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Research Paper

Effect of Multimedia Intervention on Verbal-Imagery Dimension of Cognitive Styles Among Elementary School Students

Education

KEYWORDS : Cognitive Styles, Education, Learning, Multimedia, Verbal-Imagery.

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ABSTRACT

Learning is a complex thing that happens to every person throughout his/her life. To provide instructions to a student by a teacher is very tedious task if teacher does not know the psychology of a student. Therefore, it becomes pertinent for a teacher to recognize the cognitive style of a student. Using quasi-experimental design in the study it is found that there is a remarkable improvement in the scores of students in posttest scores on pretest scores or significant decrease in the response time scores from pretest session (=2.85, S. D.= 1.91) to posttest session (=2.04, S. D. =1.26) with t(8351)=34.65, p=.000 which is <0.01 and rejected the hypothesis. To see the magnitude of the intervention's effect, the Eta squared (ɳ2) showed that there is moderate effect (ɳ2=0.13) of multimedia test and recommended that the course curriculum for the students of various levels have to be developed by including the e-learning contents so that they can learn the contents and grasp the knowledge easily.

1. Introduction

Every day, we are in the stage of learning. Everyone learns through his/her experience, observation and theoretical aspects. As we know, learning is a complex thing that happens to every person throughout his life. Developments in science and technology had encouraged reform efforts in achieving the results of technology in the learning process. The teachers are required to be able to use the tools that can be provided by the school in order to help the success of the learning process. Teachers can use the tool at least a cheap and efficient that although simple and understated but a necessity in order to achieve the expected goals of teaching. Besides being able to use the tools available, the teacher also begun to develop the skills required to create media that will be used if the media is not yet available. For that, a teacher must have knowledge and experience of learning media **(Albi, 2013)**. The development of multimedia technologies for learning offers new ways in which learning can take place in schools and the home. Enabling teachers to have access to multimedia learning resources, which support constructive concept development, can allow the teacher to focus more on being a facilitator of learning working with individual students. Extending the use of multimedia learning resources to the home represents an educational opportunity with the potential to improve student learning across the world. Multimedia systems have the potential to support continuity by: (i) Providing access to a common bank of curriculum related multimedia learning resources for both primary and secondary schools, along with non-IT measures such as transferring class teachers between schools - hence reducing the problems inherent in transfer; (ii) Reducing the need, in secondary schools, for students to move between different classes and meet with different subject teachers, given access to an extensive knowledge base in the form of multimedia learning resources that could be provided in any classroom; (iii) by enabling sharing of data across school phases. With the increase in the numbers of multimedia computer systems in the home students have started to have access to better facilities than currently provided in schools. Given access to learning resources in a quieter home environment learning may become truly dependent of time and place **(Report, 2013)**.

2. Review of Literature

Kearney (1997) seems bothered that students will consume more time to learn via technology until and unless they enable them to overcome the preliminary hindrances that come with using unfamiliar technologies. Learning is likely to be somewhat inhibited and students must embrace the idea of playing an active role in learning rather than assuming the role of a passive recipient of information.

Williams and Harkin (1999) studied the methods of effectively integrating multimedia sources into classrooms. They found that multimedia teaching is effective whenever multimedia technology is used properly by educators. They also suggested that a classroom teacher must choose multimedia based on specific knowledge or skill-set goals rather than simply introducing piece of multimedia for students to consume it and swallow the information as per their own level. **Barker, *et al.* (1999)** investigated the relationships between users' cognitive style and their performances on a multimedia application. The application was designed to present information in users' preferred and non-preferred cognitive styles. They considered differences in performances between Verbalisers, Bimodals and Imagers in areas of the application that presented information either as text and narrative or as a succession of images. The investigators found that there is no significant difference between users in supported and non-supported areas of the application. Although the differences were approaching significance (p=0.067) yet after exclusion of Bimodals, a significant difference was found (p<0.01).

Shih and Gamon (2001) analyzed the relationships between students' achievements and other variables such as attitude, motivation, learning styles, and selected demographics. This population study included 99 students taking two web-based courses offered by the college of agriculture in a university. Seventy-four (75 per cent) students completed a learning style test, an on-line questionnaire, and received a grade by the end of the semester. The learning style test was the Group Embedded Figures Test (GEFT), in which students were classified as either field-dependent or field-independent. The on-line questionnaire consisted of two scales (motivation and attitude), having pilot-test reliabilities 0.71 and 0.91, respectively. Consequently, over two-thirds of the students taking the web-based courses were field-independent learners; however, there were no significant differences (5 per cent significance level) in achievement between field-dependent and field-independent students. It is also found, students with different learning styles and backgrounds learned equally well in web-based courses.

Buzzell, *et al.* (2002) used a controlled experiment where students were grouped into three sections with one using web-based tutorials only, another using traditional instruction method, and a third using traditional as well as web-based tutorials. Results from the experiment showed no significant differences in student learning outcomes. However, they suggested that

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there is no significant negative impact of multimedia usage in classrooms.

The learning occurs due to interaction between a person and his/her environment. Therefore, learning can occur anytime and anywhere. To provide instructions to a student by a teacher is very tedious task. If a teacher has no idea about the cognitive style or level of student then he/she can't provide the instructions as well. Therefore, it becomes pertinent for a teacher to recognize the cognitive style of a student. One person that one has to learn is a change in behavior that occurs in people that are probably caused by changes in the level of knowledge, skill or attitude.

3. Cognitive Style, Multimedia and Learning

Cognitive style is seen as an individual's preferred and habitual approach to both organising and representing information. This study used a model that conceptualises style on two bi-polar dimensions: the Wholistic-Analytic and the Verbaliser-Imager dimensions **(Riding & Smith, 1997; p. 200)**. The present study considered the verbal-imagery dimension of cognitive style used by elementary school students to learn the content which was presented through words or pictures with the help of multimedia test. Riding developed a two-dimensional cognitive style instrument, namely Cognitive Style Analysis (CSA), which is a compiled computer-presented test that measures individuals' position on two orthogonal dimensions-Wholist-Analytic (WA) and Verbal-Imagery (VI). The WA dimension reflects how individuals organise and structure information. Individuals described as Analytics will deconstruct information into its component parts, whereas individuals described as Wholists will retain a global or overall view of information. The VI dimension describes individuals' mode of information representation in memory during thinking-Verbalisers represent information in words or verbal associations, and Imagers represent information in mental pictures **(Wikipedia, 2012)**.

In the present study, 'multimedia' comprised a computer program that includes words and pictures stimuli on Verbal-Imagery dimension of cognitive styles by which the students of elementary schools understood the content of these stimuli and gave responses, accordingly.

A testing effect, also called a pretesting effect, is a change in the validity of experiment that occurs when an initial measurement or test alerts respondents to the nature of the experiment. Thus, respondents may act differently than they would have if no pretest or pre-test measure had been taken. In a before-and-after study, taking a pretest before the independent variable is manipulated may sensitize respondents when they are responding the tests for the second time. Pretesting may increase the awareness towards the experiment or may increase the attention towards experimental conditions **(Zikmund, 2003; p. 272)**. In the present study, gains in the scores or decrease in the response time in multimedia learning considered as the impact of various multi-media formats. Consequently, a relationship between cognitive styles and multimedia learning achievements were established on the basis of data collected through Verbal Imaginary Cognitive Styles Test (VICS) and the Extended Cognitive Styles Analysis Wholistic-Analytic (CSA-WA) tests.

4. Objective and Methodology

The objective and hypothesis are as under:

O_1: To study the effect of multi-media intervention on verbal-imagery dimension of cognitive styles among elementary school students.

H_1: There is no significant difference towards effect of multi-media intervention on verbal-imagery dimension of cognitive styles among elementary school students.

The present study used time-series quasi-experimental design **(Zikmud, 2003; p. 280)**. In this study, an evaluation was done to determine whether a program (VICS and Extended CSA-WA software) or intervention (Multi-media learning format) has the intended effect on a study's students in terms of Verbal-Imagery (Words and Pictures) of cognitive styles. Being the pre-post test design the data was collected from 40 elementary school students' before the intervention taken place *i.e.* pre and after the intervention taken place *i.e.* post (Table 1).

Table 1: Demographic Profile of Students

Satluj Public School, Sirsa					
Grade			Gender		Total
			M	F	
5th	Age (Years)	12	1	0	1
		11	1	0	1
		10	5	1	6
		09	1	1	2
	Total		8	2	10
6th	Age (Years)	12	2	0	2
		11	4	2	6
		10	0	2	2
	Total		6	4	10
7th	Age (Years)	13	1	1	2
		12	4	3	7
		11	0	1	1
	Total		5	5	10
8th	Age (Years)	14	0	1	1
		13	3	6	9
	Total		3	7	10
Total Students			22	18	40
Percentage			55	45	100

Note: F=Female and M=Male.

Source: Data generated through VICS and E-CSA-WA Tests and Processed through PASW 18.0

The present study design looked at four groups of individuals who received the intervention, which were called the treatment groups because, the pre-post test design allowed to make inferences on the effect of intervention by looking at the differences in the pretest and posttest results.

For the purpose of final analysis, the scores of students' ID numbered 11504/12504 (Male), 11509/12509 (Male), 11707/12707 (Female) and 11803/12803 (Female) were not considered for analysis as they have an error rate more than 30 per cent in both the sessions of VICS. Consequently, the objective of the study is achieved through responses collected from responses given by 36 students from 5th to 8th classes of Satluj Public School, Sirsa on 232 stimuli with regard to verbal (116)-imagery (116) dimensions. The categories of stimuli were in form of words (58) and pictures (58): natural (26), manmade (26) and mixed (06) for verbal task. On the other hand, categories of stimuli were in the form of words (58) and pictures (58): bigger (26), smaller (26) and equal (06) for imagery task.

To collect the demographic profile of sample of elementary school students, the relevant information like name, gender, year of birth, religion (filled in the box of ethnic group) and grade (filled in the box of comments) were filled by the scholar in the introductory screen of VICS test. Further, the information with regard to the student is right or left handed and opted English as 1st language were filled up in this screen also. To answer the research questions (objectives of the study) and to test the tentative answers (hypotheses of the study), the required information were identified. Then, Verbal Imaginary Cognitive Styles Test (VICS) and the Extended Cognitive Styles Analysis Wholistic-Analytic (E-CSA-WA) were conducted in the abovesaid two elementary schools. The students took 35 - 40 minutes to complete the session of these tests.

After preparing the data, the data was tabulated and analyzed by using a set of simple statistical techniques such as frequency distribution, cross tabulation, mean, harmonic mean, range and percentage for exploratory data analysis; standard deviation (S. D.) and paired *t*-test **(Dimiter & Phillip, 2003)** for confirmatory data analysis were used. Moreover, bar charts and line graphs were also used for understanding the results in an easiest way.

5. Effect of Multimedia Intervention on Verbal-Imagery Dimension

Table 2 shows the frequency distribution of response time taken by the students during pretest and posttest sessions of VICS test (232 stimuli) in terms of seconds on 232 stimuli as discussed earlier.

Table 2: Descriptive Statistics for Response Time taken by students of Satluj Public School, Sirsa on Verbal-Imagery Dimension (Seconds)

Numbers of Stimuli=232

Session of Experiment	ID	Mean	Harmonic Mean	Range	S. D.
Pretest	11501	3.20	2.54	10.72	1.51
Posttest	12501	2.06	1.81	5.45	.84
Pretest	11502	2.97	2.55	6.86	1.21
Posttest	12502	1.76	1.56	4.36	.69
Pretest	11503	3.31	2.74	8.63	1.53
Posttest	12503	2.42	2.00	8.48	1.29
Pretest	11505	3.17	2.67	7.67	1.39
Posttest	12505	2.17	1.84	5.94	1.02
Pretest	11506	2.52	1.95	7.77	1.45
Posttest	12506	1.53	1.27	6.58	.77
Pretest	11507	3.81	3.02	10.86	1.96
Posttest	12507	2.45	2.02	6.67	1.22
Pretest	11508	5.83	4.32	17.92	3.26
Posttest	12508	3.27	2.30	12.44	1.99
Pretest	11510	4.96	2.21	26.73	3.76
Posttest	12510	2.17	1.61	6.67	1.07
Pretest	11601	3.29	2.51	13.38	2.02
Posttest	12601	2.47	1.85	8.33	1.51
Pretest	11602	2.52	2.20	6.28	1.02
Posttest	12602	1.90	1.62	4.19	.80
Pretest	11603	2.55	2.08	5.33	1.20
Posttest	12603	1.71	1.48	4.69	.78
Pretest	11604	2.33	1.95	10.20	1.21
Posttest	12604	1.74	1.50	6.83	.78
Pretest	11605	4.42	2.90	27.91	3.47
Posttest	12605	1.85	.56	15.09	1.95
Pretest	11606	2.29	1.87	6.88	1.16
Posttest	12606	2.11	1.78	5.28	.99
Pretest	11607	2.40	1.93	5.75	1.18
Posttest	12607	1.95	1.59	7.80	1.12
Pretest	11608	2.45	1.98	9.55	1.35
Posttest	12608	1.96	1.67	5.11	.92
Pretest	11609	1.76	.60	15.13	1.64
Posttest	12609	1.43	.56	8.56	1.24
Pretest	11610	2.24	1.83	6.77	1.15
Posttest	12610	1.55	1.35	5.39	.71
Pretest	11701	2.35	2.01	5.05	.99
Posttest	12701	1.63	1.44	3.70	.65
Pretest	11702	2.86	2.13	15.44	1.92
Posttest	12702	2.32	1.73	9.12	1.40
Pretest	11703	2.30	1.84	8.23	1.24
Posttest	12703	1.82	1.57	3.72	.76
Pretest	11704	1.96	1.79	3.85	.62
Posttest	12704	2.60	.70	18.33	2.90
Pretest	11705	2.79	2.14	23.02	2.03
Posttest	12705	1.91	.71	8.63	1.47
Pretest	11706	1.96	1.69	4.86	.80
Posttest	12706	1.80	1.59	4.44	.72
Pretest	11708	4.44	3.42	19.00	2.66
Posttest	12708	2.79	2.28	7.44	1.32
Pretest	11709	2.50	1.90	6.14	1.24
Posttest	12709	2.42	1.90	11.86	1.41
Pretest	11710	2.40	1.90	9.08	1.24
Posttest	12710	1.85	1.56	6.30	.91
Pretest	11801	4.08	3.31	12.39	2.02
Posttest	12801	1.91	1.69	4.74	.79
Pretest	11802	2.17	1.87	3.72	.82
Posttest	12802	1.63	1.44	3.30	.62
Pretest	11804	2.59	2.18	6.75	1.11
Posttest	12804	1.69	1.46	3.75	.73
Pretest	11805	2.70	2.20	9.47	1.40
Posttest	12805	1.92	1.66	5.08	.84
Pretest	11806	2.58	2.15	7.34	1.21
Posttest	12806	2.65	2.08	7.47	1.43
Pretest	11807	2.66	2.16	8.31	1.35
Posttest	12807	2.21	1.79	6.50	1.14
Pretest	11808	2.57	1.79	7.42	1.35
Posttest	12808	2.54	2.02	8.66	1.34
Pretest	11809	1.69	1.45	3.31	.71
Posttest	12809	1.47	1.27	4.72	.66
Pretest	11810	2.16	1.85	6.12	.95
Posttest	12810	1.73	1.48	4.66	.82
Pretest	Total	2.85	2.01	28.47	1.91
Posttest	Total	2.04	1.40	18.36	1.26

Source: Data generated through VICS and E-CSA-WA Tests and Processed through PASW 18.0

From the table, it is observed in the pretest session the participant ID 11809 took minimum time *i.e.* 390.94 seconds to complete the whole pretest session scoring maximum time *i.e.* 4.03 seconds and minimum time *i.e.* 0.72 seconds to give response to a stimuli followed by 11706 and 11704 who took 455.36 and 455.77 seconds, respectively for same session. As far as the speed of response on different stimuli is concerned, it is found that participant ID 11809 take the lead by consuming minimum time to respond a particular stimuli which can be seen from lowest Harmonic mean *i.e.* 1.45 with S. D. =0.71 followed by 11706 and 11808 with harmonic means 1.69 and 1.79, standard deviations 0.8 and 1.35, respectively.

On the contrary, participant having ID 11508 take maximum time to complete the whole session which was 1351.44 seconds. The participant took maximum time *i.e.* 19.3 seconds and minimum time *i.e.* 1.38 seconds to give response to a stimuli (Harmonic Mean= 4.32 and S. D.=3.36) followed by participant ID of 11708 and 11801 who take time 1028.92 and 945.75 seconds to complete the whole session. It may also be observed from Table 4.9 that the participant ID 12609 took minimum time *i.e.* 331.21 seconds to complete the whole posttest session scoring maximum time *i.e.* 0.03 seconds and minimum time *i.e.* 8.59 seconds to give response to a stimuli followed by 12809 and 12506 who took 341.29 and 355.55 seconds, respectively for same session. As far as speed of response on different stimuli is concerned, it is found that participant ID 12609 take the lead by consuming minimum time to respond a particular stimuli which can be seen from lowest Harmonic mean *i.e.* 0.56 with S. D. =1.24 followed by 12605 and 12704 with harmonic means 0.56 and 0.7, standard deviations 1.95 and 2.9, respectively. They took maximum time to respond a particular stimuli *i.e.* 15.2, 18.39 seconds and minimum time *i.e.* 0.11, 0.06 seconds, respectively.

On the contrary, participant having ID 12508 take maximum time to complete the whole session which was 757.95 seconds. The participant took maximum time *i.e.* 12.83 seconds and minimum time *i.e.* 0.39 seconds to give response to a stimuli (Harmonic Mean= 2.3 and S. D.=1.99) followed by participant ID of 12708 and 12806 who take time 648.05 and 615.82 seconds to complete the whole session. They took more time to respond a particular stimuli *i.e.* 8.22 seconds and minimum time *i.e.* 0.78 seconds (Harmonic Mean=2.28 and S.D.=1.32); and maximum time *i e.* 7.88 seconds and minimum time *i.e.* 0.41 seconds to respond a particular stimuli (Harmonic Mean=32.08 and S.D.=1.43), respectively.

Hence, it is concluded that the students of 6th grade have performed better in comparison of 8th and 7th grade students in both the sessions *i.e.* pretest or posttest; whereas, the students of 5th grade lagged behind in terms of minimum time as a whole

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and maximum speed for both the sessions.

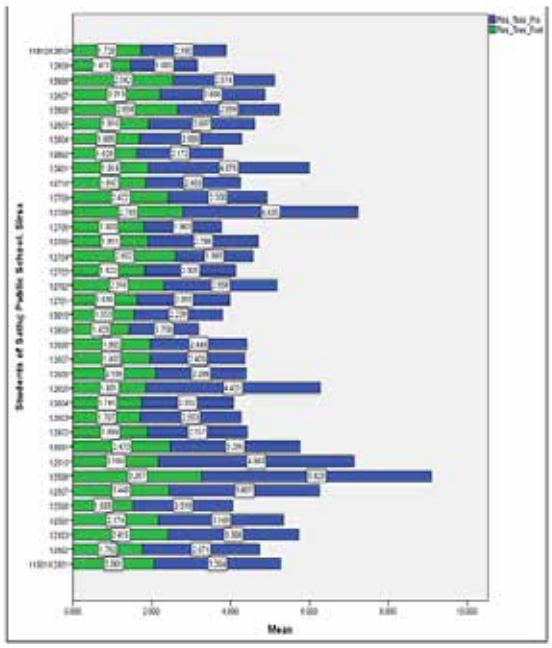
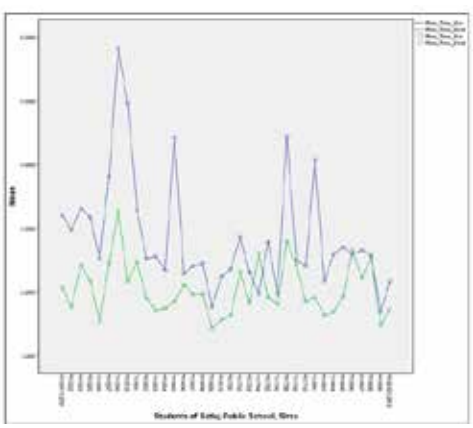


Chart 1: Response time taken by students of Satluj Public School, Sirsa
during pretest and posttest sessions

Source: Data generated through VICS and E-CSA-WA Tests and Processed through PASW 18.0



[Graph 1: Response time taken by students of Satluj Public School, Sirsa during pretest and posttest sessions]
Source: Data generated through VICS and E-CSA-WA Tests and Processed through PASW 18.0

Chart 1 and Graph 1 depict the changes in the scores in terms of response time taken by students in the pretest (Res_Time_Pre) and posttest (Res_Time_Post) sessions in terms of mean of speed. Hence, it may be easily grasped that there is a remarkable improvement in the scores of students in posttest scores on pretest scores. Table 4.10 shows the descriptive and inferential statistics calculated through paired-samples *t*-test to see the difference between the scores on response in pretest and posttest sessions of the intervention *i.e.* VICS test. And it is found that there is significant decrease in the response time scores from pretest session ($\bar{x}\bar{x}$=2.85, S. D.= 1.91) to posttest session ($\bar{x}$ $\bar{x}$=2.04, S. D. =1.26) with $t(8351)=34.65$, p=.000 which is <0.01. Hence, the hypothesis may be rejected that there is no significant difference between the scores of the students of Satluj Public School, Sirsa during pretest and posttest sessions in terms of response time on verbal-imagery dimension of cognitive styles at 0.01 level of significance **(H_1)**.

To see the magnitude of the intervention's effect Eta Squared (one of the most commonly used effect size statistics) was obtained by using the following formula:

Eta squared= $t^2/(t^2+ N-1)$

Eta squared= $(34.647)^2/(34.647)^2+8352-1$ or 0.12666 or 0.13.

The Eta squared (η^2) showed the moderate effect (η^2=0.13) of the intervention on the students' scores in terms of their response time, as Eta squared interpret .01=small effect, .06=moderate effect and .14 =large effect **(Pallant, 2005; p. 212)**. Therefore, it is concluded that there is a moderate effect of multimedia test on the learning achievement of students of Satluj Public School, Sirsa during pretest and posttest sessions.

6. Conclusions and Recommendations

Needless to mention, the expansion of teacher education, institutions and programmes during the past few years characterizes the teacher education scenario of today. Abreast education also increased the demand of teachers who are trained in advanced teaching pedagogies. Therefore, multimedia learning found a vital place within the learner's information system by which a teacher can understand the psychology or cognitive level of the students and can provide the best education to mould best citizen for the society. Hence, it is recommended that the course curriculum for the students of elementary, secondary, senior secondary and higher levels have to be developed by including the e-learning contents so that they can learn the contents of syllabus and grasp the knowledge easily.

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Note:

The Verbal Imagery Cognitive Styles (VICS) test is a computerized test that measures verbal versus imagery preferences from the way of information is represented. (Copyright 2003 University of Edinburgh). The Extended Cognitive Styles Analysis Wholistic-Analytic (CSA-WA) test is a computerized test that measures preferences for structuring information in a wholistic versus an analytic way. (The CSA is copyrighted by Richard Riding 1991. The extension to the CSA-WA is copyrighted by the University of Edinburgh 2004). Retrieved from http://www.psych.auckland.ac.nz/uoa/vics-test-and-extended-csa-wa on April 7, 2012. The said tests were used with the permission of Dr. Surinder Singh Kundu, Assistant Professor & Incharge, Department of Commerce, Chaudhary Devi Lal University, Sirsa-125055 who had made an agreement with Dr. Elizabeth Peterson, Department of Psychology, University of Auckland, New Zealand and witnessed

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