct pronunciation of words and the ability to play with words to teach by the tutor of the video tutorials.

The study indicated that out of the 50 students, 8.0% said excellent to the grading of the audibility of the narrator. 12 students which represent 24.0% said very good and 24 students representing 48% graded it as good. 10 of the students which represent 20.0% dislike the audibility of the narrator and therefore graded it as poor as shown in Figure 12. The tutor based the narration on a few written scripts whilst others came from memory and experience.

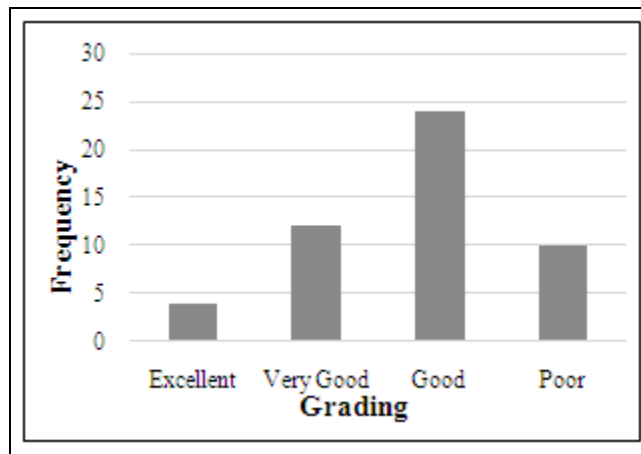


Figure 12: Audibility of the narrator  
Source: Field Data 2012

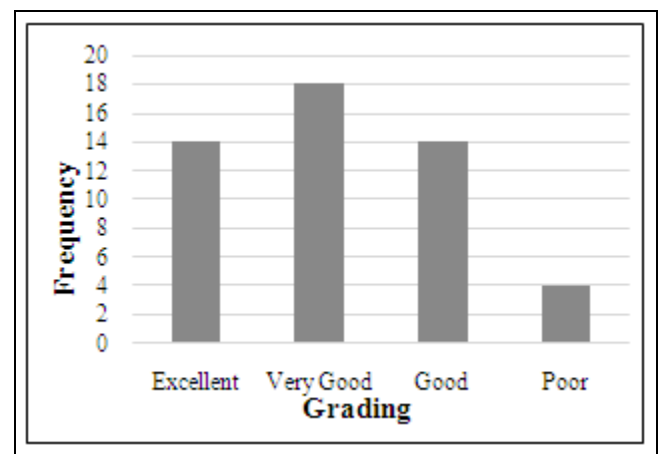


Figure 13: Synchronization of Video and Sound  
Source: Field Data 2012

Synchronization of video and sound looks at the matching of the sound to the video of the tutorials. The development of the video tutorials employed sound and video as the major component and they must move at parallel.

With the sound and video synchronization, 14 students which represent 28.0% graded it as excellent. 18 students which is 36.0% been the majority under this section graded the synchronization of the sound and video as very good. 14 students which is 28.0% and 4 students which also represent 8.0% graded the synchronization of the sound the videos good and poor respectively as shown in Figure 13. The majority constituting a total of 96% concludes that the synchronization of video and sound of the video tutorials is perfect.

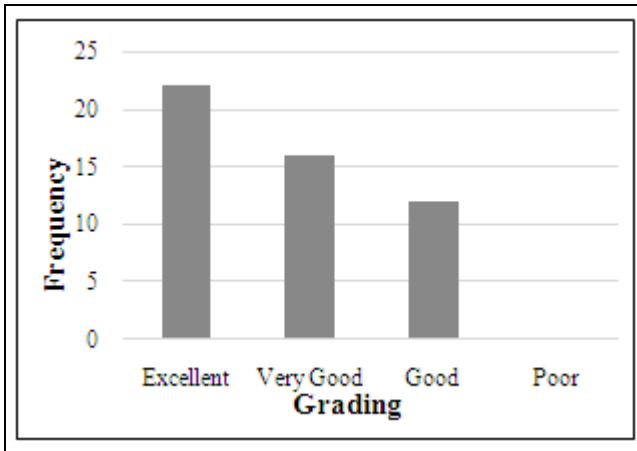


Figure 14: Can the Video tutorials teach?  
Source: Field Data 2012

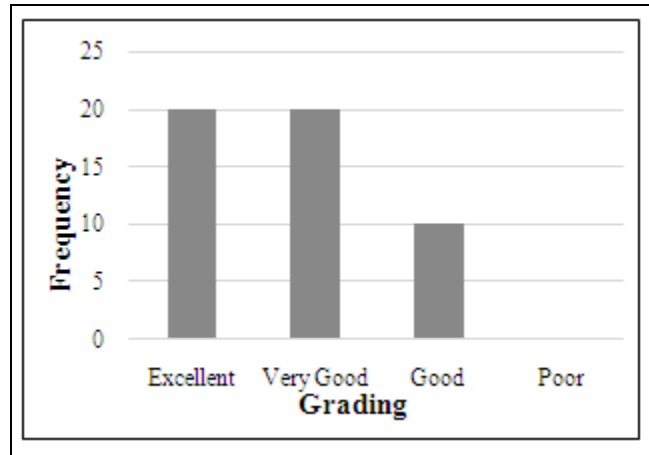


Figure 15: Can the video tutorial be learnt or followed?  
Source: Field Data 2012

After the development of the tutorials, the study was conducted to know if the video tutorials could teach and be learnt as expected. The result also indicated 44.0% and 40% said the video tutorial is excellent for teach and learning of Rhinoceros 3D software respectively as shown in Figures 7 and 8. Regarding following of the video tutorial, 40% of the students graded it very good. The minority being 24% and 20% graded the ability of the tutorial for teaching and learning as well (Figures 14 and 15). Deducing from the analysis, majority chose excellent because the instructions and demonstrations in the video tutorial was really developed to make the teaching and learning of the Rhinoceros 3D software precise and simple. The curriculum and scripts written for the tutorials was based on the training manual (Levels 1 and 2) from McNeel & Associates (2001). The final package of the tutorial features a folder called practice model which contains Rhinoceros 3D and picture (JPEG) files used in the demonstration. These files are made available to be accessed by the users in order to follow the demonstration concurrently. For the users to have enrich experience in modelling, four sample models namely Sample model 1 (First Model), Sample model 2 (Candle holder), Sample model 3 (V Block object), Sample model 4 (Flower vase) were carefully selected, modeled and rendered as shown in Figures 8-11 respectively. Each sample model features specific objectives that must be achieved at the end of each lesson.

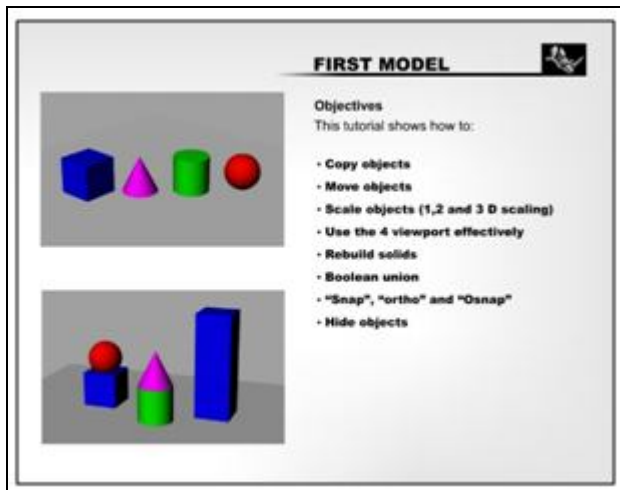


Figure 16: Sample Model 1 (First Model)

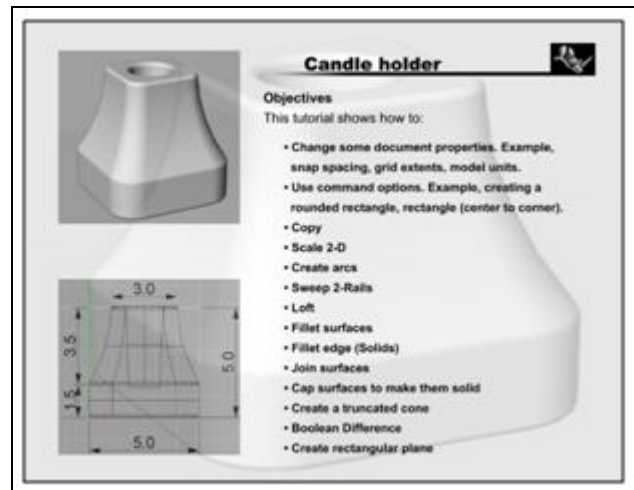


Figure 17: Sample Model 2 (Candle Holder)

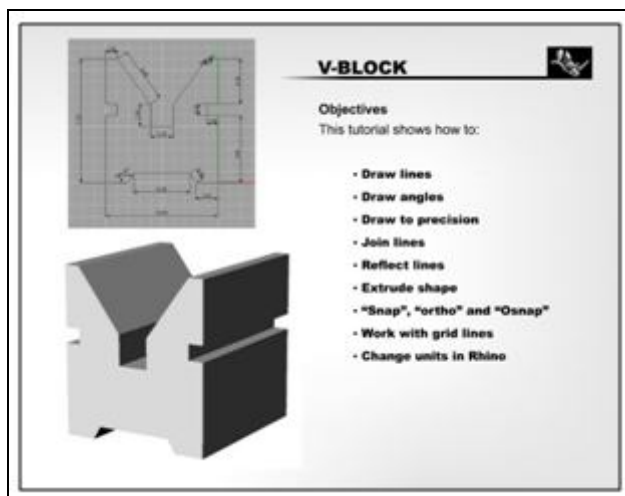


Figure 18: Sample Model 3(V Block Object)

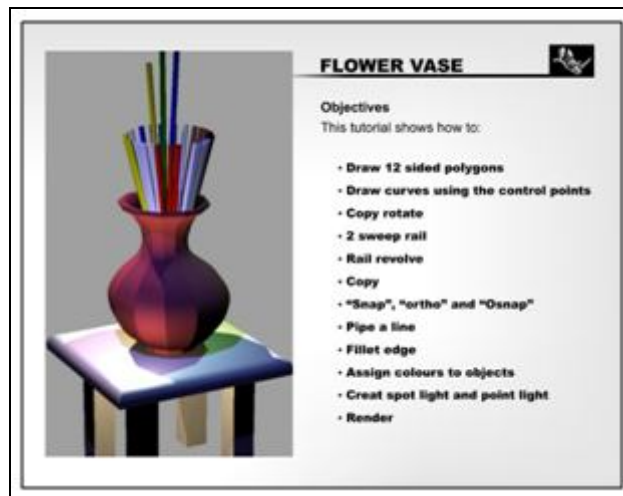


Figure 19: Sample Model 4(Flower Vase)

#### 4. Conclusion

The interactivity provided by ICT will be effectively used to bridge the gap between active learning and passive teaching or the other way round to make teaching and learning a more interesting and enriching experience. The study determined that computer-based tutorials employed as teaching and learning devices can augment the conventional methods. Interactive video tutorials indeed can boost the teaching and learning of Rhinoceros 3D software if well designed and structured. The findings of the study were based on the following structures namely the interface usability, interface design, work flow (navigation), sound quality, audibility of the narrator, synchronization of video and sound, can the tutorials teach and be learnt. These structures were used to test the efficiency of the tutorials and it has proved successful.

The technology of computer-based tutorials has come to stay and therefore must be adopted into the educational curriculum to help in the quest to teach and learn more sophisticated computer software applications.

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