Gender Differences in Verbalizing-Visualizing and Wholistic-Analytic Cognitive Styles

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The present research investigated the gender differences in verbalizing-visualizing and wholistic-analytic cognitive styles of university students in Pakistan. The sample comprised of 427 university students (male students = 160, female students = 267) with age ranging from 18 to 40 years. Verbal-Imagery Cognitive Style Analysis Test and Extended Cognitive Style Analysis-Wholistic-Analytic developed by Peterson (2005) were used. Styles were designated through verbal-imagery ratios and wholistic-analytic ratios calculated on median response times. Crosstab proportions test indicated that male students (53.1%) were more visualizer as compared to female students (32.6%), while, female students (18.4%) were more verbalizer as compared to their counterparts (8.8%). In addition, it was found that male students perform faster on visual tasks as compared to female students. Analysis of variance suggested that on mean verbal task, verbalizer were better than imager and little styles, while on mean imagery reaction time, visualizer style was better as compared to verbalizer and little styles.

Keyword. Verbalizing-visualizing cognitive styles, wholistic-analytic cognitive styles, gender, university students

Cognitive styles are individual differences that remain steady, are inherent in nature, and associated with information processing methods, that are perceiving, organization, and analyzing the information (Peterson, Rayner, & Armstrong, 2009). Cognitive styles have importance in relation to individual difference and these concepts are widely applicable in education, organization, clinical and economic settings (Riding, 1991, 1997; Riding & Sadler-Smith, 1997).

Riding and Cheema (1991) pointed out over 30 style labels, and concluded that various styles labels could be placed within two central

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dimensions. These are the wholistic-analytic and verbal-imagery dimensions (Peterson & Deary, 2006). Riding and Rayner (1998) presented a new cognitive style model. The model is presented as a two vertical dimensional illusion, showing the bi-polar nature of the construct (Peterson et al., 2009). The two fundamental dimensions of cognitive styles are; firstly, the wholistic–analytic style, which determines whether an individual tends to process information as a whole or in parts. Secondly, the verbal-imagery style, which determines whether individual process information during thinking verbally or by means of mental images (Peterson & Deary, 2006; Riding & Rayner, 1998).

Riding and Cheema (1991) built up a test subsequently, which measured the two dimensions of cognitive styles. The test was named the Cognitive Style Analysis (CSA; Riding, 2005), which provided a score for each dimension in the cognitive style model. On the wholistic-analytic dimension, a low ratio indicates a wholistic style and high ratio to an analytic style. Little styles are those individuals who fall at the intermediate position of verbalizer-visualizer and wholistic-analytic domains (Davies & Graff, 2006). The verbalizer-visualizer measurement is measured as ratios, the low ratio represents a verbalizer and high ratio represents an imager, the intermediate or little style position is portrayed as bimodal. Along these lines, verbalizers and visualizers are not a homogeneous category concerning their spatial capacity. There appear to be two different groups; that is, visualizers of high spatial ability and visualizers of low spatial ability (Kozhevnikov, Hegarty, & Mayer, 2002; Riding & Calvey, 1981). Riding and Grimley (1999) further elaborated that each dimension is continuous and the labels that attached to the continuum are for descriptive purposes. The two dimensions, wholistic-analytic and verbal-imager are independent of one another; the position in one dimension of cognitive style does not affect the position of an individual on the other dimension. Researchers have empirically supported the independence of the positions (Rezaei & Katz, 2004; Riding & Grimley, 1999; Riding & Staley, 1998).

Wholistic-Analytic Cognitive Style

The wholists have a tendency to process information as whole and are habitually consistent in any context, condition, or situation. The capacity of an individual to see the entire picture gives an accustomed view and is one of the qualities of this style. The negative qualities of this style lead an individual to find it hard to categorize particular information into its constituent rational parts (Strehler,

2008); while, the analytics have a propensity for processing information in parts. The preferred method for an individual is to see the circumstance as a collection of parts, by analyzing information into its constituent parts.

Peterson and Deary (2006) argue that a task that measures lower level processing would be a superior method for measuring consistent individual differences in wholistic-analytic cognitive style dimension. This measurement method may be more sensible in giving an understanding of wholistic-analytic style dimension at a theoretical and informative level. Peterson, Deary, and Austin (2005) speculated that individuals process information efficiently in their preferred cognitive style; this is the reductionist method, which studies the information processing in connection to the inspection of time. Inspection of time is a required exposure duration to reliably respond about stimulation selection in the task (Vickers, Nettelbeck, & Wilson 1972). Vickers and Smith (1986) contend that performance on inspection of time tasks gives an index of the rate at which a participant process sensory s, 2006).

Verbal-Imagery Cognitive Style

Verbalizers are those who tend to process information in words and they learn better from textual input. Visualizers are those who tend to process information in images, they learn best from pictorial presentation (Riding & Rayner, 1998). The research literature on cognitive style is very vast, and has been a debatable area of research. As Martisen (1994) referred to Vernon who followed cognitive styles back to the Greek and Roman writings. Riding and Cheema (1991) and Grigereneko and Sternberg (1995) agreed that Allport (1937) was most likely the first analyst who intentionally utilized the style construct in relationship with cognition. This alludes to an individual's habitual or typical style for perceiving, remembering, thinking, and decision making. Messick (1996) depicted cognitive style as reflecting predictable individual differences in the way or type of insight that is distinct from the content or level of cognition. Cognitive styles are often seen as performance variables and not as competence variables.

Riding and Cheema's (1991) research on cognitive style and Paivio's (1988) research on Dual Coding Theory improved empirical research on verbalizing-visualizing cognitive styles. In spite of the fact that this revival of interest reinforced research endeavors (Cronbach, 2002; Peterson & Deary, 2006), but the area has been criticized for lack of theory and isolation from the mainstream of psychology and

cognitive science (Coffield, Eccleston, Hall, Meagher, & Moseley, 2004; Kozhevnikov, 2007). There has been a rigorous discussion over defining the construct of cognitive style. Different psychologists have diverse depictions of cognitive style, and they carried their research from different points of view. These disagreements with the definitions have been often put to criticism (Armstrong & Rayner, 2002; Rayner, 2007). On the other hand, the findings from qualitative and quantitative studies have indicated a few consistent dimensions of individual differences (Dunn, DeBellow, & Bernnan, 1981; Riding & Cheema, 1991). Goldstein and Blackman (1978) defined cognitive style as a theoretical construct that has been formed to explain the procedure of mediation between stimuli and responses. Cognitive styles are mental measurements that represent reliable methodology in an individual's way of cognitive functioning, specifically regarding acquiring and processing the information (Ausburn & Ausburn, 1978; Witkin, Moore, Goodenough, & Cox, 1977). Tennant (1988) defined cognitive style as "an individual's characteristic and consistent way to organize and process information" (p. 89).

Paivio (1988) and Richardson (1977) proposed that persons can be categorized as verbalizers and visualizers. In keeping with this conception, verbalizers depend on verbal-analytical strategies and visualizers count on imagery when they try to execute cognitive tasks. Researchers have given empirical results that verbalizers would choose verbal-logical strategies; whereas, visualizers show a preference for imagery while processing information (Kozhevnikov et al., 2002; Mayer & Massa, 2003). When researchers examined verbalizers-visualizers in a learning setting, the imagers are able to cope easily with concrete and readily visualized information instead of semantically and acoustically complex details (Riding & Calvey, 1981).

These information processing differences underlie the system to measure cognitive style has been made by Riding's (1991) cognitive style investigation CSA test, which was observed to be unreliable (Peterson et al., 2003a). In this manner, the issues of measuring the information processing underlying the cognitive styles was dealt by developing tests (Peterson, 2005). The present study was done on English second dialect populace in Pakistani culture, and concentrated on measuring information processing that underlies the cognitive style dimensions. Cognitive style has been studied and recognized as an imperative mediator in the processing of information (Riding & Rayner, 1998). Various research confirmations have demonstrated gender differences in the execution of information processing tasks. The survey of literature on information processing have given a

rationale to utilize inspection of time on task performance, in this way, the present study expected to find gender differences concerning reaction time. Past studies on information processing interpreted that men process information quicker than women; however, less thoroughly than females who process all the more precisely (Riding & Vincent, 1980; Riding & Egelstoff, 1983).

Cognitive style has been investigated and distinguished as a critical intermediary to the process of information (Riding & Rayner, 1998). Some evidence has reported gender differences in the performance on information processing tasks (Batool, 2002; Bosco, Longoni, & Vecchi, 2004; Chung & Monroe, 1998). The writings on information processing have given rationale to utilize inspection of time on performance, subsequently, this research planned to study gender differences with respect to reaction time. The importance of cognitive styles, individual differences in cognitive styles, and the dual coding model from the research literature gave justification to the present study to investigate styles in a diverse culture on a bilingual populace. This examination brings in central information on the cognitive styles in Pakistan.

Objectives of the present study were to investigate the gender differences among the cognitive styles. It was also intended to focus on the differences along cognitive styles with respect to mean reaction time on different tasks (verbal, imagery, picture, word, and exposures).

Hypotheses

To achieve the objectives of the present study, following hypotheses were formulated.

1. Male students would prefer visualizing style while female students would prefer verbalizing style.
2. Male students would prefer wholistic style while female students would prefer analytic style.
3. There would be positive association between verbalizer-visualizer and wholistic-analytic styles.
4. Male students would perform better on imagery task while female students would perform better on verbal task in terms of reaction time.
5. There would be significant differences among verbalizers, visualizers, and little style on the reaction times.

Method

Sample

The sample comprised 427 university students (male students = 160, female students = 267) from the University of the Punjab, Lahore; University of Central Punjab, Lahore; Quaid-i-Azam University, Islamabad; and National University of Modern Languages, Islamabad was recruited. The age range of these students was 18 to 40 years (M = 23.46, SD = 3.35). Convenience sampling strategy was utilized, and students were included in the present study who can comprehend English, and because this language ability was additionally required in the computerized test. In addition, participants with at least education of matriculation were included in the sample.

Instruments

Verbal-Imagery Cognitive Style Analysis (VICS; Peterson, 2005) Test. VICS test is a computerized test and the verbal imagery cognitive style ratios (V/I) are utilized as a part of VICS test to recognize an individuals' verbal-imagery or visual cognitive style. The V/I ratios are calculated through response time, the time taken by every member on verbal and imagery task of the VICS test. The mean and median response times on VICS test are utilized as a part of the investigation. Scores that are nearer to 0 would indicate an inclination for verbal preference. The scores that are more like 2 or above indicate an inclination for an imagery preference.

Extended Cognitive Style Analysis-Wholistic-Analytic (E-CSA-WA; Peterson, 2005). The wholistic-analytic dimension is measured with wholistic-analytic ratios. The wholistic-analytic ratios are registered through response time, that is, time taken by every member on wholistic and analytic tasks of the E-CSA-WA test. Scores that are nearer to 0 indicate a propensity towards a Wholistic inclination, and scores that are nearer to 2 or above signify a propensity for an Analytical inclination.

Procedure

Peterson (2005) developed VICS test and E-CSA-WA. These are computer based tests and consist of 232 items and 80 items; respectively. These tests were administered with two demographic sheets, the former was administered electronically, and the latter was provided to the students to be filled manually.

First, five computers installed with windows XP were chosen and five moveable separate keyboards were made available for the VICS and E-CSA-WA tests. The keys numbered 1, 2, and 3 were concealed with alphabet written on a sheet of white paper as Y, N, and M; respectively. For the administration of E-CSA-WA test, the numeric pad was prepared by pasting alphabet Y and N on the keys 1 and 2; respectively. The student was instructed that s/he has to decide whether or not these two items are natural, manmade, or a combination of the both. The mixture item comprises one manmade and one natural stimulus.

Students were instructed to sit at ease on a chair before the computer and the readily prepared keyboard was shown to each student and they were required to click the left side button of the screen to open file program VICS and E-CSA-WA. A set of information which described the instructions was shown on the screen before each test. For every new student, the demographic details were entered with the help of the researcher. It took about 25-30 minutes to finish. The E-CSA-WA test took approximately 15 minutes to complete. Every student was assessed individually and carefully in order to measure each student's natural speed of response. After administering the VICS and E-CSA-WA tests, the results were retrieved from the computer. The VICS test and E-CSA-WA produced three types of reports, that is, with the name of researcher's report, summary report, and summary report plus. The research report furnished each student's response to every question and the attributes of that question. For the VICS test for each of the 232 responses per subject, there was a presentation task, type, form, exposure, correct answer, response, and reaction time. Likewise on the E-CSA-WA test for each of the 80 responses per subject, the correct response, response time was documented.

For the VICS test and E-CSA-WA test, summary report gave every student's session number, the median, and mean response times on the area of the test (verbal, imagery, wholistic, and analytic) and number of correct responses on every segment of the test. The most vital results in the summary report were the verbal-imagery ratio and wholistic-analytic ratio. These ratios were taken on median response times on verbal tasks (V) and median response time taken on the imagery tasks (I). This ratio gave an indication of the every student's verbal-imagery and wholistic-analytic style preferences.

The summary report plus likewise gave the same essential summary information for every student as given in the summary report. This report, however, gave a couple of extra points of interest, for example, name, age, gender, ethnicity, and remarks for every

student. For the VICS test, the summary report in addition gave the points of interest of the mean response times and precision for every task type, exposure, stimulus form, and type of item.

Results

The main objective of the present study was to check the gender differences of Verbalizing-Visualizing and Wholistic-Analytic cognitive styles, and to check the cognitive differences.

Table 1

Cognitive styles (Verbalizer, Visualizer, Little Style) versus Gender (N = 427)

	V/I ratio Range	Male Students (n = 160)	Female Students (n = 267)	χ^2	V
		f (%)	f (%)		
Verbalizer	< .8	14 (8.8)	49 (18.4)		
Little Style	.8-1	61 (38.19)	131 (49.1)	19.39[*]	.21[*]
Visualizer	> 1	85 (53.1)	87 (32.5)		

Note. V/I ratios are taken on median reaction time. [*]$p < .01$.

Results of chi-square tabulation indicated significant association between cognitive styles and gender. The Crammer's *V* indicated low to moderate association between gender and the cognitive styles. In addition, crosstab proportions test with bonferroni correction was used to determine which gender category has more preference with respect to the cognitive styles. It was found that male students (53.1%) are more visualizers as compared to female students (32.5%), whereas female students (18.4%) are more verbalizer as compared to male students (8.8%). This finding did not compare any reaction time, that is, who process tasks faster (see Table 1).

Table 2

Cognitive Style (Wholistic, Analytic, Little Style) versus Gender (N = 427)

Cognitive Styles	W/A ratio	Male Students (n = 160)	Female Students (n = 267)	χ^2	V
		f (%)	f (%)		
Wholistic	< .97	30 (18.8)	61 (22.8)		
Little Style	.97-1.25	89 (55.6)	161 (60.3)	4.98	ns
Analytic	> 1.25	41 (25.6)	45 (16.9)		

Note. W/A ratios are taken on median reaction time. ns = non significant

Table 2 shows three categories of wholistic-analytic dimension, as wholistic, analytic, and Little Style. Results of chi-square independence indicated non-significant association between gender and cognitive styles.

Table 3

Association between Verbalizer-Visualizer, Little Style, and Wholistic-Analytic Style (N = 427)

Cognitive Styles	Verbal-Imagery			χ^2	V
	Verbalizer	Visualizer	Little Style		
	f (%)	f (%)	f (%)		
Wholistic	17 (4.0)	29 (16.9)	45 (23.4)		
Little Style (WA)	37 (58.7)	105 (61.0)	108 (56.3)	4.72	ns
Analytic	09 (2.1)	38 (22.1)	39 (20.3)		

Note. ns = nonsignificant

The results in Table 3 show the independence of the two cognitive style dimensions (wholistic-analytical and verbal-imagery). There was non-significant association between verbal-imagery and wholistic-analytic styles.

Table 4

Gender Differences on the VICS Tasks (N = 427)

Median Reaction Time	Male students (n = 160)		Female students (n = 267)			95% CI		Cohen's
	M	SD	M	SD	t	LL	UL	d
Verbal Task	2.56	.85	2.48	.77	0.98	-.07	.23	.10
Imagery Task	2.48	.80	2.63	.75	2.00*	-.30	-.00	.30

*p < .05.

The results in Table 4 indicated significant gender differences in the scores of median reaction time on imagery task. Male students perform faster on visual tasks as compared to female students. Non significant gender differences on verbal reaction time suggested that male and female students perform equally on verbal information.

Table 5 shows significant differences in cognitive styles (verbalizer-visualizer, little style). It was found that students scored significantly different for mean reaction time on verbal task, imagery task, and mean reaction time on the picture items, and word items was found significant. The mean reaction time on the items in exposure 1 and exposure 2 with respect to different cognitive styles (verbalizers, little style, and visualizers) was significant.

Table 5

Analysis of Variance of Verbal-Imagery Cognitive Style on the VICS tasks (N = 427)

Mean Reaction Time	Verbalizer ($n = 63$)		Little Style ($n = 192$)		Visualizer ($n = 172$)			
	M	SD	M	SD	M	SD	F	η^2
Verbal Task	2.75	.90	2.93	.98	3.71	1.27	29.46***	.12
Imagery Task	3.80	1.23	3.20	1.01	3.12	1.04	10.13***	.05
The Picture Items	2.70	.90	2.47	.77	2.79	.97	6.04***	.03
The Word Items	3.86	1.26	3.67	1.26	4.04	1.31	3.94*	.02
Items in Exposure 1	3.61	1.24	3.38	1.16	3.82	1.25	5.82**	.03
Items in Exposure 2	2.95	.93	2.76	.82	3.02	.98	3.81*	.02

$^*p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Results given in Table 5 showed that a small effect size occurred for all reaction time tasks except that a medium effect size was observed for median reaction time on the imagery task. In addition, Bonferroni post-hoc correction was used to find the significant mean group differences. It was found that on mean verbal task, verbalizer were better than imager and little style. Comparison on mean imagery reaction time suggested that imager style was better as compared to the other. Moreover, form picture to exposure 2 little style were better than imagers.

Discussion

The present study was carried out to investigate the gender differences in verbalizing-visualizing and wholistic-analytic cognitive styles among university students. The difference of the cognitive styles was also investigated. The importance and significance of cognitive style is delineated in Riding and Rayner's (1998) claim that cognitive styles are missing components in the investigation of individual differences. Riding and Cheema (1991) declared that distinctive cognitive styles are accommodated in two wide style dimensions, which are marked as verbal-imagery and wholistic-analytic dimensions (Davies & Graff, 2006; Riding & Rayner, 1998; Tennant, 1988).

Male students were more visualizer when compared to female students, though female students were more verbalizer unlike male students. Therefore, the first hypothesis was supported in the present study. Past investigation on cognitive style has uncovered that individuals show significant individual differences in cognitive processing styles, which they embrace in critical thinking and in

decision making exercises (Ashton, 2013; Blais, Thompson, & Baranski, 2003; Miller, Donovan, Bennett, Aminoff, & Mayer, 2012; Price, 2004). The reason behind the differences between visualizers and verbalizers could be related to selective preferences (easy or difficult) or more frequently user of certain visual tasks (Blazhenkova, & Kozhevnikov, 2009; Richardson, 1994).

Present study also suggested that there are no preferences in wholistic-analytic styles between male and female university students. Therefore, the second hypothesis was not supported in the present study (see Table 2). This finding was supported by some studies on cognitive style differences (Cools, & Van den Broeck, 2007; Cools, Van den Broeck, & Bouckenooghe, 2009; Kollöffel, 2012).

The third hypothesis suggested that there is no association between verbalizer-visualizer and wholistic-analytic styles. To investigate style associations it was expected that there would be no relationship between verbalizer-visualizer, Little Style (on verbal-imagery dimension) and wholistic-analytic, Little Style (on wholistic-analytic dimension). These findings are in accordance with Riding and Rayner's (1998) model. This model explains the bi-polar nature of the construct and two dimensions of cognitive styles are independent of one another (Kollöffel, 2012; Peterson, 2005).

The fourth hypothesis was partially supported by the present findings. Male students process imagery task faster than the female students (see Table 4). The outcome demonstrated that university students scored fundamentally distinctive on median and mean response times of verbal and imagery tasks. These findings are supported by the literature (Blazhenkova, & Kozhevnikov, 2009; Peterson et al., 2005). Human differentiation in the light of gender is basic phenomenon that influences for all intents and purposes of an individuals' everyday life. According to Riding and Grimley (1999), the examination on gender differences regarding cognitive styles were generally little. The cultural differences were expected because there is lack of research regarding this perspective in Pakistan.

The final hypothesis was supported by the present study. Cognitive styles (verbalizer-visualizer) differ on the mean reaction time of verbal, imagery, picture, word and exposure of tasks (see Table 5). The outcomes recommend that individual differences in cognitive styles exist in university students from Pakistan. While designing learning materials for the students it is often expected that all students would learn in a similar way. This method overlooks the criticalness and significance of individual differences in cognitive style (Ashton, 2013; Blazhenkova, & Kozhevnikov, 2009; Riding &

Rayner, 1998). The style is not identified with identity or capacity but rather define an individual's predictable methodology for organizing and processing information in thinking (Cools, & Van den Broeck, 2007). In Pakistan, traditional learning and teaching strategies are utilized (Malik, 2011); however, acknowledging significance of cognitive styles and learning techniques, there is an absence of hypothetical and experimental information and the role performed by cognitive style in determining learning performance has not been investigated. The present study would give a fundamental knowledge on cognitive styles and that individuals are unique in their styles.

The present work investigated individual differences in cognitive styles for the university students and inferred that each student has a particular cognitive style. In designing learning material in Pakistani educational system, it is often presumed that all students would learn in a same way. This rationale decreases the centrality of cognitive styles. The preferred cognitive style and dual-code-dual coding theory's (Paivio, 1991) principles ought to be employed while designing the instructive procedures, pedagogical practices and learning technique.

Limitations

The present result findings could not be generalized to the whole student population as different universities of the Pakistan was not included in the sample. However, in future studies sample could be more representative by including more universities of different provinces. The present study did not infer any cause and effect relationship between the variables; instead it only suggests effect of gender and the cognitive styles on mean or median reaction time of the tasks.

Implications

This research measured individual differences in cognitive styles of university students on English, as a second language population. Experimental proofs of the examination can be applied in instructive and pedagogical practices and in understanding individual differences, which is often the missing component in educational practices. Within the setting of learning, verbalizing-visualizing cognitive styles and wholistic-analytic cognitive styles can be evaluated and measured using VICS and E-CSA-WA. These styles explain individuals' preferred and stable methods for processing information during learning. The matched mode of presentation, which discovered

verbalizer's comfort with verbal mode and visualizers with pictorial mode would help in the improvement of the instructional material and improvement in learning and elimination of redundant information.

Conclusion

It was concluded on the basis of present research findings that men are more visualizer as compared to women, whereas women are more verbalizer. Male students performed faster on mean reaction time of visual task as compared to female students. It was also found that verbalizer performs better on verbal task and visualizers perform better on visual task. Moreover, findings of analysis of variance suggested that little style was better than imagery style on mean reaction time of picture, word and exposure tasks.

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