JORDANIAN STUDENTS' THINKING STYLES BASED ON HERRMANN WHOLE BRAIN MODEL

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Abstract

The present study aims at identifying thinking styles of eight grade students in Jordan using Herrmann Whole Brain Model. There are 357-students selected from fourteen classrooms within Bani Kenana School District. Thinking Preference Questionnaire to classify participants according to their preferred thinking style was used. Perceived frequencies, percentages, and respective cumulative percentages, in addition to X^2 value based on fit-of-goodness technique were computed. Results found that no statistically significant differences between students' thinking styles based on Herrmann Whole Brain Model at ($\alpha = 0.05$). This result means that students having certain thinking style would not be substantially different from those with other thinking styles. Parallel with that, the results showed also no significant differences between students' thinking styles according to gender. In light of the results, the study recommending to identifying student's thinking styles; let them learn about them, and characteristics of each style in order to develop skills subsumed under each thinking style while caring the other thinking style and urged curriculum designers to take diversified approach when presenting the instructional content and related activities and experiments and to consider individual differences in the textbooks.

Keywords: Thinking styles, Herrmann Whole Brain Model, Learning Styles.

Introduction

Models of thinking styles are varied, some of which are concerned with thinker's personality traits, and others were interested in answering the question of how a thinker receives, processes, and align experiences, whereas others were focused on the sensory perceptual medium most preferable to a thinker when receiving, processing and aligning experiences. As a result, thinking styles were depicted with various models and graphics with unilateral, bilateral, multiple and interfered polarizations (Qtami, 1998). These models are: Carl Jung , Kolb, Dunn and Dunn thinking style Model, Myers-Brigg, McCarthy, Honey and Mumford, Felder-Silverman, and Herrmann model (Hadfield, 2006; Anabela, Alvaro, Lilian & Mendes, 2007; Dunn, 2000; Dunn & Dunn, 2003). This study will adopt the Herrmann Whole Brain Model (HWBM), because Herrmann's Model is systematic and inclusive and considers student's preferable thinking styles as being inconsistent and can be changed and developed.

Herrmann Whole Brain Model (HWBM)

Many theories were concerned with the brain and attempted to answer the question: How thinking occurs? McClean in 1952; for example, proposed the triple-brain theory, suggesting three interfering brains in each of which thinking takes place in certain way: rational, intermediate and primitive brains, Sperry in 1964, on the other hand, proposed a two-chamber brain; left brain and right brain, wherein specific kinds of thinking occur (Hermann, 1988). Based on McClean and Sperry theorization, Herrmann developed his Whole Brain Theory in 1988. In the Whole Brain Theory, and depending on thinking characteristics, the brain was divided into upper left/right and lower left/right parts. As a whole, the upper part of the brain concerns conceptual and abstract thinking, whereas the lower part of the brain is entirely concerned with emotional and visceral.

Similarly, the upper left brain is logical and quantitative, whereas the lower left brain is sequential and organized. The upper right brain is conceptual and visual, whereas the lower right brain is interpersonal and emotional. In general, the right part of the brain seems to be loosely structured, while the left part of the brain is strictly structured (De Boer, Coetzee & Coetzee, 2001; Zainal, Shuib & Othman, 2004; Loren & Bean, 1997) Fig. 1

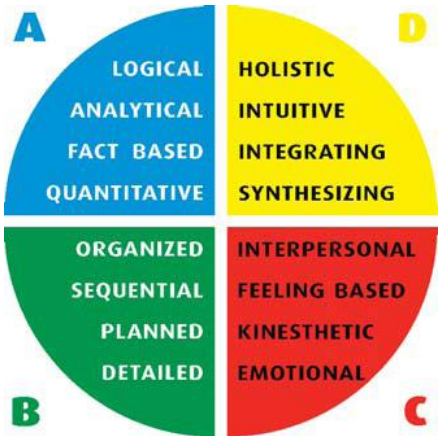

Figure 1. The Whole Brain Model (Herrmann, 2000)

First style, external thinking style (QA); Herrmann referred to this thinking style as fact-based thinking style that is analytical, logical, theoretical, or external. Second style, procedural thinking style (QB); described as procedural thinker, oriented or controlled, planned or structured, sequential or procedural. Third style, interactive thinking style (QC), designated as feeling, emotional, social, interpersonal, and interactive. Finally the fourth style, internal thinking style (QD), this thinking style is referred to by Herrmann as open-minded, innovative, integrative, analytical, imaginative, and intrinsic.

The Theory behind Herrmann Whole Brain Model

Herrmann (2000) considers dominance as natural and normal in organisms that result from experiences and conditions faced by the organisms on a daily basis. For example, the human body greatly involves paired structures, which in most cases are identical in one way or another. A good example of resemblance and identical structures are hands, feet, legs, eyes, etc. See figure 2.4 below, which in fact represents a schema that embodies the concept of dominance, wherein dominance starts as early as infancy growing over time by experiences, experiments, and daily use.

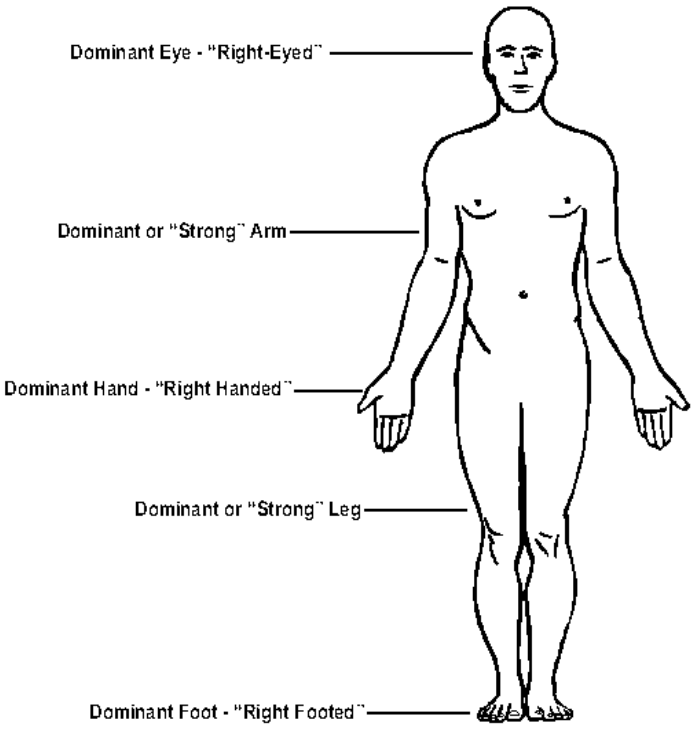

Figure 2.4 Illustrates Identical Forms in Human Body (Herrmann, 2000)

Herrmann (2000) supported this observation noting that it is reasonable as, for example, when we use our right hand or right arm to do a variety of activities they will become stronger. Your right arm or hand as a result will be strong enough to perform such action like carpentry, handwriting, drawing, and other activities. Herrmann also argued that there are other paired organs that couldn't be directly visible as they are internal to the human body such as lungs and kidneys. Such are physical examples of the existence of dominance. Paired organs of the human body, both internal and external, led Herrmann to construct his preconception of the dichotomies structure of brain. For Herrmann, the human brain consists of two hemispheres and two limbic that are strongly linked with each other by linkages that allows the four parts to function systematically. Herrmann assimilated the coordination of hands, feet, and eyes with the double structures of brain noting one difference; that is their unique physical and chemical composition and functional specialization; i.e. to think in different ways and perform various mental tasks (Herrmann, 2000).

The example cited by Herrmann (2000) is *our dominant hand* that is used more than the *non-dominant hand*, and the frequent use makes it stronger and empowered to perform various tasks and actions. The same applies to the brain. The preferred thinking in certain ways more often means frequent use of specific part of the brain; one hemisphere or one limbic half; thereby it develops and grows to become more efficient by practicing a variety of mental activities. The same as the underdeveloped and non-dominant hand help the skilled and dominant hand, developed structures of brain work cooperatively with more preferable and more dominance in the mental operations to produce better mental power with greater ability to accomplish day-to-day tasks and events. It is, therefore, natural that the human brain forms a cooperative unit of specialized structures to cope with more intricate situations given that the developed brain forms an integrated unit of many different preferences (Herrmann, 2000). As we see, Herrmann used the analogy of body parts and how they function to explain how the brain functions in relation to its component parts. From Herrmann's view, as already discussed- the brain consists of four areas of preferences (QA, QB, QC, and QD). Herrmann, as a result, developed his internationally accepted scale for the purpose of classifying individuals relying on their preferences of thinking (preferable thinking styles).

Gender and Thinking Styles

Since in most classrooms boys and girls are always there to think, either together or separately according to their sex in certain countries, the role of gender in thinking cannot be overlooked. Many studies have harped on the differences between how boys and girls think, but the precise methods of how they think still remain a question. Consistent with the results of many studies on the effects of gender in thinking, Honigsfeld and Dunn (2003) discovered that boys had a preference for more peer interaction rather than individual thinking and more kinesthetic activities. On the other hand, girls preferred a more social variety of thinking and they were more responsible or conforming to rules and regulations. For the girls, getting the job done well and receiving high grades were the two most important aspects of their education and this result directly correlate with the results from previously mentioned studies. The inclination shown here is that girls did not think that active participation in class was required for getting a good grade or completing a task successfully. They also discovered that boys were more peer oriented than girls when it came to efforts to achieve successes in the classroom. For the boys, feedback, acknowledgement and attention from their teachers seemed to be more important when they wish to achieve their best results.

In another study related to gender, Huang (2002) researched on the perceptions of thinking environments of middle school students in Taiwan. A total of 644 seventh grade students from six middle schools in northern Taiwan participated in this study. The data were analyzed using a multivariate analysis of variance (MANOVA). The study discovered some gender issues where the girls, as opposed to the boys, seemed to have more affection in their study as they were more involved, more affiliated and more cooperative with their fellow classmates. The girls were also perceived to abide to classroom rules and needed teacher support more than the boys. That is the girls seemed to seek positive reinforcement from their peers and teacher, and they steadfastly abided by the rules and carried out their tasks carefully in the classroom. This could be interpreted as the nature of girls being more detailed than the boys in carrying out activities in the classroom. It was also found that the girls had more initiative where they would carry out more research to solve problems than the boys. The girls were much more academically inclined than the boys but yet the former, who often wished to perform excellently in everything, still needed support from their peers to do well. On the whole, the girls were more academically oriented than boys. In contrast, the boys appeared to be insensitive to the school culture and they are less inclined to participate in activities in the classroom merely for the prospects of obtaining good grades or getting positive reinforcement from the teacher and/or their peers. In fact the boys preferred to do something based on personal enjoyment or because they enjoyed doing something of interest to them rather than merely for educational gains.

Some studies have shown that the thinking styles of boys and girls could determine how they participate in class. For instance, it was found that boys who adopted the kinesthetic thinking style were most active in class as they tend to participate in the on-going lesson, while who girls were known to be passive adopted other thinking styles. Such methods of relating the thinking styles with their classroom behaviors set the way to understanding if the boys and girls tend to think differently. Apart from this, the study of the classroom behaviors of boys and girls also includes the way they perceive their successes in the classroom, and, how their accomplishments in the classroom are related to their classroom behaviors. Through the above, we find that the debates still exist with regard to the differences between males and females in their preferable thinking styles, and because male-female schools in Jordan are completely separate. The current study interested in students' gender and preferable thinking styles.

Studies on Herrmann Whole Brain Model

Shelnutt et al., (1996) conducted a study to identify thinking styles in a group of engineering students from North Carolina University. The study used HBDI as self-awareness instrument. The sample was 500 students. Following the administration of HBDI on the students, the results showed that the mean degrees of items related to each quadrant of the brain were for A, B, C, and D brain quadrants 86, 78, 54, and 69 respectively. These results confirmed dominance of A and B quadrants among engineering students. De Boer and Steyn (1999) conducted a study to identify thinking style distributions that are most preferred by students and how they are developed. Preferable thinking styles were measured in 31 first year students, who did not fulfill admission requirements, and thus attended extended science program to meet admission conditions in a college of science, University of Pretoria using HBDI. The student's distribution on thinking styles was: (A= 32.2%; B= 48.4%; C= 12.9%; and D= 6.5%). Dominance of (B) and weakness of (D) modes was accounted for by the fact that teaching delivered by schools was focused in (B) more on sequential thinking skills than in (D) where creative thinking skills were less emphasized.

In order to develop thinking styles, students were informed of the respective preferred thinking styles and together they discussed the characteristics of each style. The researcher allowed the students one week to normalize and integrate their thinking styles within their usual practice. This in turn raised their interest in developing ability in other thinking styles and encouraged the use of the whole brain in their learning thus developing more than one dominant thinking mode. De Boer and Berg (2001) conducted a study to inquire thinking styles and distributions to the four quadrants of brain depending on HWBM using HBDI. Their sample consisted of 68 students enrolled in Bacteriology course in the first semester in the University of Pretoria. The results indicated that the students were equally assigned to the four thinking styles (A, B, C, and D). Zainal, Shuib and Othman (2004) conducted a study focusing on inquired thinking styles most preferable to a group of students from Curtin University of Technology Sarawak Campus of Malaysia (East Malaysia). The sample (N=244) consisted of business (n=154) and engineering (n= 90) students in the first and second year. To identify thinking style most preferable to students, the HBDI was employed.

Analysis results indicated that in general Malaysian students used more of the left-hand side of their brain than the right side, primarily in A and B quadrants and their preferred thinking mode is analytical, rational, and logical. Similarly, QB was transcendence QA within the left hemisphere. QD learners preferred only intuitive and creative thinking styles over holistic, integrative, synthesizer thinking style, whereas no preference of any thinking style is shown in QC. In a study conducted by Bawaneh, Ahmad Nurulazam and Salmiza (2010) aimed at identifying the thinking styles held by 10^{th} grade students in Jordan and examining the relationship between these styles and their preferred educational track. The results indicated no statistically significant difference in assigning students to the four thinking styles. In other words, Jordanian 10^{th} grade students' thinking styles were distributed proportionately into the four thinking styles of HWBM (A, B, C, and D).

Problem statement

Mcloughlin (1999) argued that student-thinking styles should be taken into account when designing content that need to be learned. Doing so facilitates thinking and content assimilation. In the same context, She (2005) considered thinking style as a fundamental factor in designing effective instructional practices for a wide student population. Stone (1986) (cited in Qtami & Qtami, 2000) stressed that identifying student-thinking styles plays a significant role to improve such operations as addition, encoding, logging, data process and assimilation, career choice, and lifelong thinking. Thinking styles help design activities and tasks that meet individual learners, and are effective in training, identifying thinking difficulty, and performance assessment of students. In context of gender, many studies (Sjoberg & Schreiner, 2005; Reiss & Zhang, 2006; and others) have shown that boys and girls possess different thinking methods due to the differences in the way they think and perceive their role in the classroom.

Therefore, teachers teaching boys and girls must make a distinction in the approach needed to handle or to teach the boys and girls. In terms of motivation in thinking, boys and girls also have many differences too in terms of characteristics and individual preferences according to their gender (Thibert & Karsenti, 1996; Tindall & Hamil, 2004; Anderson, Hamilton & Hattie, 2004). Tindall and Hamil (2004) held the same view that boys and girls have different preferences for thinking certain topics in that boys are all for topics that involve the psychomotor coordination while girls will go for topics related to esthetic thinking and emotional relationships. However, there should be more detailed information in this area to allow policy makers, educators and education planners alike to distinguish the strengths and weaknesses for each gender in each of the specific area so as to plan for the most suitable curriculum, assessment and methodology to teach and assess each group of students effectively. As such, more researches need to be conducted in the area of gender as a moderator variable so as to unearth more information in this area.

Purpose of the Study

The purpose of the present study was to answering the study questions.

1. What thinking styles are held by primary 8th grade students in Jordan based on Herrmann's Whole Brain Model?
2. Are there any significant differences in 8th grade students' thinking styles based on Herrmann's Whole Brain Model according to gender?

Methodology

Population

The population of this study comprised all eighth grade students (male and female) enrolled in Bani Kenanah educational directorate from Irbid Governorate in the second semester for the academic year 2009-2010.

Students are from different towns within the Bani Kenanah Education Directorate. The population of this study is representative of almost all the existing social classes in Jordan in terms of gender, age, nationality and native language. They are in the age group ranging from 13.5 – 14.5 years. They are also homogenous in terms of their nationality, mother tongue (Arabic), exposure to English as a foreign language, and educational system and cultural background. Students in the selected schools – as well as all Bani Kenanah Government schools - were from approximately equivalent socioeconomic status as defined by the Ministry of Education of Jordan.

Sample

Fourteen primary and secondary schools including eighth grade during the 2nd semester of the academic year 2009-2010 participated. Students were randomly selected from each school. The total sample was 371 students. Fourteen students were absent during the use of the courseware. Finally, the actual samples consisted of 357 students. Table 1 shows participants distribution according to the teaching methods and schools.

Table 1. Participants' Distribution by Gender and Schools

Gender	*School's Name*	*Number of classrooms*	*Number of students'*
Male	Al-Manarah Comprehensive boys' Secondary School	3	76
	Abu- Alougass Primary boys' School	1	22
	Harema Comprehensive boys' Secondary School	2	54
	Ubla Primary boys' School	1	28
Total		**7**	**98**
Female	Kofersoom Comprehensive girls' Secondary School	3	70
	Abu- Alougass Primary girls' School	1	15
	Kharja Comprehensive girls' Secondary School	3	92
Total	Total	**7**	**85**
Total		**14**	**357**

Selection of subjects was done on as what was enrolled in each school without any discriminating factor involved. That is, each and every of the students in the defined population have an equal and independent chance of being selected (Gay & Airasian, 2003).

Instruments

Thinking Preference Questionnaire

To classify participants according to their preferable thinking styles, a questionnaire developed by Nawafleh (2008) to accommodate the Jordanian environment was used. Nawafleh (2008) instrument was an adaptation of a 60-items questionnaire already developed by She (2003), which primarily was based on HBDI that in its original version had (120) items based on the HWBM. Nawafleh (2008) obtained the unique Chinese version of the instrument through direct communication via email with She. This 60-item instrument developed by She (2003) describes a series of instructional activities which would likely be thinking preferences for students. Such activities were divided into four groups matching the four quadrants of brain relying on HWBM. Nawafleh (2008) translated the Chinese version of She's instrument into Arabic and tested its validity by showing it to a panel of 12 experts with Ph.Ds. in psychology and teaching methods. To test for reliability, the instrument was administered to primary 9th grade students in Jordan and re-administered two weeks later. Cronbach alpha coefficients were computed for the first test (QA=0.78; QB=0.79; QC=0.76; and QD=0.77). Comparatively, such coefficients for the Chinese version as computed by She (2003) and She (2005) were (QA=0.73; QB=0.78; QC=0.76; and QD=0.78). Once again reliability coefficients were tested using test-retest method (QA=0.79; QB=0.76; QC=0.8; QD=0.75) (Nawafleh, 2008). Drawing on reliability indications and based on Odeh & Malkawi (1992) the instrument was considered appropriate for the Jordanian environment. In his study, Nawafleh followed the modifications suggested by the experts, some items, therefore, were deleted or modified but the final version included 60-item as in the original version (Nawafleh, 2008).

Identification of Students' Thinking Style

Students' thinking style will be identified depending on the aggregate response to the instrument items, where each student will select the thinking activity which, from his view, is easy and enjoyable for thinking. The aggregate response score will be computed for each respondent and the percentage will also be computed for each quadrant by dividing the number of items chosen within that quadrant by the aggregate number of items chosen across quadrants. Students, as a result, will be assigned to one of the four thinking styles depending on which quadrant they had the highest percentage.

Study Design

The study design was survey administered inclusively to participants.

Statistical Treatment

Perceived frequencies, percentages, and respective cumulative percentages, and expected frequencies and respective percentages, in addition to X^2 value based on fit-of-goodness technique. Standardized residual for interactive cells were also computed.

Results

Table 2. Frequencies, percentages, and cumulative percentages of Gender * Whole Brain held by 8th graders in Jordan by Herrmann's Whole Brain Model

			Whole Brain				
			Quadrant A	Quadrant B	Quadrant C	Quadrant D	Total
Gender	M	Count	34	35	61	50	180
		% within Gender	18.9%	19.4%	33.9%	27.8%	100.0%
		% within Whole Brain	50.7%	49.3%	49.6%	52.1%	50.4%
		% of Total	9.5%	9.8%	17.1%	14.0%	50.4%
	F	Count	33	36	62	46	177
		% within Gender	18.6%	20.3%	35.0%	26.0%	100.0%
		% within Whole Brain	49.3%	50.7%	50.4%	47.9%	49.6%
		% of Total	9.2%	10.1%	17.4%	12.9%	49.6%
Overall		Count	67	71	123	96	357
		% within Gender	18.8%	19.9%	34.5%	26.9%	100.0%
		% within Whole Brain	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	18.8%	19.9%	34.5%	26.9%	100.0%

To answer the research questions, Frequencies related to individual thinking styles held by primary 8th grade students in Jordan were entered to find out the relative sizes as percentages to the total sample (N=357), in addition to the cumulative percentages as shown by Table 2.

Table 2 shows results of overall percentages as follows:

1. Thinking style QC Interactive was placed top representing 34.5% of the overall thinking styles held by primary 8th graders.
2. Thinking style QD Internalized was ranked next representing 26.9% of the overall thinking styles held by primary 8th grade students.
3. Thinking style QB Procedural was placed third accounting for 19.9% of the overall thinking styles of the primary 8th grade students.
4. Thinking style QA Externalized was placed in the fourth rank accounting for 18.8% of the overall learning styles of primary 8th grade students.

According to gender, Table 2 also shows the results as follows:

1. Thinking style QC Interactive was placed top representing for both gender, male = 17.1% and female = 17.4% of the overall thinking styles held by primary 8th graders.
2. Thinking style QD Internalized was ranked next representing for both gender, male= 14.0% and female = 12.9% of the overall thinking styles held by primary 8th grade students.
3. Thinking style QB Procedural was placed third accounting for both gender, male = 9.8% and female = 10.1% of the overall thinking styles of the primary 8th grade students.
4. Thinking style QA Externalized was placed in the fourth rank accounting for both gender, male = 9.5% and female = 9.2% of the overall learning styles of primary 8th grade students.

From the above results we can see that the arrangement of students' thinking styles for both gender male and female in the same sequence and in the same sequence with students' thinking styles for overall (QC, QD, QB and QA). To test whether these descriptive differences are statistically significant, X^2 test was used. Table 3 represents the inferential statistics.

Table 3. Results from X^2 test to reveal substantial differences in perceived and expected frequencies of major of gender * Whole Brain of primary 8th graders

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.179[a]	3	.981
Likelihood Ratio	.179	3	.981
Linear-by-Linear Association	.038	1	.845
N of Valid Cases	357		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 33.22.

Table 3 shows no statistically significant superficial difference at (α=0.05) between perceived and expected frequencies regarding the four thinking styles (X^2 = .197), p = .981, and regarding students' gender (X^2 = .038), p = .845 in 8th grade students attributed to varied perceived frequencies for each of the major of thinking styles and students' gender. The meaning is that students with one thinking style do not differ substantially from students with the remaining thinking styles.

Discussion

Results related to paper questions as evidenced from Goodness of Fit X^2 test aiming to reveal whether substantial differences in student's thinking styles are found no statistically significant differences at (α = 0.05). This result means that students having certain thinking style would not be substantially different from those with other thinking styles. In other words, student's thinking styles proportionately assigned to the four quadrants (A, B, C, and D). This results seems to be consistent with findings from De Boer and Berg (2001), that supported the result that students proportionately distributed to the four thinking styles (A, B, C, and D), whereas it is inconsistent with many other studies, for example, Shelnutt et al (1996); De Boer and Steyn (1999) and Nofal and Abu Awad (2006). However, initially results indicated priority of the thinking style QC in the upper left quadrant of brain (34.5%), the result which finds support from De Boer and Steyn (1999). Next is the thinking style QC in the lower right quadrant of brain (26.9%), whereas thinking style QB come in the third place (19.9%), and finally in the upper right quadrant of brain (18.8%) is the thinking style QA. This later result is consistent with results from Shelnutt et al (1996). Results indicate that all thinking styles are proportionately represented in the sample. I think this is good for community to strike social balance in terms of diversifying jobs and employment opportunities depending on mental abilities and interests of individual job seekers.

Even results of descriptive analysis showed that the arrangement of thinking styles for male and female in the same sequence (QC, QD, QB and then QA), the results of inferential statistics showed that there was no significant difference between students' thinking styles based on Herrmann Whole Brain Model according to gender. We can explain this result by number of factors:

- Students are from different towns, with representative of almost all the existing social classes in Jordan in terms of gender, age, nationality and native language. They are in the age group ranging from 13.5 – 14.5 years. They are also homogenous in terms of their nationality, mother tongue (Arabic), exposure to English as a foreign language, and educational system and cultural background. Students in the selected schools – as well as all Bani Kenanah Government schools - were from approximately equivalent socioeconomic status as defined by the Ministry of Education of Jordan.
- Somewhat equal technical and academic levels of male and female teachers.
- Jordanian parents no longer differentiate between male and female students regarding an equal opportunity to learn due to conscious promotion programs emphasizing on the need to provide girls education at higher levels. The trend is obvious as reflected by the male and female ratio among the university students, as well as workforce employed in various sectors in Jordan.

Conclusion

In light of the results reached to by the current study the following is recommended:

- This study recommends identifying student's thinking styles; let them learn about them, and characteristics of each style in order to develop skills subsumed under each thinking style while caring the other thinking style. Herrmann (2000) argued that thinking styles can be developed so that for learner to acquire more than one thinking style.
- Results from the resent study urge curriculum designers to take diversified approach when presenting the instructional content and related activities and experiments and to consider individual differences in the textbooks.

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