

IMPACT OF MULTIMEDIA-ENHANCED eLEARNING COMMUNITIES ON COGNITIVE LOAD AND LEARNING OUTCOMES CONSIDERING THE LEARNER'S COGNITIVE STYLE

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This paper presents results of a study to investigate the critical issues associated with integration of multimedia on to e-learning communities for the benefit of African distance learners. The focus is on trying to find out whether there is any impact on learning outcomes and learner satisfaction that is brought about by the integration of different media considering the different learners' cognitive styles. We hypothesized that the different alternative e-learning environments design based on the integration of multimedia may lead to different effect basing on difference in students characteristics. The more interesting it becomes for other learners, the more demanding it becomes for others, but they are expected to achieve the same at the end. As technology is finding its way in education, there has been an increase in the use of multimedia especially in supporting distance and blended learning, however very little has been said in terms of the real impact of this integration on the learning outcome.

Literature has suggested that one's cognitive style determines one's preference of multimedia. This implying that there are chances that if the learning environment is not designed in line with the learner's cognitive style. The media can lead to cognitive overload. Which in turn can lead to negative impact on the student's learning outcomes. Very little to no educational researches have been carried out in order to assess the practical impact of alternative e-learning community designs through the integration of different forms of media to both field independent and field dependent learners, especially focusing on African learners and in engineering courses.

This research is mainly based on the Cognitive theory according to Sweller as well as Mayer's cognitive theory on multimedia learning.

Duffy and Jonassen pointed out that the value of learning rests in the ability to predict the impact of new learning environments or instructional on what is learned. The interchange of ideas between these two disciplines is essential (Duffy & Jonassen, 1992) As Africa is joining the rest of the world in the implementation of e-learning as way of delivery, and also as way of supporting distance learning, the integration of multimedia on to the e-learning communities is not an issue that should left out. Mainly due to the role that multimedia plays in education. There is need to asses the real impact that is brought about by this integration of multimedia.

(Schnotz & Lowe, 2003) acknowledged the important role that is played by the multimedia in education. In their work they also pointed out that research on learning and instruction should focus on the semiotic and sensory levels of multimedia with the emphasis on the effects of different forms of external representation.

Very little research evidences is available that focus on the effect of multimedia on learners on the bases of their cognitive styles. As an already agreed fact that when multimedia instruction is not based on cognitive theories and principles it can also have a negative impact on learning. As cognitive styles plays an important role on individual preferences of multimedia during the learning process. These styles need to be a factor to consider also during the multimedia integration onto e learning communities.

The focus of this paper is not only on the impact of multimedia integration on e learning communities. It goes further to include the individual learner differences based on their cognitive

style. As these styles play an important role in determining the effectiveness of this integration, with the sole purpose of guiding the designing process so as address all the learners' needs.

RESEARCH QUESTION AND THEORETICAL FRAMEWORK

In coming up with this paper the research was being guided by two major questions which were saying: What impact on the learning outcome is brought about by the integration of multimedia (animation and audio) on to the e-learning communities? Is the effect by the alternative designs the same on the different students basing on their cognitive styles? Answering these question would help in the setting up of e-learning communities in that the African university communities would know how this should be done in order to address the needs of all the different students so as to achieve their main goal.

An experimental research approach was adopted. A sample of 56 Bachelor of Science degree students at the University of Zimbabwe took part in the research.

From these research questions we managed to derive a number of hypotheses building upon a number of variables that were seen to be interacting. Basing on the theoretical base shown in figure 1,

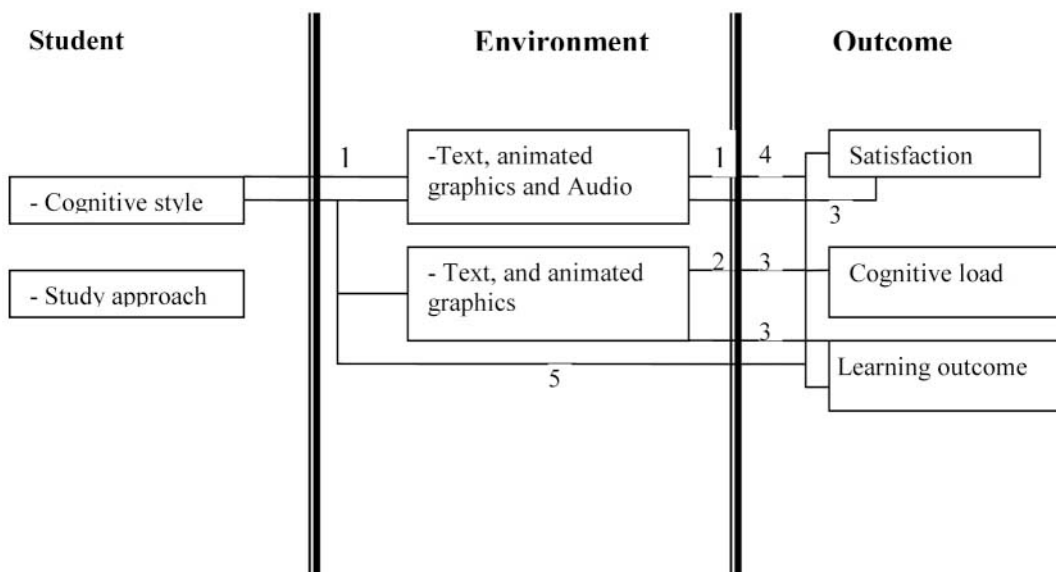


Figure 1: Graphical representation of the variables in the theoretical base and positioning of hypotheses.

In the figure 1 a graphical representation of variables and processes in the study is given as part of the theoretical base. The figure is related to figure 2 which try to show the role that is played by the environment on to the other dependent variables. The experiment was run in an asynchronous e-learning environment. Figure 2 shows how the environment was manipulated so as to show the integration of different media inorder to assess the impact on the learners.

The hypotheses were derived also on the bases of the design which took cognizant of one the important variable which is the cognitive load.

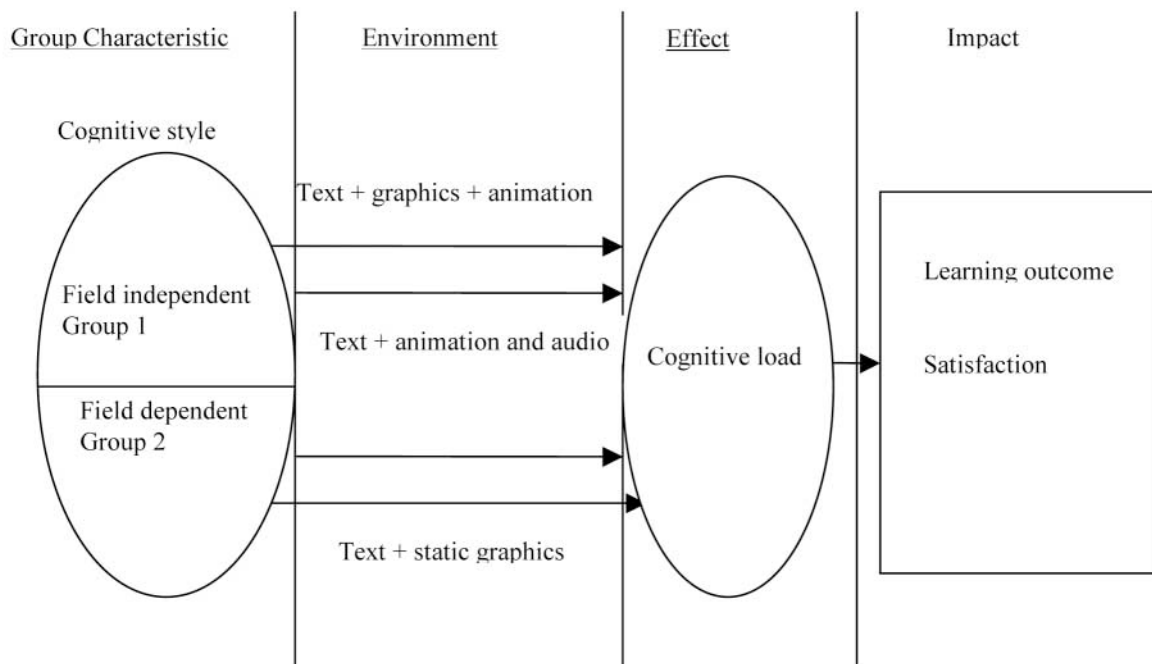


Figure 2: Graphical representation of cognitive style in the theoretical base and its positioning in the hypotheses formulation.

A group of students 56 took part in the study. These students were studying for a bachelor's degree in computer science at the University of Zimbabwe. These students were in their second year of the course.

Learners considered as field independent constituted group 1 while those considered as field dependent constituted group 2.

The two groups, group1 and group 2 were composed of thirty one (31) students and twenty five (25) students respectively.

The e-learning environments were composed of the following:

Control environment

Text and static graphics:

Experimental environment

Text animated graphics

Text animated graphics and audio

The course on software engineering was presented to the learners as an e learning course on Caroline platform in the form of an asynchronous learning community. Based on the three e-learning environmental designs, these environments were showing the integration of multimedia in their implementation.

The research took both an independent and a repeated measures design for the two groups of participants in which each participant was made to perform under both conditions the experimental and the control. The participants were made to go through the course in three different environments, and the researchers were measuring the learning out come, cognitive load and satisfaction as illustrated in table 1.

	Control environment	Experimental environment	
	Text and static graphics	Text animated graphics	Text animated graphics and audio
Group 1 (Field Independent)	-Learning outcome -cognitive load -satisfaction	-Learning outcome -cognitive load -satisfaction	-Learning outcome -cognitive load -satisfaction
Group2 (Field dependent)	-Learning outcome -cognitive load -satisfaction	-Learning outcome -cognitive load -satisfaction	-Learning outcome -cognitive load -satisfaction

Table 1 Research design and the focus during the experiment.

CONCLUSIONS

To what extend does the integration of multimedia mainly text, animation and audio impact on the learning outcomes, satisfaction and cognitive load of the learner considering their cognitive styles.

It was noted that although the integration of multimedia really affected the learners; this effect does not lead to differences between the two groups of learners in terms of the scores. However the integration of text animation only, and text animation and audio were affecting the learners differently depending on their cognitive styles.

For field independent learners, the integration of text, animation and audio had the following effects on the learners as compared to the integration of text, and animation only. This inclusion of audio increased the learning outcome (score), increased the level of satisfaction and decreased the cognitive load. The learners were affected more on this environmental design than in the environment enhanced with text and animation only. The decrease effect on cognitive load is not significant.

For field dependent learners, although there is no significant effect that is brought about by these two environments, there seem to be a different effect in which learning outcome and satisfaction levels goes down while there is an increase on cognitive load. This is more on the environment enhanced with text animation and audio then the one enhanced with text, and animation only.

The learners' cognitive style influences their performance of the learner leading to differences in terms of the learner satisfaction and cognitive load. But no there is no difference on learning outcome. This may be as a result of the motivation effect on the field dependent learners.

There is therefore a different effect on learners due to their cognitive styles in terms of their learning outcomes, satisfaction and cognitive load due to the integration of multimedia as alternative designs of enhancing e-learning communities.

The integration of text animated graphics and audio does not lead to any differences on learning outcome as measured in terms of score.

As the learners both field dependent and field independent get affected with the integration of multimedia the learning outcomes of students improve as we integrate more media especially for the field independent learners but as for the field dependent the effect is not always positive as at times there is a negative but mainly caused by integration of text and animated graphics. There is need to investigate why there is no difference in terms of the learners marks. This could be the motivation effect that is associated with the learning environment.

Although there is a significant effect by the text and static graphic on the learning outcomes generally, the field independent and field dependent learners will only differ on the scores. The inclusion of the animation will not affect the learners from both groups significantly, although there might be different means these will not make the groups appear different in their performance. However with the inclusion audio, will lead to a significant effect to the learners resulting in the learners appearing different on satisfaction and cognitive load but not reflecting any difference in the learning outcomes (scores). So the question that remains is how can these e-learning communities enhanced with multimedia be designed in order to capture these individual learner differences on African learners?

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