A study on the Relationship between Field Dependent-Independent (FD-I) Cognitive Style and Brain Dominance among College Students

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Abstract:

Previous study examined the Gaze pattern of individuals differing in FD-I cognitive style and finding revealed the difference in Blink count, Saccade count and Fixations. Cognitive style also termed as learning style has its implication in education among students and students differing in their hemispheric preferences has their own set of proficiency. The present study investigates the relationship between FD-I cognitive style and hemispherical preference among students pursuing majors that requires distinct capabilities. 45 participants (10 male and 25 female) of 15 from each department (Costume designing and fashion (CDF), Mathematics and English literature) were selected randomly. Participants were administered with Group Embedded Figure Test (GEFT) and Brain dominance inventory (BDI). Finding indicates the discrepancy in distribution of FD-I cognitive style and brain dominance among students belonging to different majors. Equal distribution founded in regards with cognitive style and brain dominance among CDF students. But in terms of mathematics department, Field Independent S' (FI) outnumbered Field Dependent S' (FD) and those who were FI preferred to be Right hemisphere dominant and similarly in English literature majority falls on the category of FI and their preferred hemispherical dominance is also Right. Overall finding concludes that more than half of the students were belongs to FI cognitive style and for the most part of they were Right hemispheric dominant. Practical implications of the results were discussed.

Keywords: *Cognitive Style, Learning Style, Field dependent-independent (FD-I) and Hemispheric preference*

I. INTRODUCTION

Present scenario of education system exemplifies the teacher centered approach rather student centered one in teaching. Since it is termed to be a decade for information technology, the appreciation of computer technology is in its preliminary stage in educational setup. Formulating a module for computerized education needs a clear cut understanding of psychological attributes involving in learning process. Course of learning and conceptualization involves interference of higher mental process which is influenced by perceptual style and the way of processing visual stimuli (Workman, 2004). So this study intends to investigate the relationship between cognitive style/ learning style and brain dominance. Individuals' cognitive characteristics and visual complex environments have been gaining ground in the literature. Cognitive Style (CS) is the individual's preferred way of attending, processing, organizing and interpreting information presented in the visual field (Miron et al., 2004), furthermore CS is an unwavering psychological attribute in an individuals' manner of cognitive functioning, specifically in the unique way of gathering and processing information (Ausburn, L.J. et al., 1978).

Unlike abilities and attitudes which are expressed in terms of multipolar dimensions, cognitive style is unique for its bipolar expressions such, field dependence-Independence (FD-I) (Witkin et al., 1975), Reflection – Impulsivity (Kagan, 1965), Objective vs. nonobjective (Leithwood & Montgomery, 1982), Verbaliser – Visualiser (Richardson, 1977), Serialistic–Holistic (Pask, G., 1976) and Simultaneous vs. Successive (Das, 1988). Among various cognitive styles, FDI dimension has its direct manifestation in executive functions. Differences between the field dependent and independent continuum narrate to the degree of differentiation of psychological functioning in perception (Witkin, et al., 1974).

The FD-I dimension is also incorporated to personality characteristics (Olstad, Juarez, Davenport, & Haury, 1981), which have essential instructional and learning implications. Field dependent S' (FD) were reported to have high social orientation (Witkin et al., 1977), influenced easily by negative reinforcement (Goodenough, 1976), and are inclined by the opinions of authorities (Castaneda, et al., 1972). Whereas field independents' (FI) were better in learning impersonal abstract subjects (Rollock, 1992), independent learners (Wilborn, 1981), prefer to be an individualistic (Frank, 1986) and less influenced by others (Witkin et al., 1977). The major difference among FD-I domain and the concerns of this research is its perceptual process, FI is effective in perceiving the stimulus from the environment easily by their sequencing ability whereas for FD S' other relative stimuli tend to hinder it because of their global perception (Witkin, 1950).

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Brain and Cognition is two related but still distinct concepts that has to be probed deeply. In order to explore the link between brain and cognition, many researchers intend to study the relationship between learning style/cognitive style with the hemispherical dominance (O'Boyle, 1986; Zalewski, Sink, & Yachimowicz, 1992; Seng & Yeo, 2000). Cognitive style is being the determinant of individual's perceptual process (Sadler Smith and Badger, 1998), learners with each four diverse classes and with the two hemispherical modes (sequential-left brain and global-right brain) (McCarthy, 1987; Felder and Solomon, 2001). Hemispherical dominance could be stated as individual's inherited predispositions towards preferential use of the processes associated with one or the other cerebral hemisphere (Bradshaw & Nettleton, 1981; Minagawa & Kashu, 1989; Hellige, 1990).

An investigation of Huteau in 1980's on both the FD-I domain and the neurological basis of brain function laid the foundation for the study of relationship between FD-I cognitive style and brain organization. By the spirit of Huteau's work study on cognitive style and brain organization takes up two approaches, Physiological basis of perceptual selectivity and the degree of preference over two cerebral hemispheres (Carolina et al., 1993). Research studies on the brain damaged participants reveals that while performing Gottschaldt test, there observed abnormalities in the performance of aphasic (Teuber, et al, 1956; Russo, et al., 1967), posterior lesion (Teuber, et al., 1951) and anterior, posterior or multiple neoplasms patients (Battersby, et al., 1953). Non aphasic left hemisphere lesion patients found to be out performed subjects with right hemisphere lesion (Russo, et al., 1967). Corkin (1979) concluded that the severity of lesion is much important than the localization of lesion in terms of perceptual tasks. Degree and direction of dominance of hemispheric asymmetry play a vital role in individual differences in cognition. Gadzella and Kneipp (1990) evidenced the Right hemispheric students were processing informations logically and systematically whereas Left Hemispheric children processes non linearly and holistically. Recent brain imaging research reveals the relationship between brain and cognition that during visual searing process there exists the increased haemodynamic activity in the prefrontal cortex (Sarah et al., 2015).

There exists abundant research on cerebral dominance and FD-I cognitive style among diverse brain damaged participants. This research concerns the interference of hemispherical preference involving the perceptual chore like unearthing the simple form concealed in the complex figure (EFT) of participants with no neurological complaint. The primary objective of this study is to investigate the relationship between cognitive style (FD-I) and brain dominance among students belonging to different majors. This study is hypothesized as there exists relationship among FD-I cognitive style and brain dominance among students pursuing majors that requires distinct capabilities. The implication of the study is to facilitate the educationists to module a student based approach in teaching.

II. METHOD

Participants:

This study was conducted in Tamil Nadu, India. This study included 45 participants between the age of 18 and 21 (M=19.4; S.D= 0.66) belonging to three departments (each 15) requiring distinct abilities such Costume Designing and Fashions: Visuo-motor and Visuo-spatial, Mathematics: numerical ability and sequential processing and English literature: Comprehension and Vocabulary. Before the conduction of experiment, the participants were explained with the objective of the study and got signed with informed consent. After the conduction, results were delivered separately to each interested individuals.

Instruments:

1. Group Embedded Figure Test (GEFT):

Developed by Witkin, Oltman, and Raskin in 1971, containing the complex figure where the subject has to trace the simple concealed in it with the pencil. The reliability of the test is .82, established by administering the parallel form of test within the same time limit. Internal consistency and construct validity of the test is found to be satisfactory and Salmani-Nodoushan (2007) reported acceptable split-half reliability.

2. Brain Dominance Inventory:

Brain Dominance Inventory (BDI). Each items of BDI has only three responses will hardly take 15 minutes for completion.

III. PROCEDURE

The participants were administered with GEFT. The first 9 items was meant for practicing and rest was awarded with 1 mark for each correct responses. Since there were no such cut-off scores described by the author, the median value of 15 is calculated and the participants were segregated in to Field Dependent (>15) and Field Independent (<=15). After the GEFT they were given with Brain Dominance Inventory (BDI). Each item in BDI has three responses. The scorings were done manually, analyzed with SPSS and results were drawn.

IV. RESULTS AND DISCUSSION

Table No. 1: showing the frequencies and percentages of socio demographic variables and study variables.

Variable		Frequency	Percentage
Age	18	3	6.7%
	19	19	42.2%
	20	22	48.9%
	21	1	2.2%
Sex	Male	10	22.2%
	Female	35	77.8%
Department	Costume Designing	15	33.3%
	Mathematics	15	33.3%
	English	15	33.3%
Academic Performance	51-60	3	6.7%
	61-70	6	13.3%
	71-80	16	35.6%
	81-90	18	40.0%
	91-100	2	4.4%
Cognitive Style	Field Dependent	16	35.55%
	Field Independent	29	64.44%
Brain Dominance	Bilateral	6	13.3%
	Left Brain dominant	17	37.8%
	Right Brain dominant	22	48.9%

Table-I shows the frequencies and percentages of socio demographic variables and study variables for the study on cognitive style and brain dominance among college students. Among the participants 10 were males (22.2%) and females were 25 (77.8%). In this group there was 3 eighteen year old participants (6.7%), 19 nineteen years old (42.2%), 22 twenty years old (48.9%) and only one 22 years old participants (2.2%) of three departments such as Costume designing and fashions (15) (33.3%), Mathematics (15) (33.3%) and English literature (15) (33.3%). They were segregated in to two groups by their performance in Group Embedded Figure Test (GEFT) as Field Dependent (16) (35.55%) and Field Independent (29) (64.44%) and into three categories by their responses to Brain Dominance inventory as Bilateral (6) (13.3%), Right Hemisphere Dominance (17) (37.8%) and Left Hemisphere Dominance (22) (48.9%). In academic performance, 3 (6.7%) participants have scored 51 – 60, 6 (13.3%) participants have scored 61-70, 71-80 scored by 16 individuals representing 35.6%, (81-90) holding majority of 18 students representing 40% of total population and (91-100) were only two representing 4.4% from total population.

Table No. 2: Cross Tabulation of cognitive styles, brain dominance and academic performance in regards with participant's department.

		Costume Designing	Mathematics	English
Cognitive Style	Field Dependent	7	5	4
	Field Independent	8	10	11
Brain Dominance	Bilateral	2	1	3
	Right Hemisphere	8	6	8
	Left Hemisphere	5	8	4

Table II showing the cross tabulation of Cognitive style, Brain dominance and Academic performance in rows versus departments in column. By the findings, there were 7 FD and 8 FI individuals in Costume designing department, (i.e.) almost equal distribution, retaining the existing contradiction in studies on Cognitive Style's influence on arts (Ndudi and Mkpa, 2003; B. U.Onyekuru, 2015). In mathematics department, there were 5 FD and 10 FI participants. Dealing with numerical data requires adequate retained attention and working memory. It is in line with the theory of Baddeley and Logie's (1999) on working memory theory and Pascual-Leone's (1997) constructivist dialectic model, which describes FD as capacity deficit. English literature department, majority were FI (11) and FD participants were only four (4). Researchers quoted that the FI were relatively superior in the performing tasks such listening (Ebrahim Khodadady, 2012), Reading (Nozari, Siamian, 2015), and in translating (Keshmandi, Akbari and Ghonsooly, 2015). The Brain dominance score of Costume designing & fashion (CDF) was 2 in Bilateral, 8 in Right Hemisphere and 5 in Left hemisphere. Among 15 participants from mathematics, only one was bilateral, 6 had Right and 8 had left hemispheric dominance. Whereas in English literature, 3 were Bilateral, 8 falls on Right and 4 were Left hemispheric dominant. Right hemispheric dominance outnumbered Left hemispheric dominance among English literature students and reverse happened with Mathematics. This results are incongruent with the research concluded that Right-brain dominance including majors like science, engineering and mathematics and Left-brain dominance includes the majors like communication, arts and humanities. (Bakan, P,1969; Kolb. D. A. 1979; Rowe, Waters, Thompson, & Hanson, 1992).

Table No. 3: Cross Tabulation between Cognitive style and Brain dominance among three departments.

		Brain Dominance		
Department	Cognitive style	Bilateral	Right	Left
Costume Designing & Fashions	Field Dependent	1	4	2
	Field Independent	1	4	3
Mathematics	Field Dependent	1	0	4
	Field Independent	0	6	4
English literature	Field Dependent	1	3	0
	Field Independent	2	5	4

Table III showing the cross tabulation between Cognitive style and Brain dominance of students of three majors. From the findings it is revealed that the distribution of hemispheric dominance of FI and FD S' were almost equal and there exists no noticeable difference among CDF department students. In terms of mathematics department students, 10 students out of 15 were FI and among those 10, 6 students preferred to be Right hemispheric dominant and out of 15 participants 5 were FD and among those 5 FD S' four of them preferred to be Left hemispheric dominant. This result is in line with the finding of Semple., et al, that while performing simple tasks like arithmetic and facial recognitions, FI S' tend to prefer Right hemispheric activation and FD S' preferred to being left hemispherically activated. Whilst in English literature department, 11 out of 15 were FI and among them 5 were Right hemispheric dominant and 4 were Left hemispheric and 2 were Bilateral. Whereas only 4 were FD and among them 3 were Right hemispheric and only one was Bilateral. This finding reveals that majority of English Literature S' were FI and more than half were Right hemispheric dominant. The present study's result is consistent with the findings that FI S' performed superior than FD S' in listening comprehension (Ebrahim Khodadady, 2012) and in language translation (Keshmandi, Akbari and Ghonsooly, 2015). But at the same time it contradicts the findings that language comprehension (Saleh, A., 2001) and communication (Thompson, & Hanson, 1992) relies on the left hemisphere.

V. LIMITATION

- Small sample size is one of the limitations of the study.
- Usage of brain imaging techniques would have yielded better results.

VI. IMPLICATION

- Understanding the individual difference among students facilitates the teachers to formulate student centered academic module that helps the students to function efficiently in educational setup. Study of perceptual style and influence of brain in processing information leads the techniques to present virtual environment to the students that could require minimum effort to be processed.

VII. CONCLUSION

The overall finding of the study resulted that majority of the students were field independent and of right hemispheric dominant but still there exists population in the considerable amount that lies on the opposite spectrum. Cognitive style and brain dominance of students from different major differs significantly and so that their information processing style is. Understanding the individual differences leads the scientist to incorporate the appropriate technological tools in educational setup for enhancing the academics.

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