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3d Model to Educational Multimedia Approach for Simulate Parts of Shock Tunnel

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ABSTRACT

Background: Computer Aided Learning (CAL) or Computer Assisted Learning can be defined a process of using the computer for the purposes of teaching and learning. Generally CAL employs multimedia technologies for the purpose of making the subject more effective, speeding up the learning process, understanding and enhancing perception of the learners **Objective:** To develop a user friendly software for education purposes using multimedia technology. **Results:** student's acceptance level of teaching has been increased using multimedia approach than traditional methods in subject shock tunnel. **Conclusion:** improve the students' score in Mechanical Engineering Design by using this model into 38% when compared with result of quiz using traditional methods.

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INTRODUCTION

Computer Aided Learning (CAL) or Computer Assisted Learning can be defined a process of using the computer for the purposes of teaching and learning. Generally CAL employs multimedia technologies for the purpose of making the subject more effective, speeding up the learning process, understanding and enhancing perception of the learners. In general CAL is being used extensively in several areas such as medicine, engineering, and science. CAL uses films, 2D or 3D images, sounds, effects, animation, graphic to facilitate the understanding, conservation and learning. Today CAL has moved into the realm of creating learning environments, whereby the participant has the ability and necessary tools to produce their own learning paths and outcomes (Whalley, R.M. 1998). CAL is the use of software Multimedia Learning Tools that not only provide its users with information to learn but tests the users' knowledge and provide feedback on the material learnt in an interactive manner (Degoulet *et al.*, 1999).

Objective:

- To develop a user friendly software for education purposes using multimedia technology;
- To develop animation for 3D model to simulate assembling and disassembling process of High speed flow shock tunnel;

Multimedia:

Multimedia can be defined as concept of integrating text, video, graphics, animation and sound for entertainment and educational purpose "http://www." Television is one typical example of multimedia platform, which constitutes all these elements. An educational application that comprises animation, sound, and text can termed "multimedia software" "http://www." Basically the multimedia products are available in CDs or websites.

Attributes of Multimedia:

Several models of multimedia courseware intended for researchers and students has been designed and adopted in part of the curriculum and the reason for this is due to (Manjit Sidhu *at al.*2003): -

- 1) The continuing need for the development of educational systems to suit with nature thinking of students from one generation to another (Dearing .1997);
- 2) The need for flexibility in dealing with products intended for educational purposes, that caused an increasing number of students who prefer to study in a part-time basis (Englert, A., *at al.* 2009)

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3) It can be divided into three main groups; functional multiple media, delivery control and interactivity shown Fig.1 (Englert, A., at al. 2009), where it allows developers to choose any form deemed appropriate to represent the subject, which facilitates delivery of knowledge to the user in a simple way and ensures that this is a good way to learn, especially for complex subjects (Cairncross, S. at al.2001).

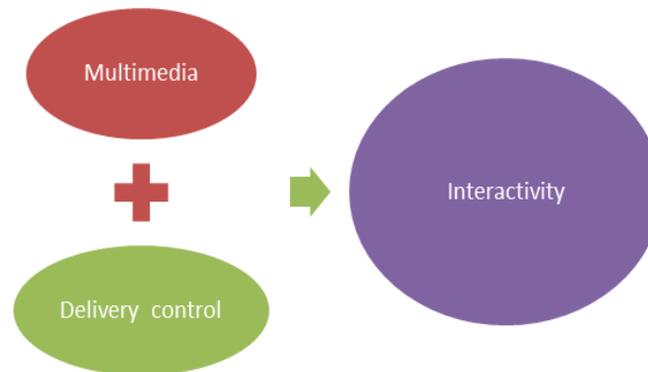


Fig. 1: Key attributes of multimedia (Manjit Sidhu at al.2003).

- 4) The use of any interactive style when you choose any part or clicking on it shows the details of that part which allows the user, flexibility and interactivity with the course (Cairncross, S. at al.2001);
- 5) Simulate some difficult experiences, such as handling spacecraft's or satellites, or some costly and difficult engineering tests. This allows the user to do experiments and provides them with less effort and cost, in addition avoid some of the risks that arise as a result of that experience; and
- 6) Three-dimensional and VR are shapes which allows the user to see, imagine, understand and realize the whole explanation on the subject.

Courseware developed at UNITEN:

In line with many other multimedia product developments this study also employs the ADDIE model for developing the tool. The analysis phase is concerned with finding relevant articles and other sort of resources to find out the best solutions, to solve the problems associated with the traditional method of teaching the mechanical engineering students and how to enhance their learning experiences using multimedia techniques. The design and development phases are more focused towards the gathering resources, flow charts, coding, writing scripts, drawing, and module transition and integrating. The implementation phase involves in implementing the learning tool for the benefit of students. Accordingly the evaluation phase involves in testing the product by summative and formative evaluation methods. The process of analyzing data from the questionnaire is done through the use of statistical software such as SPSS and Excel .SPSS using Mean, Std. Error of Mean, Median, Mode, Std. Deviation, Variance, Skewness, Std.Error of skewness, Kurtosis, std.Error of Kurtosis, Rang, Sum, and percentile (25, 50, 100) and Excel for Statistical graphics, all that was done for evaluating the performance of the Multimedia learning tool (Figure 2 explain the stages of methodology).

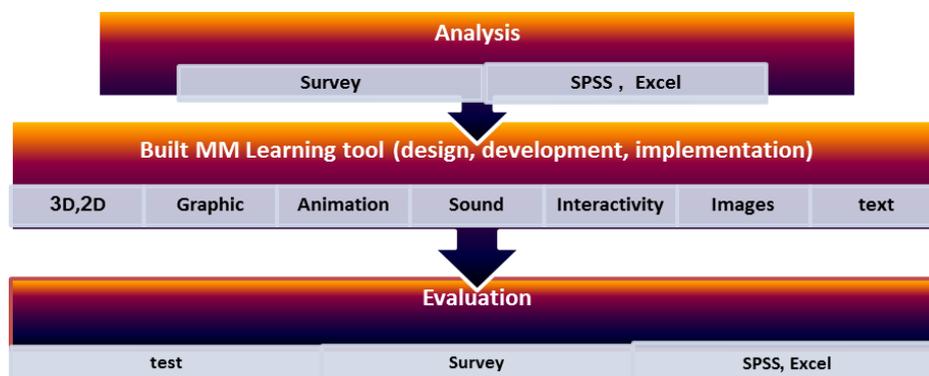


Fig. 2: Stages of methodology.

Participants:

Students from Faculty of Engineering Department of Mechanical Engineering, UNITEN, were chosen as the participants in the sample. The participants deal with the Mechanical engineering design subject. The number of samples are ($n= 29$) students. According to the lecturer of the subject Dr. Amir Al_Falahi, most students suffer from the problem of understanding the subject of shock wave, because the student do not have preconceptions about the topic, as the lecturer feels difficult in clarifying the details accurately.

Analysis:

In this part, the questions were distributed to collect the required data in order to implement the interactive Multimedia tool, determine and define the nature for the problems. The collected data gave the researcher a clear vision about the existing problem and the method to address the issue of learning and understanding Shock Tunnel. The total numbers of samples collected were 29 students Mechanical Engineering Design subject, in COE, UNITEN.

Shock wave topic is vague and hard to follow

Agree Neither Disagree

From the analysis the data resulted from this question, the *Shock wave topic is vague and hard to follow* the percentage answer of students are 75.9% of the students who filled the questionnaire “Agree”, 20.7% “Neither”, and 3.4% Disagree. Figure 3 shows the Pie Chart-Percentage of Q1, Table 1 explains the Frequency of Q1, and the Table 2 explain the statistical analysis for question 1

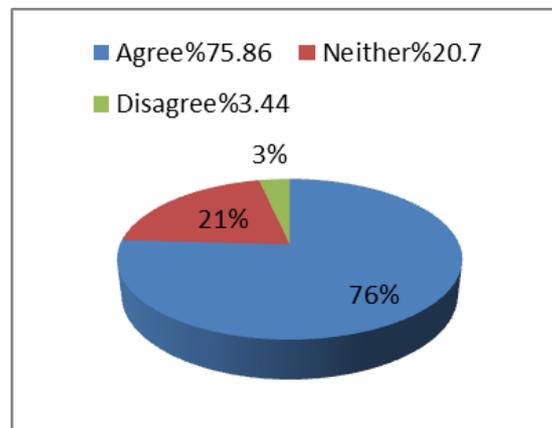


Fig. 3: Pie Chart-Percentage of Q1.

Table 1: The Frequency of Q1.

Valid	F	P	V.P	C.P
Agree	22	75.9	75.9	75.9
Neither	6	20.7	20.7	96.6
Disagree	1	3.4	3.4	100.0
Total	29	100	100.0	

Table 2: The statistical analysis for Q1.

		Q1
N	Valid	29
	Missing	0
Mean		1.2759
Std. Error of Mean		.09797
Median		1.0000
Mode		1.00
Std. Deviation		.52757
Variance		.278
Skewness		1.813
Std. Error of Skewness		.434
Kurtosis		2.714
Std. Error of Kurtosis		.845
Range		2.00
Sum		37.000
Percentiles	25	1.0000
	50	1.0000
	75	1.5000

I am interested in learning more about shock wave using multimedia technique:

Agree Neither Disagree

From the analysis the data resulted from this question, “*the students are interested in learning more about shock wave using multimedia technique*”. The percentage answers of students are 93.103% of the students who filled in the questionnaire were agree, 6.896% Neither, and 0.0% Disagree. Figure 4 shows the Pie Chart-Percentage of Q2, Table 3 gives the data of the Frequency of Q2, and the Table 4 gives the statistical analysis for Q2.

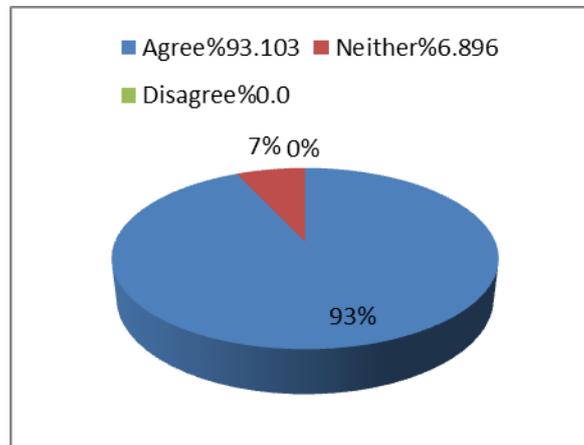


Fig. 4: Pie Chart-Percentage of Q2.

Table 3: The frequency of Q2.

Valid	F	P	V.P	C.P
Agree	27	93.103	93.13	86.2
Neither	2	6.896	6.869	100.0
Total	29	100.0	100.0	

Table 4: The statistical analysis for Q2.

		Q2
N	Valid	29
	Missing	0
Mean		1.1379
Std. Error of Mean		.06517
Median		1.0000
Mode		1.00
Std. Deviation		.35093
Variance		.123
Skewness		2.216
Std. Error of Skewness		.434
Kurtosis		3.123
Std. Error of Kurtosis		.845
Range		1.00
Sum		33.000
Percentiles	25	1.0000
	50	1.0000
	75	1.0000

Design and development:

The 3D model has been developed by using 3DStudio MAX(Fig 5), this model built by AutoCAD and export into 3D Max', the proposed system can potentially control on the animation on 3D shock tunnel model by moving in any direction left, right, up, down, move in, move out, rotate left, rotate right, rotate up, rotate down, clockwise, counter-clockwise rotation, zoom in, and out, and reset(Fig 6,7). The student can see the methods of assembly and disassembly for all parts of shock tunnel accurately by the graphic model by clicking on the video button. However students can use the system with the basic input devices such as mouse and keyboard.

As mentioned earlier this system constitutes: sound, video, text, graphic, image, 2D–3D model, and animation. The primary feature of the system is interactivity, which enables the students to interact with the system very freely. The next important feature is flexible control over the 3D model: this system has the ability to control the 3D model, enabling it to be viewed in any angle. The third feature is Accuracy: this system has high accuracy in 2D and 3D models and graphics of shock tunnel; they almost resemble the real tunnel. Finally

the ease of use is yet another positive feature of the system. The system is very user friendly and does not have any complex aspects that confuse the students. Moreover the 'help' feature will assist the students whenever they have doubt in using the features.



Fig. 5: The Implementation phase for Multimedia learning tool

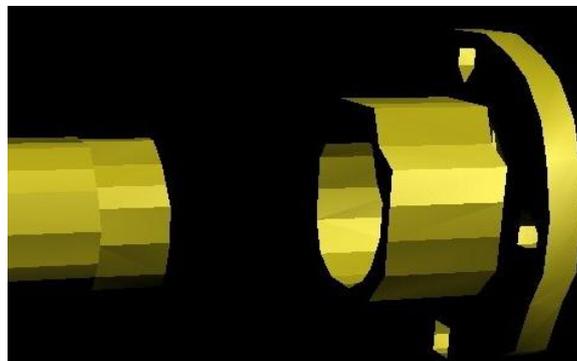


Fig. 6: Driven section 3D model

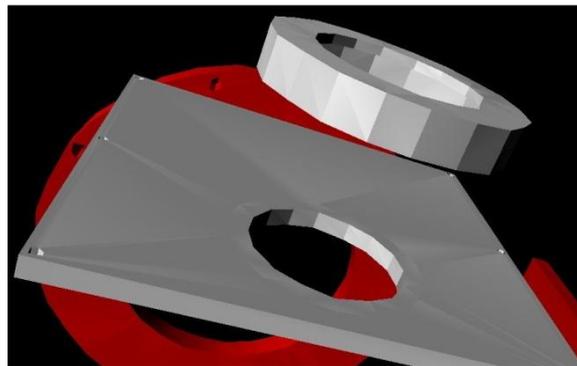


Fig. 7: Zoom in until 800%

The implementation phase deals with the actual delivery of the developed multimedia learning tool. The multimedia learning tool was delivered in the form of CD-ROM. At this stage, the multimedia learning tool was ready to be evaluated by the users. The proper instructions were given to the users in order to perform testing on the multimedia tool.

Evaluate:

The samples of this survey are 26 students from Mechanical Engineering students from COE, at UNITEN. The survey had two steps; in the first step the topic of SHOCK WAVE for Mechanical Engineering Students were explained by traditional methods and later a quiz was conducted. The second step involved in explaining the same topic but by the multimedia learning tool followed with a quiz. The results of the quizzes from steps 1

and 2 were later compared to determine the rate of acceptability of the multimedia learning tool as shows in Fig 8

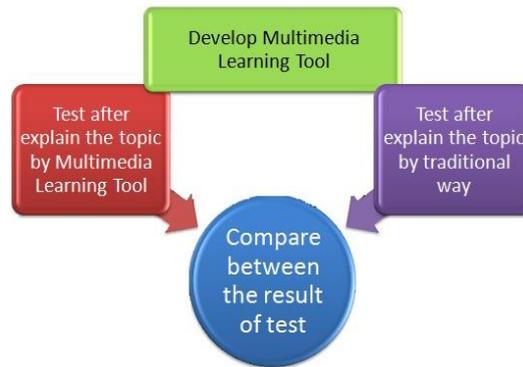


Fig. 8: Methodology of evaluate.

- The result of quiz after explaining by using traditional method:

Table 5: The result of quiz after explaining by using traditional method.

A	A-	B+	B	B-	C+	C	C-	D	E
3	5	8	4	2	2	1	1	0	0

Figure (9) shown the Pie-chart for the result of quiz after explain by traditional method

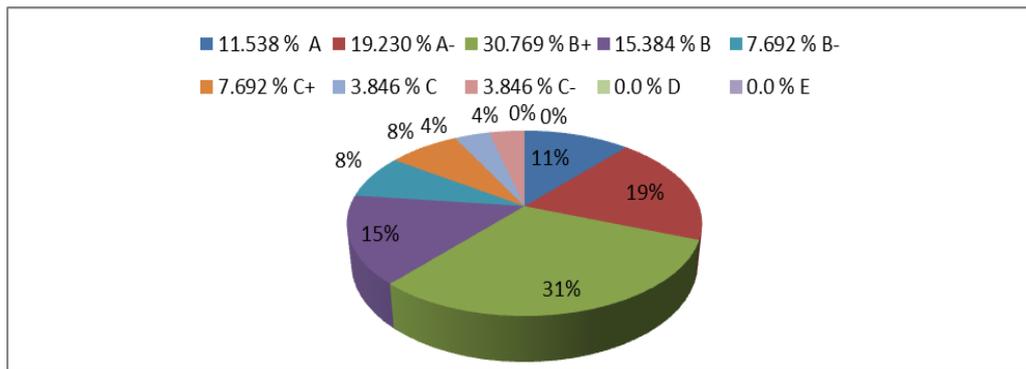


Fig. 9: Pie-chart of result after explain by traditional method.

- The result of quiz after explaining by using the developed multimedia learning tool.

Table 6: the result of quiz after explaining by using multimedia learning tool.

A	A-	B+	B	B-	C+	C	C-	D	E
8	10	4	2	2	0	0	0	0	0

Figure (10) shown the Pie-chart for the result of quiz after explaining by using multimedia learning tool

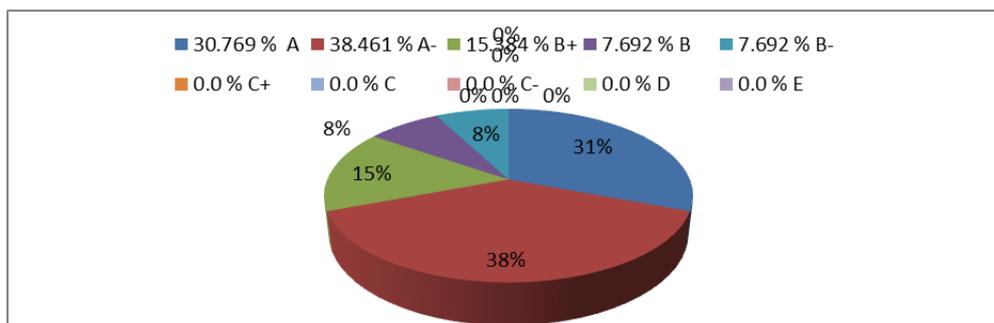


Fig. 10: Pie-chart of the result of quiz after explaining by using multimedia learning tool.

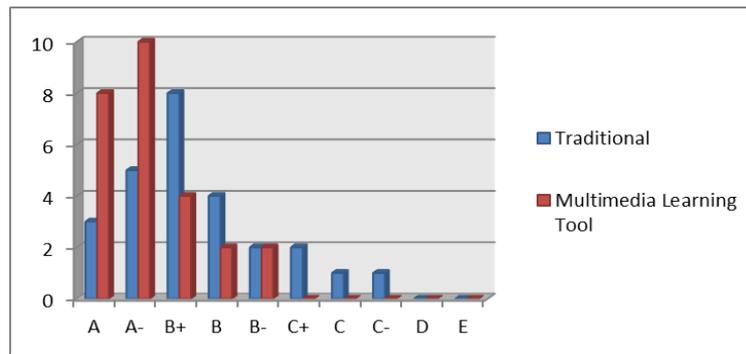


Fig. 11: compare between results.

Evaluation of the 3D animated Models:

Table 7: Analysis of Q1.

A:V.good	B:Good	C:Middle	D:Pass	E:Fail
19	5	2	0	0

As shown in Figure (12), for the question “Evaluation of the 3D animated Models”

73% of the students had answered ‘very strongly agree’, 19% had answered ‘agree’, the total percentage of the above is 92% from the result higher than 80%. However 8% of the respondents stayed neutral, 0.0% average and 0.0%-strongly disagree. Table 8 shows the frequency for Q1, and Table 9 shows the statistical result for Q1.

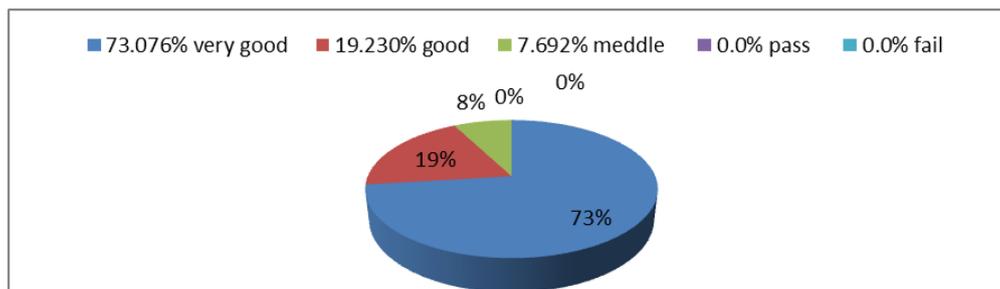


Fig. 12: Pie-chart of 3D Evaluate.

Table 8: Frequency of Q1.

Valid	F	P	V.P	C.P
V. GOOD	19	73.1	73.1	73.1
GOOD	5	19.2	19.2	92.3
MIDDLE	2	7.7	7.7	100.0
Total	26	100.0	100.0	

Table 9: Statistical result for Q1.

	Q1
N	Valid 26
	Missing 0
Mean	1.2308
Std. Error of Mean	.11513
Median	1.0000
Mode	1.00
Std. Deviation	.58704
Variance	.345
Skewness	2.510
Std. Error of Skewness	.456
Kurtosis	5.324
Std. Error of Kurtosis	.887
Range	2.00
Minimum	1.00
Maximum	3.00
Percentiles	25 50 75
	1.0000 1.0000 1.0000

Conclusion:

This model led to improve the level of understanding, interactivity, and cognition in concept of shock wave in shock tunnel facility for students the subject of Mechanical Engineering Design in Dept. of Mechanical Engineering in COE, UNITEN. This model has more flexibility movement by students to any direction, this feature assistant of student to memorized more of detail for the model based on 3D Multimedia Technology. That led to improve the students' score for Mechanical Engineering Design by using this model into 38% than the answers after explain in traditional ways (from 31% improve into 69% student have more than 80% in the quiz by using 3D model for the purpose learning.).

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