

## Effect of User Interface Design in a Multimedia Courseware to Encourage Students' Learning Process in Distance Education

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**Abstract:** The advances and use of multimedia technology provide enormous potential by means of increased interaction between students and content in courseware to make learning more dynamic and interactive with attention to the specific needs of individual students. Some studies have shown that the interface, course structure and organization, learner interaction and engagement affect students' satisfaction and perceived learning in online learning environments. However, there is still limited literature regarding how user interface design of multimedia courseware environments foster student-learning process and achievement. The purpose of this study was to investigate the effects of interface design and student-content interactions on students' perceived learning and achievement in a distance education undergraduate course. Adult learners (n=56) who registered in a distance education course participated in this quasi-experimental research design. The collected data was analyzed using descriptive statistics and one-way ANOVA and MANOVA. According to the survey results, the nature and usability of the interface design of multimedia courseware influenced learning motivation, interactivity, and achievement in a distance education setting. The study's findings revealed that interface design has a significant effect on students' perceived learning in a distance education setting and is conceptually relevant to inform practice related to increasing retention and improving the quality of online teaching and learning. This may also need to be retested in other empirical studies on larger samples, using other research approaches and designs to allow for generalisability and gain additional credibility of the research findings.

**Keywords:** Interface design, learning process, multimedia courseware, academic achievement, distance education.

### 1. Introduction

Educational technology is defined as a variety of electronic tools and applications that help deliver learning content and support the learning process (Cheung & Slavin, 2013). Even though the outcomes of applications may vary but most literature mentions on the positive effects. These applications are shown to be effective in improving student-learning outcomes (Schmid et.al, 2014). Saputri, et.al (2018) stated that the development of multimedia technology has great potential in changing the way people learn, obtain information and adjust information. Multimedia provides opportunities for educators to develop learning techniques to produce maximum results (Clark & Mayer, 2016) and to help students absorb information quickly and efficiently (Winarno et.al, 2018; Minkova, 2016). The most important feature of interactive media is that students pay attention not only to the media or object, but also the need to be engaged while learning (Wiana, 2018). In this case, the first contact or point of interaction is the interface design of the learning applications or courseware that could make or break the interest of the learners to proceed.

A properly designed and planned multimedia courseware is the initial focal point of developing a promising learning process. Interactive multimedia, designed and developed with learning strategies, is an appropriate alternative learning medium to facilitate and enhance student interest in learning (Dikshit et.al, 2016; Zhou & Guo, 2016). Rusli and Atmojo (2016) stated that interactive multimedia is useful in explaining complex and dynamic concepts clearly, facilitate in remembering content easily, improve the understanding of content via students' perspective thus making them interested in learning. This is in line to foster deeper learning in students. Jyotsna (Dikshit et.al, 2016) in his research suggests learning using interactive multimedia results in higher academic achievement and is considered more pedagogically effective. It keeps students interested in instructional activities (Wahyuningtyas & Neni, 2016; Khan & Masood, 2015). Other studies also have shown that interactive multimedia has a significant impact on the student attention while improving their motivation and learn optimally (Dikshit et.al, 2016).

Education as is seen today is moving on developing a highly interactive multimedia learning content with appropriate interactive pedagogy. However, the inability to develop effective, useful, useable, and satisfying electronic contents remains one of the major obstacles in e-learning (Mohapatra, 2015). In addition to that, Meyer, Gaskill & Vu (2015) warn that an improper or poorly designed user interfaces distracts the focus of the students,

increases unnecessary stress and impedes the quality of the learning process. In another related study, Faghieh, Reza & Katebi (2013) added that a not user-friendly program with disorganized interfaces demands the users to place more emphasis on mastering its navigational configuration rather than focusing on its instructional content where it is supposed to focus. A confusing and inefficient design of information presentation places the learners in more difficulty in achieving the learning outcomes and may lead to needless stress, frustration and aggravation. The target of any user interface design is to make the user's interaction as simple and efficient as possible with limited-human-related support thus alleviating the hassle of possible complex navigation and instruction. It is so because the educational design is complex, and the main aim of developing e-content or courseware is to achieve specified goals in education, and place the learner needs at the centre of the learning process (Sarkar, Mohapatra & Sundarakrishnan, 2015) rather than the tribulation of the navigational structure. Thus, it is important to properly plan, design a promising and friendly user interface that assist the learners to study almost seamlessly without the aggravation of trying to understand the possible interaction in the interface.

## **2. Research Objectives**

This study sought to assess the nature of the user interface based on the following objectives:

- Explore the effects of user interface design on adult learners' motivation in multimedia courseware.
- Explore the effects of user interface design on adult learners' learning interactivity in multimedia courseware.
- Establish the extent to which user interface design influences the adult learners' learning process.

## **3. Literature Review**

This study focuses on the user interface design to influence learning motivation, interactivity and achievement in distance education. This part covers Interface Design and Content Structure, Interface Design and Learning Motivation, Interface Design and Learning Activity.

### **a. Interface Design and Content Structure**

In Distance Education, the main instrument of this teaching and learning environment are printed materials or multimedia learning materials. These contain carefully designed, developed and optimized courses that set learning into motion. The articulation of instruction revolving instructional design or educational technology has been a central theme of pedagogics or andragogic. The structure is seen most clearly and most densely in programmed instruction. "It is the representative of instructional theories in which each word, learning step, teaching strategy is planned and developed with the greatest care in order to simplify learning and make teaching more successful" (Lee & Rha, 2009).

The design features in the study include quality interface, interactions and technology resources. The interface in the multimedia courseware must integrate the needs of its intended recipients and the learning content so the learners are better prepared to spend time studying using the courseware (Lee & Kim, 2014). In addition, the aspect of the interface is also noteworthy as the design of the interface reflects the personality of the software system that is the first factor that influences the content of learning (Zhu, 2015). The use of graphs in the interface view should also help users to anticipate and understand the functions and representations used to aid the teaching and learning process (Surjono, 2015). A study by Young (2006), as cited by Jaggars and Xu (2016) also mentioned that "students appreciated instructors who made a strong effort to create a thoughtful course that was well organized and carefully structured".

### **b. Interface Design and Learning Motivation**

Motivation in learning is an intrinsic force that drives adult learners' actions and directs them towards the accomplishment of a learning objective. It is considered as one of the vital elements to understand learners' engagement, level of achievement and satisfaction in learning (Rothes, Lemos & Goncalves, 2017). However, the adult learners' motivation for learning is still a scarcely studied area. User interface design for interactive courseware must enrich and stimulate learner-content interaction experiences so as to encourage the learner's interaction with the technology.

Sogunro (2015) opined that another way to motivate the adult learners is through developing and preparing quality instructions. Several empirical studies like Tang (2018) and Xiao (2017) claimed that poor instructional and interface design for adult learners in distance education contributed to attrition. The design affected the effectiveness of the course, motivation and disrupted learners' enrolment (Lin-Siegler, Dweck, & Cohen, 2016; Ghirardini, 2011). Learning courseware is required to include motivational interface design to maintain attention and increase motivation (Faul & Carbery, 2019; Xie et al., 2018).

### **c. Interface Design and Learning Activity**

The application of information and communication technology in today's educational system has led many consumers to desire high-quality interface design when interacting with content that has been transformed into an e-learning material. This is because interface design is a core and essential component of the entire e-learning system and it influences how information is presented (Nordin& Dalbir, 2016; Zhu, 2015). Croxton (2014) found that “interactivity is an important component of satisfaction and persistence for online learners, and that preferences for types of online interactivity vary according to type of learner”.

User interface design for interactive materials must factored in the need for interactivity. Good interface design in the presentation of information enhances student engagement in e-learning because interface design plays an important role not only in enhancing the look and feel but also influences how students interact with e-learning (Nordin& Dalbir, 2016). In multimedia technology, the user interface is a learning medium. Quality interfaces enhance the learning experience of students, increasing the level of memory of the information received (Bashir, 2017; Zhu, 2015).

This aspect of interactivity – student-content interaction has a strong influence on student satisfaction in online learning (Wu, 2017; Croxton, 2014; Chametzky, 2014). Graphical user interface and easy navigation must be very easy and practical to use, as it provides users with a hands-on experience (Essel, 2016). As with any quality interactive materials, it starts at the very beginning. Good storyboard production has helped multimedia product developers to visualize the design of each display that needs to be built, determine the overall navigation flow and determine the interaction or interactivity between users and multimedia products (Kumar B, 2013).

#### 4.Methodology

This study was designed quantitatively with a non-equivalent control and experimental group design (quasi-experimental) with the central idea behind this paradigm is to gain a better understanding of what effect do interface and interaction in a multimedia learning courseware have on the process of learning and its outcome. It involved 56 adult learners in a distance education program in a local public university in the Klang Valley. The experimental group received the proposed intervention i.e. the independent variable (learning materials based on Knowles Andragogy and Gagne model) with the intended user interface design while the control group did not receive the intended interference (learning materials which was not based on the Knowles Andragogy and Gagne model). Both groups went through the pre-posttests to evaluate the effect of the independent variable on the first dependent variable (Academic Achievement). The experimental group received the 5-point Likert scale questionnaire to evaluate the second dependent variable (evaluation on the multimedia courseware user interface and interaction aspects). Three content experts with instructional design knowledge were asked to gauge the content validity and evaluate the grading items to the defined content and provide feedback on the rubric so the researchers can make the necessary modifications if need be. The researchers also conducted a reliability test to measure the consistency of the items in the instrument. It examined the 14 items related to the user interface aspects under investigation. The alpha values based on a pilot study are reported in Table 1.

**Table.1.**Reliability Test Statistics.

Aspect	Cronbach’s Alpha	N of items
Courseware Interface	.86	14

#### 5.Results and Findings

Table 2 demonstrates that there existed no significant differences in the academic achievement scores between the experimental and controlled groups prior to the study thus indicating that both experimental and controlled groups were at the same level before the study commenced. It can be said that both groups are homogenous and fulfil the normality criteria.

**Table.2.** showing the comparison of pre-post-test between control (n=28) and experimental group (n=28).

Group	Pre			Post		
	M	SD	P value	M	SD	P value
Experimental	15.50	3.33	.20	28.14	2.35	.20
Controlled	14.30	3.09	.20	15.53	3.76	.20

M – Mean, SD – Standard Deviation

However, an ANCOVA test was carried out after the post-test to evaluate the effect of the intervention. The values are shown in Table 3. This F value ( $F(1,53) = 172.39; p=.00 (p > 0.05)$ ) was recorded. The significant p value is .00 and as such it can be interpreted that the intervention, which was designed and developed with the user interface design consideration, has significantly increased the experimental group’s performance. Another point worth noting is the percentage of the post-test score performance that was influenced by the contribution of

the courseware as an independent variable relating to the user interface design. The value of this variance is through the partial value of Eta squared i.e.  $\eta_p^2 = .77$  which is converted into the percentage form that is 77%. The teaching and learning method using the courseware with careful consideration on the user interface design with Gagne's instructional design and Andragogy theory, on the experimental group showed better performance with considerably huge impact or influence to the effect of 77%. Hence the learning using the proper interface design courseware based on Gagne's instructional design model and Andragogy theory (significant ( $p < .05$ )) could improve achievement of adult students.

**Table.3.** showing the results of ANCOVA analysis when pre-test scores are controlled.

Source	Type III Sum of all squares	df	MS	F	p	$\eta_p^2$
Pre test	71.00	1	71.00	6.98	.01	.17
Group	1753.11	1	1753.11	172.39	.00	.77
Error	538.96	53	10.16			

significant  $p < .05$

An analysis was also done using descriptive statistics involving frequency, percentage, mean (M) and standard deviation (SD). This information is used to determine the evaluation of courseware interface performance in the experimental group. Table 4 shows the evaluation of the courseware interface design performances in the experimental group. The items with the highest mean was the 'Effective use of video' items with values of  $M = 4.57$  and  $SD = .57$ . Frequency and percentage analysis showed that one (3.6%) student moderately agreed, 10 (35.7%) students agreed 17 (60.7%) students strongly agreed to the statement above.

While the item with the lowest mean is the statement 'Effective use of audio' with a value of  $M = 2.96$  with  $SD = .74$ . Frequency and percentage analysis showed that eight (28.6%) students expressed disagreement, while 13 (46.4%) students moderately agreed while seven (25.0%) students agreed to the statement above. This is certainly the case as the courseware contains limited audio. Overall, the construct of the interface presentation in the experimental group was reported to be  $M = 3.81$  and  $SD = .66$ . In conclusion, the overall value of this Mean is of high moderation which indicates that the experimental group agrees with the courseware interface design used.

**Table.4.** showing the Frequency, Percentage, Mean and Standard Deviation on Courseware Interface (Experimental Group).

No	Courseware Interface aspects	Strongly Disagree	Disagree	Moderately Agree	Agree	Strongly Agree	M	SD
1	Attractive screen design	-	-	16(57.1%)	9(32.1%)	3(10.7%)	3.53	.69
2	Texts are clear and legible	-	4(14.3%)	14(50.0%)	10(35.7%)	-	3.21	.68
3	Attractive and impactful graphics	-	-	15(53.6%)	10(35.7%)	3(10.7%)	3.57	.69
4	Effective use of colours	-	2(7.1%)	14(50.0%)	8(28.6%)	4(14.3%)	3.50	.83
5	Effective use of audio	-	8(28.6%)	13(46.4%)	7(25.0%)	-	2.96	.74
6	Effective use of video	-	-	1(3.6%)	10(35.7%)	17(60.7%)	4.57	.57
7	Animation is used to support learning	-	11(39.3%)	4(14.3%)	11(39.3%)	2(7.1%)	3.14	1.04
8	I think it is better to use the concept/information through multimedia (e.g. interactivity, clicks)	-	-	8(28.6%)	17(60.7%)	3(10.7%)	3.82	.61
9	Easy link to topics and pages	-	-	-	15(53.6%)	13(46.4%)	4.46	.50
10	The icons and symbols are clear and easy to understand	-	-	1(3.6%)	12(42.9%)	15(53.6%)	4.50	.57
11	The courseware guidelines are clear and easy to understand	-	-	1(3.6%)	18(64.3%)	9(32.1%)	4.28	.53
12	The final review helped to better my understanding of the related topics	-	-	13(46.4%)	13(46.4%)	2(7.1%)	3.60	.62
13	The courseware provides sufficient illustrations and examples	-	-	3(10.7%)	12(42.9%)	13(46.4%)	3.78	.62
14	The overall courseware interface performance is satisfactory	-	-	-	15(53.6%)	13(46.4%)	4.4	.57
	Overall						3.81	.66

It was found that, for the interface design evaluation aspect of the Experimental group the value was  $[F(1, 54) = 160.99, p = .00]$  with a partial eta squared value of  $= .75$  (equivalent to 75%). Given the  $p = .00$  value, this indicates that the null hypothesis of no relationship between students' performance and the interface design is

rejected. It can be said that the interface design in the courseware has an effect of 75% in the achievement of the students. In conclusion, there was a significant difference in the mean of the experimental group interface aspect based on the  $p < .05$  value as shown in Table 5.

**Table 5.** showing the *MANOVA* Output: Interface Design Evaluation

Source	Dependent Variable	Type III sum of all squares	df	df2	Min Square	F	p	$\eta_p^2$
Group	Interface	34.79	1	54	34.79	160.99	.00	.75

## 6. Conclusion

Distance learners today are increasingly being supported with technological advancement regarding e-learning and the most common among these being rich and diverse user interface designs multimedia courseware. Among the main aims of any interactive courseware is to allow learners meaningful and engaging learning interactivity and motivation. As such a carefully designed and thoughtfully developed courseware must be produced for meaningful learning to be accomplished. Generally, user interface design has a significant impact on learning. Better user-friendly learner-content interaction helps to ease information transfer, knowledge acquisition and enhance learner engagement. Moreover, usable interfaces scaffold learner abilities of perception, organization, integration and recall of knowledge and focus on learning objectives. On the contrary, poorly designed courseware interface devoid of clear navigation and with ambiguity in instructions will certainly distract student learning.

The findings of this study on how multimedia user interface design help to foster adult learners' learning process are in line with ER and ER (2016) in their study that interface design promotes interaction and influenced academic performance. Similarly, Lee and Rha (2009) found that structure and interaction has a positive relationship with learners' achievement and satisfaction. Bashir (2017) whose study found that the correct interfaces enhance student learning interactivity and motivation also strengthens the findings of this study.

The result of this study has shed some light on the design of multimedia courseware interfaces that can enhance adult learners' interactivity and enhance their learning motivation. Even though the findings only provided a general overview of use interface design for multimedia courseware, it is recommended that future empirical studies be conducted on larger samples, using other research approaches and designs to allow for generalisability and gain additional credibility of the research findings.

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