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Skill development in Multimedia Based Learning Environment in Higher Education: An Operational Model

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ABSTRACT

"A picture is worth more than thousand words" refers to the impression that a complex concept can be conveyed with just a single image. Multimedia-based education is a combination of interactive / non-interactive learning material with a stimulating, coherent graphics, video and animated components. When education is creative, problem based, interactive, and target based, learners always interested in learning. Such learning environment could be provided by means of Multimedia based Education. An ineffective learning environment could be witnessed if instructions are designed without considering the multimedia principles. A research is required to identify the elements and structure, which can help the learner to increase the skill level, reduce the learning time and improve the performance of a learner. This study has been conducted in 12 universities where instruction and assessments were conducted in multimedia environment. The student's responses are recorded and factors are highlighted after using mathematical rules. An operational model has been suggested incorporating all the factors to enhance overall academic performance of a student.

Keywords: *Multimedia based education, skill development, Multimedia Based Learning, and student performance*

1. INTRODUCTION

Learning is all about acquiring new knowledge, sharpening skills, enhance performances, and better understanding. The modern computer-based multimedia instructional designs provide a platform to learn better, faster and even on self-pace [1] . It has been observed that learners enjoy studies through computer assisted multimedia instructions, and learn thoroughly [2]. An innovative instructional design is required for better understanding of a program [3]. Students are able to concentrate in the class because of the well-designed interactive material [4]. Ineffective learning environment could be witnessed if instructions are designed without considering the multimedia principles [5]. Multimedia Based Learning (MBL) could help in recalling the last discussion to connect with current discussion[6]. To maintain the learning pace and interest with students, a learning environment should have adopted various tools and technical techniques [7]. Developing an interesting, attractive, and logical multimedia-based instructional learning module is a challenging task. Modules prepared using LORI (Learning Objective Review Instrument) standards could create better impact in learning process [8]. This paper discusses relevant literature related to multimedia-based learning environment, followed by aims and objectives, research methodology, results and analysis, conclusions, limitations and scope for future work.

2. LITERATURE REVIEW

2.1 Multimedia in Education

Computer and Net Technologies are becoming essential components of the modern learning environment [9]. These technologies are found to be deployed in many schools,

colleges, universities and industries. Through multimedia, teachers could present the information in an innovative manner and motivate the students to learn quickly. Delivering the topic using multiple media could be more effective than doing it through a single medium [10]. An effective multimedia requires carefully combining in well-reasoned ways that take advantage of each medium's unique characteristics to represent the learning content [11].

Learning material prepared with higher interactivity could create more interest in the learning process. The recent trends and technologies are capable of providing an environment which is known as "anytime-anywhere learning [1][12]. Sometimes, these learning environments fail to deliver expected results because today's educational system is preoccupation with "what to learn" and ignorance of the more pertinent issue of "how to learn" [13] . In a traditional classroom, teachers provide the entire information and students feel they are overloaded with that information. On the other hand, they are passive learners and follow teacher's instruction [14].

Using multimedia in the teaching learning environment supports students to become critical thinkers quick learners, and problem-solvers [15], more suitable to seek information, and more motivated in their learning processes [4]. Multimedia case studies have the potential to bridge the gap between knowledge acquisition and application, but their effectiveness will be severely restricted by ineffective methods of implementation [11]. Using multimedia components such as text, images, audio, video and animation with a technical order and logical flow will not create a distraction during learning and a learner will not feel overloaded [16][17]. It provides environment to learn complex skills with ease [18], increase interest in classroom lectures [19] and improves productivity by eliminating time

and place [20]. Lack in design could lead to inferior learning environment [21].

2.2 Multimedia Based Learning Environment

A stress less and fear free learning methodology accelerate the learning process. When the learning content is supported with multimedia technology, learners learn the information with interest and attention. An enhanced mental conversion will take place when students learn with the correlation of visual and sound images. Necessary narration, sound for the relevant representation helps in better learning by association [10]. Learner recollects and recognizes the content learned when it is recorded in the human memory; this process is more accurate when content is learned with some association. Images and visuals create a better impact on recognition [4]. Multimedia-based instruction stimulates many senses of human because of its media nature. A multi-sensory stimulating approach leads to better holding of learned information [15]. Universities should take initiatives in making curriculum to enhance their teaching methodology to support their students for better learning [22]. Higher achievement level is witnessed when instructions are delivered in a very simple form. Computer assisted multimedia instruction promise for simple and enjoyable learning environment [2].

The learners feel that they could pay more attention to teaching content presented through power point presentation. Interrupting the teacher to ask questions is easy since they could move forward or backward through the slides, which was not possible during the traditional classroom based teaching [15]. Teachers were more inspired in multimedia based teaching since they could interact with more enthusiasm [23]. In turn, students are more inspired with better content and varieties in the presentations [24]. The latest generation has been working with computers and feels it is a way of learning. This promotes students and increases their involvement [1]. Students are very much impressed with the quality of the presentation, which motivates them to be more punctual for classes and more engaged during their course work.

2.3 Interactive Learning Environment

Multimedia Based Learning resources create an interactive learning environment than the traditional [15][25]. These resources make the learner to enjoy the learning with interactivity [26]. Learning process is maximized when the training description are given as demonstration, and these demonstration can be made easy by means of digital video and animation [27]. This approach could save the time [28] being spent in passive learning and increase the practices [29]. When a class is being conducted for 90 minutes, average involvement of a learner in learning would be 47%. This percentage could be improved by adding interactivity. Multimedia based interactive events could help a learner participate actively in the class and these results in retention [30] and involvement [31]. Designing such interaction requires powerful multimedia tools [13]. Technologies

adapted in the learning environment should make the learner to feel so friendly with the tool rather than being a passive audience [32]. When the tools are is friendly and have the ability to provide feedback about the learner could increase involvement and motivation towards participation [33] and contribution in class discussion.

Setting up a multimedia based learning environment could cost more, so there is a demand for low price equipment which can support a teacher to teach from any computer, anywhere [34]. Demands to the equipment must be low price and easy to handle. A teacher should be able to take any node, anywhere to start a course. An extended internet based distributed computing infrastructure capable of providing space for publishing, sharing huge amount of multimedia content [28]. Learning content stored as digital documents in a database has lot of advantages such as authenticated access, online exams, announcing results and updating learning content [35] with easy access by the teacher. Many universities are moving towards digital multimedia learning content to improve the learning efficiency [4]. To improve the capturing efficiency of learned information on the working memory[36], the content delivered over digital media should follow the cognitive load theory [30]. A digital multimedia learning environment is capable of providing better self-explanation, and inquiry based learning [6] that leads to better results in knowledge construction, and increase in efficiency and production of a learner [37]. Special skills are required to develop and implement this instructional media in the class to support the learners with these learning preferences [30]. A learner can save time up to 36% by learning from multimedia instruction than the traditional class learning [3]. This interactive method of learning facilitates a learner to learn on his or her own pace [4], and it is known as degree of learner control [38] (i.e.) learn with less pressure.

The learning material prepared for teaching purpose should be understandable by everyone regardless of their technical background [23], at the same time it should be designed to the particular purpose in such a way as to give a clear orientation about what they are learning [4]. The content provided to the learner could be more interactive so that they could participate in it and not just passively watch it [39]. A well-structured material with sub division and a nonlinear navigation throughout the material could provide a better orientation and prevent the learner from cognitive overload [38]. Including attractive banners, inappropriate animated objects, and sound tracks could initially capture the learner's attentions but in the later stage it could create lack of attentiveness during learning process [8]. Placing the dynamic elements (animation) rather than static (images) in the learning content could increase alertness [4] and produce positive results and avoid distraction and information overload [31]. Incorporating multiple sensory modalities could motivate a learner to pay more attention [39] in their learning and this result in better retention [36] [25]. Sometimes multiple sources of information could cause split attention to the learner, where a learner needs to integrate elements before they understand, so it is recommended to

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follow split attention principle while designing such complex instruction [24].

Conventional lecture in some situations become more passive and the learner's concentrations will not be more than 15-20 minutes [25]. A well-structured multimedia-based instructional content could engage and support learner to concentrate throughout the class. A pointless instructional activity conducted just to engage learner could make them to pay more attention or concentration, that leads in overloading working memory and prevent from acquiring the essentials information that is to be learned [24]. A well planned instruction could be delivered effectively in multimedia learning environment, and this practice could influence in concentration and attention-span of learners [40].

Multimedia based learning forces teachers to develop and invent new teaching aids even for subjects usually taught by traditional methods to enhance the attention span of students from various backgrounds [30]. Traditional techniques such as Mind Mapping are developed and reorganized more to facilitate remembrance and new systems are invented to aid learning [25]. Students get involved in learning actively, assess their progress independently and set their own pace of learning. This ultimately leads to enhance skill development [41]. Multimedia Instruction tools help the learner to learn new skills. A well designed tool could challenge a learner to think creatively [42], and should have features to select the learning style according to their expertise level [21]. Student's performance will be better when the learning material uses narration [10]. Multimedia assisted teaching produce better outcome in the learning process [29].

Table 1: Summary of Indicators (I)

Indicator	Definition	Source
Association	Connecting mind with a particular memory, idea, or feeling during learning process	[10]
Recognition	An act of remembering more when taught using MBL	[4]
Orientation	Alignment of oneself or one's ideas to surroundings	[23],[39], [38]
Retention	Multimedia gives long lasting memory	[4]
Stimulation	MBL accelerates learning process	[13]
Efficiency	It is the quality of being able to learn a content/topic/task successfully, and conveniently without wasting time or energy	[4], [6], [37], [30]
Acceptance	Easy to study from MBL	[2]
Comprehension	Easy to understand in MB class room teaching	[43]
Inspiration	Creative ideas are developed when content taught using audio, picture and video	[24]
Interaction	Teacher gets enough time to interact with students	[31],[14], [24], [25]
Enthusiasm	Students attend classes with enthusiasm	[1]
Impressive	Multimedia based classes are so refreshing and exciting	[44]
Time Saving	Learning takes less time	[3], [4],

		[38]
Inventiveness	Multimedia based learning increases imagination	[25], [30]
Involvement	MBL enables participation so it is more interesting	[13], [30], [31], [33]
Performance	Students perform well in examinations	[29], [10]
Interpretation	Understanding level of the topic is more.	[5]
Alertness	Students are more attentive and perform better	[8], [9], [15], [24], [25], [31]
Concentration	Students don't talk to each other in class and learn more	[25], [40]
Enhancement	MBL enrich knowledge, thinking, and innovations	[41]
Demonstration	Teacher explains more content	[29],[27], [28]
Expertise	New skills are developed in a multimedia-based classroom environment.	[21], [42]
Alternatives	Students take fewer notes since they have digital copy	[34], [28], [35]

3. AIMS AND OBJECTIVES

This research work is divided into two phases. The first phase of this study is to identify the important factors, which really affect the students' learning process. An Operational Model, using all the factors is developed in the first phase of the study to see how these factors are interconnected and improve overall learning process. In the second stage of the study, this model will be tested and validated statistically. Authors would like to see how these factors are contributing in better understanding and improve performance, which leads to expertise. This study would also reveal the correlation between the factors and highlight the importance of factors based upon mathematical rules. This Operational Model could be used as an instructional format to improve the students' learning process.

4. RESEARCH METHODOLOGY

It has been observed that many universities are using multimedia-based education in their curriculum. The courses considered to conduct this research were IT, Engineering, Architecture, Biotechnology, Management Studies, and Fashion Design. To conduct the first phase of the study, the questionnaire methodology was selected and an inventory system for the same purpose was developed. Prior to the commencement of the study, variables affects the students learning process in the multimedia environment, were extracted from the literature review and a detailed questionnaire was constructed specifically for this research. This questionnaire consists of two sections viz., demographic enquiry (Section A) and the main construct (Section B). Section A, measurement used was the nominal scale. This section was designed to collect demographic details of respondents such as age, gender, education, subjects, university and country. Twenty-three indicators related to multimedia-based education, were used to construct the second part of the questionnaire. The data collected for the

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second part were represented on a five point scale, 1-Strongly disagree; 2-Disagree; 3-Neutral; 4-Agree; 5-Strongly Agree. The respondents were selected through convenience sampling. The target respondents were the students who studied in multimedia environment. Questionnaire was then distributed to 350 students using online platform and in person approach. Authors received 294 responses against 350 (Response rate = 84%). The data obtained from respondents were statistically tabulated and processed. To analyze the data, statistical package for social sciences (SPSS-Ver16) was used. Descriptive statistics has been used to determine the importance of variables considered in this study. Factor analysis (Principal Component Analysis) was used to group the variables. Based on the discussed methodology, statistical analysis carried out and results were obtained as presented in the next section.

5. RESULTS AND ANALYSIS

As per the data, age groups of 17-22 are more interested towards learning through Multimedia instruction. It has been seen that the young generation is more attracted towards recent gadgets and portable media where they get information anytime, anywhere. The operational model shows that the better understanding of the subject matter is dependent on the Ease of Learning, Enriched Instructional Design, Principled Collaboration and Attentiveness in the class. These independent variables have significant impact on the students' performance and better understanding. Learner could achieve highest level of confidence provided teaching material is developed fully with better understanding of multimedia principle.

Table 2: Demographic Characteristic of Respondents

Description	Frequency	Percentage
Age		
1	36	12.2
2	160	54.4
3	63	21.4
4	20	6.8
5	15	5.1
Total	294	100
Gender		
Male	122	41.5
Female	172	58.5
Total	294	100
Education Level		
UG	254	86.4
PG	40	13.6
Total	294	100
Subject		
IT	98	33.3
Science	33	11.2
Mass Media	24	8.2
Business Studies	43	14.6
Engineering	50	17
Architecture	46	15.6

Total	294	100
University		
Manipal University	204	69.4
Other Universities	90	30.6
Total	294	100
Country		
UAE	266	90.5
Others	28	9.5
Total	294	100

The sample included for this study was students from Science, Engineering, Computer Science, Business Studies, Fashion, and Interior Design background. The vast majority (33.3%) were science students followed by business studies (14.6%). In terms of the students representation in this study, (69.4 %) students were from Manipal University and 30.6 % students have other affiliation. In terms of students in representing the level of the study, most of them were studying in undergraduate courses and rests (13.6%) were pursuing the degree courses.

Table 3 presents the summery of factors and it is very much visible that the respondent has given importance to each variable (mean value ranging from 3.18 to 4.05) but there is no indication that respondent awarded average value equal to five.

Twenty-three variables have been used to see how multimedia-based academic environment affects students learning process. These, 23, indicators were then grouped into six factors by using Principal Component Analysis Method. Easy to study all together, these 23 indicators were classified into six factors namely Ease of Learning (EOL), Ease of Understanding (EOU), Amended Attentiveness(AA), Confidence (C) , Increased Interactivity (II) and Ease of Skill Development (EOSD).

Table 3: Summary of Measurement Scales

I	Latent Variable	Measured Variable	M	S.D	Factor Loading	R α
Ease of Learning (EOL)						
I05	Association	Information acquired more when see diagrams	3.82	0.872	0.716	
I15	Recognition	Remember more when taught using MBL	3.79	0.909	0.695	0.840
I11	Retention	Multimedia gives great long lasting memory	3.76	0.95	0.686	
I07	Stimulation	MBL accelerates learning	3.67	0.849	0.677	
I02	Acceptance	Easy to study from MBL	3.66	0.942	0.625	
Ease of Understanding (EOU)						
I03	Comprehension	Easy to	3.88	0.832	0.691	7

823

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		understand in MB classroom teaching.				
I04	Inspiration	Excited when audio, video, pictures while teaching	4.05	0.827	0.665	
I18	Enthusiasm	Students attend classes with enthusiasm	3.83	0.868	0.652	
I14	Impressive	Multimedia classes are so refreshing and exciting	3.93	0.785	0.629	
I23	Interpretation	Understanding level of the topic is more.	3.85	0.831	0.625	
Ease of Skill Development (EOSD)						
I13	Inventiveness	Multimedia based learning increases creativity	3.81	0.919	0.757	
I09	Enhancement	MBL enrich knowledge, thinking, and innovations.	3.8	0.907	0.734	0.793
I12	Expertise	Multimedia based class helps to learn new skills	3.76	0.865	0.71	
I17	Performance	Students are performing well in exams.	3.38	0.9	0.448	
Amended Attentiveness (AA)						
I01	Orientation	Diversion in class while delivering lecture is less.	3.33	1.069	0.834	
I16	Alertness	Students are more attentive and performing better	3.52	0.98	0.775	0.768
I20	Concentration	Students won't talk to each in class and learn more	3.18	1.108	0.672	
Increased Interaction (II)						
I22	Interaction	Teacher gets enough time to interact with students	3.4	0.947	0.738	
I21	Demonstration	Teacher explains more content	3.72	0.961	0.729	0.717
I08	Involvement	MBL enables participation so it is more interesting.	3.77	0.89	0.501	
Convenience (C)						
I19	Alternatives	Students take fewer notes since they have digital copy.	3.88	0.981	0.779	0.685

I10	Efficiency	MBL help to learn conveniently.	3.76	0.843	0.662	
I06	Time Saving	Learning takes less time	3.69	0.958	0.657	

The results of the study indicate that five variables were involved in forming the first factor: Association, Recognition, Retention, Stimulation and Acceptance. Considering the variables participating in its formation, the factor named as Ease of Learning (EOL). Variables considered as Comprehension, Inspiration, Enthusiasm, Impressive and Interpretation were clubbed together and named as Ease of Understanding (EOU).

In this continuation, the third factor were framed by four variables, defined as Inventiveness, Enhancement, Expertise and Performance and named as Ease of Skill Development (EOSD). Fourth factor considered Amended Attentiveness (AA) by three variables Orientation, Alertness and Concentration. The variables Interaction, Demonstration, and Involvement are grouped and named as a fifth factor that is Increased Interaction (II). Finally, there were three variables, which have formed a factor Convenience (C), and they are Alternatives, Efficiency and Time Saving.

For the examining the reliability of data, cronbach's alpha co-efficient was considered to measure the internal consistency of the measured total items wise and factors wise. In this study we found exceptionally good reliability value of the cronbach's alpha co-efficient ($\alpha = 0.954$). The reliability value of all 6 scales has been given in table 3. The six factors extracted in this study clearly show the acceptable level of reliability in terms of internal consistency.

The descriptive statistics for the six factors shows that all the scales have value more than to their mid points. It is a clear indication that the factors EOL, EOU, II, AA, and C could be considered as a medium to enhance the Ease of Skill Development (EOSD) in the learning process.

Analysis of the correlation Table:4 suggests that the various multimedia based strategies act in synergy to affect the skill development of the learner. Ease of Learning (EOL) is considered to be an integral part of the skill development through association, recognition, retention, simulation and simplicity. Ease of Understanding (EOU) and Amended Attentiveness has a great role to guide the learning process and motivate learners to enhance the skills.

Interactions with students make sure that the students are involved actively in the discussion to demonstrate their knowledge level and enhance the learning. Convenience affects the learning through digitization of the courses in the multimedia-based learning environment.

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Table 4: Descriptive Statistics and Correlation for Factors

Factor	Mean	S.D	EOL	EOU	EOSD	II	AA	C	Item
EOL	18.6973	3.53435	1						5
EOU	19.5374	3.00573	.567**	1					5
EOSD	14.7517	2.8205	.599**	.567**	1				4
II	10.8946	2.23663	.471**	.435**	.499**	1			3
AA	10.0238	2.61189	.422**	.428**	.468**	.469**	1		3
C	11.3299	2.18355	.554**	.380**	.467**	.429**	.362**	1	3

*The parson correlation in the table 4 shows that all factors, EOL, EOU, EOSD, II, AA, and C are correlated.

The important contribution of this research is the findings of important factors of multimedia-based learning environment. The findings here suggest that these factors are inter-correlated and contribute significantly in skill development process.

indeed suggested that, if the same environment is brought to the classroom, skill development may be witnessed in near future.

The main objective of this study was to identify the important factors, which really affect the learning process in higher education. The responses given by the students could be used as valuable information to design the instructional format for teaching and learning process. Study shows that the multimedia-based instructional format helps in better understanding, provide innovative teaching methodology, give good opportunity for interaction and help in making discussion in self-controlled way. The Study shows that the five factors Ease of Learning (EOL), Ease of Understanding (EOU), Increased Interactivity (II), Confidence (C), and Amended Attentiveness (AA) could play an important and significant role in the development of the skill of the learners (EOSD). After acquiring expertise through the following channel give way to overall confidence in the subject they are learning.
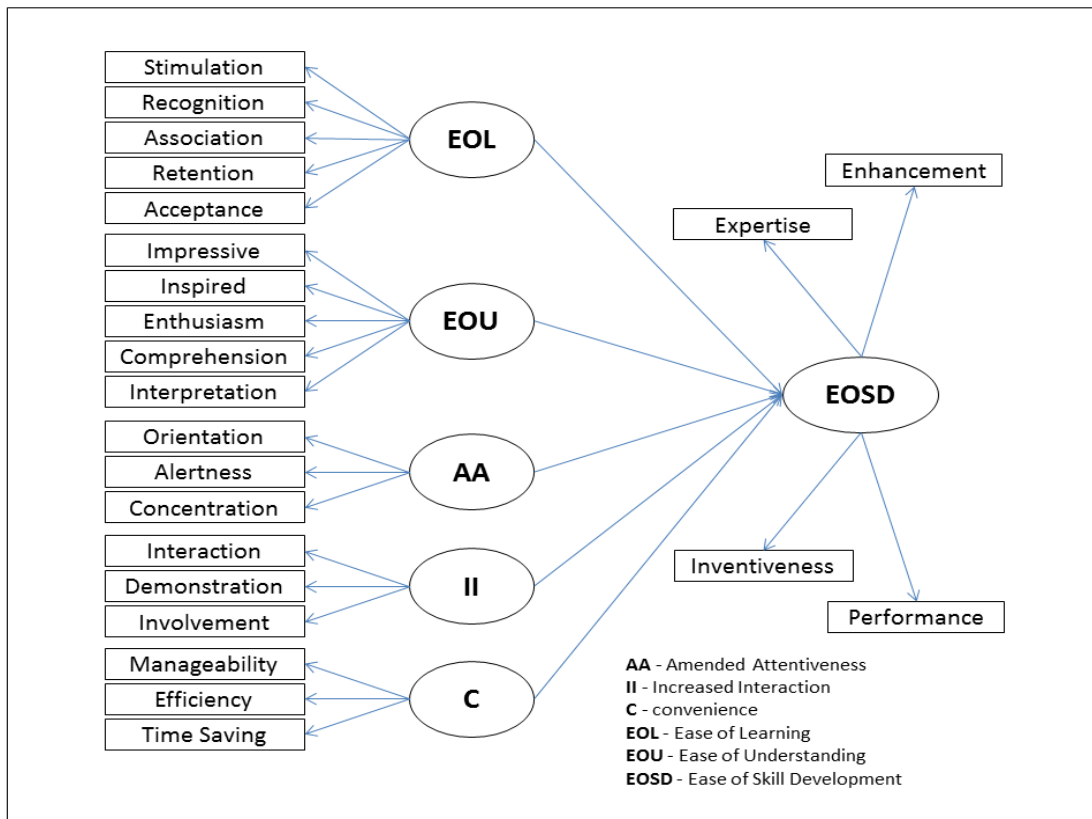

Figure 1: Proposed Multimedia Educational Model

6. CONCLUSIONS

Creating the multimedia-based learning environment for skill-based courses would solve the learning related issues, understanding related concerns, Attentiveness matters, interaction related questions and convenience related complications. Multimedia-based environment has the ability to provide the solution for above-mentioned issues and it is

Nevertheless, in our opinion, the results of this study have many important and significant inferences for skill development in multimedia-based learning in higher education. We have come to conclusion that EOL, EOU, AA, II and C have great impact in the development process.

In our proposed model, teachers would play a significant role in the teaching-learning process. Teacher's ability, expertise, experience, attitude and delivery pedagogy will definitely

help in designing the useful content for their respective courses. This is the way by which, we can utilize the optimum benefits of multimedia-based learning in higher education in near future.

Multimedia-based learning is considered to be an important area and will continue as important learning platform in near future especially in skill based learning programs. The factors obtained in this study may play a very significant role in designing of instructional format. Effective implementation of the discussed factors of multimedia-based instruction could definitely open a new era of learning practices and provide a new paradigm to learners in the days ahead.

7. LIMITATIONS AND SCOPE FOR FUTURE WORK

There are some limitations in this study, and at this point, two limitations of the study need to be explained. The first limitation of this study is that we have considered the courses, which have been taught in multimedia-based environment, and thus we cannot generalize these findings for all other courses. The second limitation is that the most of the students participated in this study were from a particular university. This study also has a geographical limitation. The conceptual model developed in this research is based on the variables extracted from the literature using mathematical rule Principal Component Analysis (PCA), and further improvement in the proposed model would include:

- Developing a hierarchy system by using Analytical Hierarchy Process (AHP) to see the relative importance of the features needed for multimedia based educational model
- Developing an evaluative maturity framework to measure the capability level of the system
- Examining the causal relationships between explored factors to make this model mathematically robust for assessment purpose

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