A Study of the Relationship between Iranian EFL Learners' Level of Spatial Intelligence and Their Performance on Analytical and Perceptual Cloze Tests

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Abstract

During the last two decades, Gardner's theory of multiple intelligences with its emphasis on learner variables has been appreciated in language learning. Spatial intelligence, as one domain of the multiple structures of intelligence, which is thought to play a great role in reading, writing, and literacy, particularly in L2 learning, has not received sufficient attention as it deserves. The aim of this study was twofold: (1) to examine the relationship between EFL learners' spatial intelligence and their performance on cloze tests in general; (2) to determine which variety of cloze tests, analytic or perceptual (based on deletion method), may correlate more strongly with learners' spatial intelligence. Accordingly, a correlational study was conducted with 41 male Iranian EFL learners at Jihad Daneshgahi Language Center of Tehran University (Iran). Participants' scores on the spatial intelligence test were first compared with their scores on two cloze tests. Next, the obtained correlations were examined to see the effect of deletion method for cloze tests on the strength of the relationship between the spatial intelligence scores and scores on the cloze tests. Significant correlations (0.61 and 0.56) were found between the variables. The findings emphasize making reconsiderations in using cloze tests in EFL contexts. Further research is also suggested to explore spatial intelligence and its role in language classrooms.

Keywords: Multiple Intelligences (MI), Spatial intelligence, Cloze tests, Analytical cloze test, Perceptual cloze test, Language learning

1. Introduction

As early as 1983, based on evidence gained from research in biology, genetics, psychology and cultural anthropology, Howard Gardner, a Harvard graduate in psychology, suggested the existence of eight relatively autonomous intelligences. In fact, he redefined the concept of intelligence by viewing each one as a bio-psychological potential for processing information which can result in solving problems or creating products which are of value in a specific culture (Gardner, 1983, 1993).

Spatial intelligence, as one of the eight proposed intelligences, enables individuals to perceive the visual world, to reconstruct and modify their original observations, and to re-create and restructure different aspects of an early visual experience. Sense of sight is known to be the main sensory aspect of spatial intelligence since it provides individuals with the ability to form mental images and pictures in their mind for retaining information (Gardner, 1983).

Gardner (1985) proposed that spatial intelligence "emerges as an amalgam of abilities which is loosely tied to and developed out of the individual's observation of visual world" (p. 173). In effect, this type of intelligence can be applied to the fulfillment of "a variety of scientific ends, as a useful tool, and aid to thinking, a way of capturing information, a way of formulation of problems, or the very means of solving problems" (p. 192). Based on

Gardner's definition, spatial intelligence can be construed as the ability to process, manipulate, and categorize information for shaping abstract images and perceiving spatial relations which may also result in products such as drawings and other forms of concrete arts.

However, applying mental spatial abilities (intelligence) for solving problems has not received equal attention as the other two more prominent intelligences, linguistic and mathematical. Relying on the observations and findings in the study of brain-lateralization, Gardner (1983, 1993) claimed that while the left hemisphere is mainly concerned with processing information from a linguistic point of view, the right hemisphere specializes in visual/spatial processing (See also Carroll 2008, pp. 373-4). As Williams (cited in Dean 2007) states, the right hemisphere is responsible for combining parts and transforming them into a whole through the construction of patterns and relationships. Dean (2007) goes further calling learners who have high levels of spatial intelligence *Gestalt thinkers,* due to their spatial characteristics and sequential learning abilities.

Regardless of the common conceptions about reading and writing aspects of literacy, as part of linguistic intelligence, Armstrong (2003) views literacy as a whole brain activity. He theorizes that as the eyes catch sight of written words, the related information is stored and processed in the main visual center in the occipital lobe which is the place where spatial intelligence is at work. Then the information is processed, and visual configurations are made. After this, one must link these visual images to sounds and other symbolic aspects of words and written information. Concluding that the visualization of meaningful information that one reads is an inseparable part of reading process, Armstrong (2003) indicates that our present understanding of the role of the right hemisphere in reading and writing processes is incomplete and still in its infancy. He refers to the findings of Coney and Evans's (2000) study of the brain that making semantic decisions while reading and writing tasks can evoke right hemisphere particularly in the early phases of making a choice among a number of possible words. Pointing to the crucial role of the right hemisphere in reading and writing processes, Armstrong (2003) states:

> *"… the person who reads and writes is doing far more than simply linguistically encoding data. She is also looking at the visual configuration of the letters. Thus, spatial intelligence, the intelligence of pictures and images, must first be brought to bear on the printed letters" (p. 19).*

The cloze procedure is one of the rare few applications of the concept of *closure* (one of the principles of Gestalt theory), which, as Farhady et al. (2004) state, emphasizes that human beings are endowed with a natural disposition for inferring a general whole out of unfinished patterns and figures. This, in their view, mainly relates to the ability of human mind to perceive the world visually. Thus, it is a part of perceptive ability "to draw upon the sensory data together into a pattern" (p. 278). From this, it can be inferred that while taking cloze tests, test takers should try to shape a complete image of an incomplete text with a number of blanks that must be filled in with words. For this to happen, the test takers seem to be in need of calling upon their ability to recreate and transform the words into overall visual images.

Taylor (1953, 1957), the first scholar who developed the cloze procedure, considered and used it more as a measure of assessing readability of texts (See also Oller, 1979). Later on, cloze tests came to be widely utilized as a measure of English language proficiency in EFL classroom settings for different academic levels. However, in spite of their advantages as integrative tests, their relative ease of preparation, administration and scoring, the construct validity of cloze tests has been subject to question as to realize what cloze tests tend to measure and what they actually measure.

Oller and Jonz (1994), for instance, claimed that such tests evaluate an underlying grammar of expectancy, and the capability of learners to synthesize and analyze sequential linguistic elements in realistic contexts of use, whereas some researchers viewed cloze tests as basically unreliable and erratic (e.g., Alderson, 1980). Lam et al. (1992) examining the construct validity of cloze tests, confirmed the sensitivity of cloze tests to the deletion method. They reported that depending upon the type of deletion, cloze tests may draw upon different types of cognitive processes.

In Iran, cloze tests have widely been utilized as an integral part of English tests, used in university entrance examinations (UEE), achievement tests, or as a part of course book exercises for different academic levels. Although cloze tests are less common than other measures of English language proficiency when they come to be used in critical examinations such as UEE, where every correct answer is given one credit, cloze tests, due to their multitude of items, play a crucial role in candidates' overall success.

Owing to our experiences and observations as EFL teachers, we came to notice the notable difficulty level of cloze tests and the toll which they place on learners' mind in comparison to other language tests. The inclusion of such tests as a part of exams, even occasionally, seems to result in learners' complaints.

Noticing the relatedness of the theoretical foundations for visual/spatial aspects of perception and the principle of

closure as the underlying construct of cloze tests with their heavy emphasis on the formation of images and mental representations of information, the need was felt for examining the relationship between cloze tests and the spatial intelligence test in practice.

In contrast to some of the existing studies in Educational Resources Information Center (ERIC), in which the definitions of multiple intelligences and the way they have been evaluated were different from the way Gardner had already defined them, the tools used here for assessing spatial intelligence were quite intelligence fair. Gardner (1999) favored assessing each specific domain by using materials which were representative of that domain.

Relying on Gardner's (1993) statement regarding the relative autonomy and independence of each of the eight intelligences, it can be assumed that spatial intelligence as an autonomous competency exists and can be measured separately, independent of the other intelligences.

Spatial intelligence, as the ability to perceive the world through the formation of images and mental representations, seems to have a lot in common with one's ability to do such problem solving tasks as doing cloze tests which similarly exploit mental processes such as creating image-like representations of information and restructuring the information in a way that it leads to the formation of a whole form of an image. Accordingly, it can be assumed that the spatial intelligence test and cloze tests, used in this study, tend to measure similar mental traits.

To date, almost no major studies have set to explore the relationship between learners' spatial intelligence and their performance on cloze tests. Thus, the central concern of this study was to determine the degree of overlap and relations between an individual's level of spatial intelligence and his/her performance on cloze tests. Since this study aims to investigate the nature of spatial intelligence as one aspect of multiple intelligences theory and also to evaluate the construction and use of cloze procedures in TEFL, it can contribute to the existing body of knowledge in TEFL and the field of cognitive psychology.

Based on their method of deletion, cloze tests are of two major categories: analytic and perceptual. The cloze tests chosen for this study were supposed to be representatives of the two categories. Information from the brain research emphasizes that the analytic processes are centralized in the left side of the brain, whereas, the right side of the brain which specializes in doing perceptual tasks is also the center for visual/spatial perception (Akmajiian et al. 1994; Armstrong 2003). Accordingly, the assumption is that due to their place of localization, the scores on spatial intelligence test may have a greater correlation with the performance on perceptual type of cloze tests than with the analytic type of cloze tests.

2. The Background

2.1 Studies on Spatial Intelligence

In contrast to the earlier views on the nature of intelligence which presented a muscle-like view of the brain and saw intelligence as a unitary general capacity, measured by a test, inherited from one's parents, and fixed from birth, the Multiple Intelligences (MI) theory proposed by Gardner (1983) suggests several intelligences to be at work. These intelligences are expressed in individuals' performance, products, and ideas, and the way they are expressed is culturally grounded.

Initially, Gardner (1983) identified seven intelligences; later he went on modifying his list by adding one more intelligence (naturalist intelligence), which met the intended criteria. These eight intelligences which constitute the heart of the MI theory include: Bodily/kinesthetic, verbal/linguistic, logical/mathematical, interpersonal, intrapersonal, naturalistic, visual/spatial and musical/rhythmic intelligences. These intelligences satisfied the following eight criteria which Gardner (1983) initially anticipated, and later on were agreed upon by other cognitive psychologists as well. Armstrong (2003, p. 14) summarizes the criteria as follows:

-- Based on evidence from the field of experimental psychology, the intelligence/ability does not automatically transfer from one to another.

-- In case of brain damage, the existence of intelligences is demonstrated by their liability to potential isolation.

-- Each intelligence has an "evolutionary history and evolutionary plausibility".

-- All the intelligences develop in stages and result in end state performances.

-- For each intelligence, there are a number of paragons who display high levels of that intelligence.

-- Each of the intelligences can be encoded in a symbol system.

-- Every intelligence has a recognizable set of core operations or a number of operations which represent it.

-- The scores gained from a psychometric test of one single intelligence do not correlate with scores obtained from other intelligences. This is a good indicator of the independence of intelligences.

Gardner's view stands against the previously accepted assumptions on intelligence in that he believes that intelligence can be improved, redirected, modified, trained and even changed. It is also believed that if students' strengths are identified through assessment, educators will be able to build on those strengths and support them with suitable strategies.

2.1.1 Views on the Nature of Spatial Intelligence

Spatial thinking is a process occurring in the mind where through transformations the individual creates mental images, maps, codes, decodes, and recalls information based on the stimuli or the given information of different forms and the prevailing values in his society (Piaget and Inhelder, 1971; Vygotsky, 1978; Arenheim, 1974; Gardner, 1983, 1985, 1993). According to Piaget and Inhelder (1967, 1971), this form of thinking develops in three stages. In the first stage, the child develops the ability for perceiving an object due to its adjacency, nearness, or distance to other objects, how it is located within a background or is configured in a setting. After this stage, the child develops another distinctive ability which allows him/her to view, consider, and understand an object from different points of view. Finally, the abilities for maintaining, measuring, placing and manipulating the space and its component parts such as distance, size, and proportion are developed. Such a linguistic or figurative manipulation of space is said to be representative of spatial knowledge. Piaget and Inhelder (1971) concluded that the development of image acts as a mediator between perception and intelligence which figuratively evokes objects and their relations in the mind, and turns them into a sensible form.

Arenheim (1974) describes visual thinking as a kind of mental processing in which the individual views an entity or configuration in the mind where the objects are replaced by some form of imagery while they may not be replicas but abstract patterns of some sort. Eventually, this can lead to the mental reproduction of static objects and patterns. Analyzing children's drawings, Ives and Gardner (1984) and Gardner (1999) came to the conclusion that the development of spatial intelligence is a natural trait common to all children from diverse cultural backgrounds.

2.1.2 Spatial Intelligence and other Learning Abilities

Seng and Chan (2000) identified a positive correlation between spatial intelligence and mathematics achievement. In a study of elementary students, they measured spatial ability of male/female students, using spatial relationship-orientation test and the spatial visualization test. The results indicated no better performance of one gender over the other on spatial tasks.

Tucker (1995) analyzed the writing styles and cognitive processes of two groups; visual/spatial learners and linguistic/verbal learners. He found visual learners quite holistic in the accomplishment of the writing tasks. Such learners, he concluded, needed more time for preparation and reflection than linguistic/verbal learners did.

Also, in Dixon's view (cited in Dean, 2007) learners equipped with this asset tend to reason abstractly, see things from holistic perspective, act creatively, and respond intuitively. Due to such characteristics and their location of information processing center in the brain, those endowed with this kind of thinking have usually felt inferior to other learners with a greater inclination for analyzing information in the right hemisphere. Roark (1998) found a positive relationship between visual learners and higher achievement in reading in an adult correction facility. After determining learning styles of the learners through the vocation styles inventory, visual learners and non-visual learners were correlated with vocabulary comprehension.

Armstrong (2003), pointing to the results of a study done with reading disabled Chinese children, states that although the students were at a poor level of linguistic intelligence, they could draw upon their relatively higher level of spatial intelligence as a compensatory processing potential which could assist them in gaining literacy. To him, literacy is "a whole brain activity" (p. 18).

2.2 Cloze Procedures, their Emergence and Applications to Language Testing

Gestalt as a theory belonging to the category of rational psychology insisted on the active role of the mind in reorganizing and restructuring information for problem-solving tasks rather than habit formation. Gestalt psychologists, then, claimed that human beings also make mental representations of future events using their earlier experiences. Due to the wide acceptance of behaviorism which viewed human behavior as just depending on the formation of habits, concepts which included the formation of mental representations did not gain much attention (Murray, 1995). Toleman (cited in Murray, 1995) asserts that human beings for finding a solution to a problem need to develop some cognitive map or simply put an image to create a mental representation of the whole.

Adopting the concept of *closure* from Gestalt psychology, Taylor (1953) devised the cloze procedure as:

"A method of intercepting a message from a transmitter, mutilating its language patterns by deleting parts, and so administering it to receivers that their attempts to make the patterns whole again potentially yield a considerable

number of cloze units" (p.416).

Taylor (1953) claimed that the cloze procedure "is by no means confined to readability or reading ability of individuals" (p.432). Accordingly, Oller (1972) referred to another versatile use of cloze tests and their capability in the assessment of grammar of expectancy. Faraday et al. (2004), in their discussion on the concept of "closure", state that "if a person has developed a perception of an object, the object will be perceived completely even if it contains some incomplete points or closures" (p. 279).

From a quite different perspective, Ackerman et al. (2000) showed that cloze and completion tests can act as supplements to the measurement of crystallized intelligence which is a measure of higher-order intelligence. Hanania and Shikhani (1986), claiming that cloze tests measure processes beyond sentence level, state that "to reconstruct the textual message, students have to understand key ideas and perceive interrelationships within a stretch of continuous discourse" (P. 99).

Lam et al. (1992) examined the construct validity of a cloze test based on two sources of evidence: (1) the descriptions of the cognitive processes used by learners in doing cloze tests, and (2) the confirmatory factor analysis of learners' responses to different cloze tests. The results showed that the choice of cloze test method did matter. Accordingly, they suggested that the four types of cloze tests deletion methods (rational deletion, preposition deletion, fixed-ratio and random word deletion) assess two cognitive processes of language use: the analytic and the perceptual.

In the analytic approach, the learner defines the problem explicitly and analyzes the information presented in the text. In the perceptual (automatic) approach, the learner reads the text and without an explicit definition of the problem, finds an answer to the test item. It is believed that "content word" and every "nth" word deletion measure the analytic process better, while "random word" and "preposition deletion" can measure the perceptual processes more appropriately (Lam et al. 1992). Sachs et al. (1997) demonstrated that cloze tests which follow the proposition deletion method assess the underlying perceptual processes more efficiently.

From the literature presented here, it can be concluded that spatial intelligence, as the ability to perceive the concepts visually and to perform transformations on those perceptions which allow for recreating ideas in a visual manner, is influentially effective and responsible for processing information and making configurations while reading and writing tasks. This ability of human mind, which enables the individual to perceive the world visually through the formation of image-like mental representations, seems to have a substantial overlap with the kind of mental ability that cloze tests require on the part of the test taker for processing the written information and configuring a whole out of the given parts.

In fact, the principle of configuration, as the building block for the theoretical foundations of the concept of "closure", the cornerstone upon which cloze tests have been built, in Piaget and Inhelder's (1967) words is a stage in human beings' development of spatial thinking which in Armstrong's (2003) view is of great significance in successful accomplishment of reading and writing tasks. Accordingly, it can be assumed that one's level of spatial intelligence seems to play a key role in how he/she can take cloze tests successfully.

Furthermore, it follows from the research done by Sachs et al. (1997) that cloze tests, based on their method of word deletion, have the potential to draw upon both the analytic and perceptual cognitive mental processes. The analytic cognitive processes are summoned when either a fixed ratio or a random method of deletion is adopted. Thus, such cloze tests necessitate the involvement of the left side of the brain where the analytic information processing center is located. On the other hand, cloze tests which are constructed through a rational deletion method (the removal of either prepositions or content words) call on the perceptual cognitive processes that are localized in the right side of the brain. As Armstrong (2003) states, this same side of the brain, which is responsible for doing perceptual tasks, also happens to be the center for spatial thinking and visual perception. This same location of cognitive processing seems to indicate the existence of a greater level of compatibility between what rational cloze tests and spatial intelligence tests measure in comparison to that between the spatial intelligence tests and cloze tests which draw on analytic cognitive processes. The subsequent section addresses the research design and methodology for this study.

3. The Study

3.1 Research Questions

As mentioned above, the present study aims to measure the possible relationship between L2 learners' spatial intelligence and their performance on cloze tests. To this aim, the following questions were raised:

- Is there any significant relationship between EFL learners' spatial intelligence and their performance on cloze tests?

- Which type of cloze tests, analytic or perceptual (depending upon deletion method), correlates more strongly with EFL learners' degree of spatial intelligence?

3.2 Research Hypotheses

To provide objective answers to the questions, the following null hypotheses were constructed to be tested out:

Ho1: There is not any significant relationship between the scores of EFL learners on spatial intelligence test and their scores on cloze tests.

Ho2: The correlation between learners' scores on the spatial intelligence test and their performance on perceptual cloze test does not differ significantly from the correlation between learners' scores on the spatial intelligence test and their performance on the analytic type of cloze tests.

3.3 Participants and Instrumentations

A total of 41 male Iranian EFL learners, aged 18-25, studying in English classes at Jihad Daneshgahi Language Center (Tehran University Branch, Iran) were asked to participate in this research project. The mean age of the participants was 21 years (SD =0.54).

The tests employed for this study included a Michigan test of English Language Proficiency (1984 version), three cloze tests (cloze test A as the perceptual type of cloze, cloze test B as the analytic class of cloze, and cloze test C as a criterion for the two previous ones), and a test of visual/spatial intelligence. Cloze test C, which was borrowed from Bachman (1985), followed a fixed-ratio deletion method. Bachman (1985) realized this test to be highly reliable and the correlation between this test and TOEFL test equaled 0.83, while split-half reliability of this test was above 0.86.

Cloze test A was constructed out of a 263- word passage adopted from a reading passage by Connie Odone entitled 'Global Pizza' (a general topic). It was extracted from the intermediate book of American Headway. The difficulty level of the text, determined through Flesch Reading Ease test, was realized to be 60.8, which was optimal for serving the related purpose. Following Sachs et al.'s (1997) study, all the propositions throughout the passage apart from the initial 33 words and the last 36 words were removed. Noticing its method of deletion, cloze test A was mainly designed to exploit the underlying perceptual processes.

Cloze test B, on the other hand, was a multiple choice test, which followed a fixed deletion ratio of 1:7. It was originally intended to draw upon the underlying analytic processes which are utilized while reading. This test was extracted from "Techniques for Effective Reading" (Farhady et al., 2004). The test had been clearly labeled as a graded test which set to evaluate intermediate EFL learners' knowledge. However, this labeling was not seen reliable enough by the researchers and it underwent the same reliability and validation procedures as the ones employed for cloze test A (See Appendix 1 for a sample cloze test).

3.4 Data Collection and Analysis

Early on, a pilot study was conducted with12 participants to evaluate the criterion related validity and test-retest reliability of cloze tests A and B. The results revealed a high level of test-retest reliability at 0.01 level of significance (0.82, 0.85, respectively), which indicated the consistency of scores during the two administrations for a sample size as large as 12 participants (Appendix 2, Tables A1 and A2). In order to see the validity of these two tests, the scores of participants in the pilot group on these tests were compared to their scores on cloze test C (the criterion). Correlation coefficients computed through Pearson-product moment for cloze tests A and B were 0.71 and 0.79, respectively, which were satisfactory to the purpose of this study (Appendix 2, Tables B1 and B2). Thus, the existence of a positive association between these two tests and the criterion test (C) proved to be high.

Similarly, test-retest reliability was appraised for the spatial intelligence test, but since no other spatial intelligence tests were available to the writers, only the content validity of this test was considered by a panel of experts in the field through the Delphi technique. Regarding the reliability concerns for the spatial intelligence test, over a two week interval, the test was again administered to the pilot group. The obtained correlation coefficient stood at 0.83, which indicated a high degree of test-retest reliability for this test (Appendix 2, table A3).

A panel of experts managed to analyze and evaluate the validity of the spatial intelligence test. Simply put, a test is believed to be valid when it measures what it is supposed to measure (Dornyei, 2007). Accordingly, the experts came to examine the test in terms of the core underlying components of this form of intelligence. Therefore, such components as color, rotation, sequence, shape, line, point and balance were examined. The experts all approved the validity of this test. This test was adopted from *queendom.com* website which is a subsidiary of Psycho Tests AIM Inc. This 10 item test followed a multiple choice format. All the 10 items were centered on images which gave the test a sense of being more culture-fair and less domain specific. Since this test had not already been utilized in the

researchers' home country (Iran), the concern for validity was seen relevant (See Appendix 3 for a sample of this test).

Having obtained satisfactory measures of reliability and validity for these tests, the Michigan test was administered to a group of EFL learners to determine their homogeneity in terms of English language proficiency. Accordingly, the candidates whose scores were one standard deviation (8.8) above and below the mean (48) were pulled out, and shaped the population of the study, 41 ones (Appendix 4 shows detailed descriptive statistics related to this test). Four weeks later, cloze tests A and B were administered concomitantly with the usual midterm exam. Here, the participants' scores on cloze test A, which was supposed to mostly draw on the perceptual processes, and cloze test B, which followed a fixed ratio deletion method (every 7^{th} words removed) and was determined to call on the underlying analytic processes in the test taker's mind, were registered.

Five weeks later, the final phase of the project (administering the spatial intelligence test) was conducted. Despite the relative simplicity of the test directions, attempts were done to assist the participants in better understanding of the items whenever they needed guidance. After identifying these three sets of scores, the participants' scores on the spatial intelligence test were first compared to their scores on cloze test A, and then correlated with scores on cloze test B. Eventually, a comparison was made between the way scores on spatial intelligence test had correlated with scores on cloze tests A and B.

4. Results and Discussion

In this study, the key statistical analyses were centered on the investigation of correlations between the main variables of the study: Spatial intelligence and cloze tests A and B. After obtaining the participants' scores on these two cloze tests, their scores were separately correlated with their scores on the spatial intelligence test.

First, using Pearson- Product moment correlation, the participants' scores on the spatial intelligence test were correlated with their scores on cloze test A. The results demonstrated the existence of a significant positive correlation between the participants' performance on these two tests (Table 1). Here, the probability for the occurrence of this degree of correlation (0.61) for this sample size is less than 0.00 which is quite noticeable. Such a correlation (0.61) for this sample size is at an acceptable level and is, in fact, significant to the purpose of this study.

Second, using the same procedure as used in the previous part, the existence of possible correlations between the participants' scores on the spatial intelligence test and cloze test B was investigated. The results also revealed a significant correlation between the two variables (correlation coefficient equaled 0.56) at 0.01 level (Table 2); however, this correlation was much less than that between the two previously mentioned variables. Based on this, the first research hypothesis can be rejected.

Examination of the relationships between participants' performance on the spatial intelligence test and the two cloze tests showed two significant positive correlations above 0.50 which were significant at 0.01 level (See Appendix 5, for detail statistical analyses). This acceptable degree of correlation between the participants' performance on the spatial intelligence test and their performance on cloze tests in general, indicates the existence of a level of compatibility between what these tests aim to measure. This might be due to the fact that these tests demand the occurrence of similar mental processes in participants' mind. This is, in fact, supported by the existing literature on the underlying theoretical constructions of cloze tests and the concept of *closure* on the one hand, and the nature of spatial intelligence, spatial thinking and its development in human mind, on the other (Piaget and Inhelder 1967, 1971, Gardner 1983, 1993, Murray 1995, Armstrong 2003, Farhady et al. 2004, Dean 2007). Thus, it can be asserted that performance on the spatial intelligence test and cloze tests may, to some extent, draw on the individual's ability to think spatially.

The careful examination of the obtained correlations revealed that participants' performance on the spatial intelligence test correlates more strongly with their performance on cloze test A rather than their performance on cloze test B.

In fact, this discrepancy between the correlations obtained from the comparison of participants' performance on cloze tests A and B, which differed in the deletion method, with their performance on the spatial intelligence test can be justified by the review of the literature on brain lateralization and the type of mental processes which occur in each side of the brain while doing different cognitive activities (Carroll, 2008). The center for doing spatial activities is localized in the right hemisphere of the brain which is also responsible for conducting perceptual cognitive processes. Yet, as Armstrong (2003) states, reading and writing activities are whole brain activities which extend beyond the confines of purely linguistic left-side hemispheric processes and, therefore, necessitate the involvement of the right hemisphere for processing and perceiving the written information visually. This tendency for doing perceptual tasks and processing information visually in the right side of the brain is, in fact, a general fact which has

been proved by solid evidence received from the brain research and biopsychology (Gardner 1983, 1993, Coney and Evans 2000, Armstrong 2003, Strecker 2008). On the other hand, cloze test A, which was constructed through the adoption of a rational deletion method, put a greater demand on the participants to utilize their perceptual cognitive processes in comparison to cloze test B, as a test belonging to the mechanical class of cloze tests, which, as Helm (1980), Lam et al. (1992), Sachs et al. (1997), and Carroll (2008) maintain, call on the analytic cognitive processes. Subsequently, the existence of a greater level of correlation between the participants' performance on the spatial intelligence test and cloze test A can be attributed to the greater affinity in terms of their psychological realties and their center for mental processing. Thus, such a discrepancy allows for rejecting the second research hypotheses.

5. Conclusions, Implications and Suggestions

From the two correlations found in this study, it can be concluded that there exist positive relationships between the learners' performance on the spatial intelligence test and their scores on cloze tests. Moreover, it was revealed that the relationship between learners' visual/spatial intelligence and the perceptual type of cloze tests was much greater in comparison to that of the analytic class of cloze tests.

Overall, results indicated the existence of a high degree of compatibility between what spatial intelligence test and what cloze tests tend to measure. This provided the grounds for rejecting the first null hypothesis. In concept, such a result is in line with the notion of spatial intelligence: the ability to shape mental images of meaningful concepts which allows the person to perceive the world through images. This definition is in close proximity to the theoretical foundations of cloze tests which define the cloze procedure as a process in which the learner is required to mostly tap into his/her ability to shape a total mental image of the written words, and to infer the relationship between and among the parts so as to complete an unfinished pattern.

There appears to be the possibility for the existence of a degree of overlap between abilities related to spatial intelligence and reading aspects of language learning which should be taken into account. Indeed, competencies related to visual/spatial intelligence are likely to contribute remarkably to reading and writing aspects of language learning; thus taking them into account while designing language tests and designing language teaching tasks seem to be of importance.

In fact, identifying learners' level of spatial intelligence can provide educators with a better opportunity for predicting activities appropriate for both learners with higher levels of this intelligence and those who are weaker in this ability. For this to happen, teachers need to realize that different learners with different types of the eight intelligences respond to instruction and evaluation in different ways, and the use of teaching strategies and test methods which are limited only to linguistic and/or mathematical intelligences may not evoke the same kind of responses in the spatial learners. This study can also highlight the need for taking individual differences into account in language assessment and how these differences may lead to variations in learners' performance on different language tasks.

Further studies with learners of different first languages and more diverse levels of English language proficiency (i.e. elementary, advanced) on all of the four basic language skills may bring about more interesting results. It is also suggested to conduct research with females to see the existence of possible similarities or differences in the obtained results. Providing the grounds for attracting active participations of children for examining their think-aloud protocols about the way they tend to draw upon spatial thinking in doing different language tasks would also help draw a new and more precise sketch of the role and the development of spatial thinking in human beings.

Finally, conducting a similar study on the relationship between the performance of participants who come from the same academic background on the spatial intelligence test and their performance on cloze tests, which have been constructed out of academic texts, would probably produce interesting results for ESP.

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Table 1. Correlation between the spatial intelligence test and cloze test A

Cloze A	Spatial Intelligence		
.612(**)	1	Pearson Correlation	Spatial intelligence
.000	.	Sig. (2-tailed)	
41	41	N	
1	.612(**)	Pearson Correlation	Cloze A
.	.000	Sig. (2-tailed)	
41	41	N	

Table 2. Correlation between the spatial intelligence test and cloze test B

Cloze B	Spatial intelligence		
.567(**)	1	Pearson Correlation	Spatial intelligence
.000	.	Sig. (2-tailed)	
41	41	N	
1	.567(**)	Pearson Correlation	Cloze B
.	.000	Sig. (2-tailed)	
41	41	N	

Appendix 1: A sample of Cloze Test, Test A

So you thought the hamburger was the world's most popular fast food? After all, McDonald's Golden Arches span the globe. But, no, there is another truly universal fast food, the ultimate fast food. It's easy …1… make easy …2… serve, much more varied …3… the hamburger, can be eaten …4… the hands, and it's delivered …5… our front door …6… served …7… fancy restaurant. It's been one …8… the American's favorite foods …9… over 50 years. Ir is …10… course, the pizza.

It's kind …11… silly …12… talk …13 … the moment when pizza was "invented'. It gradually evolved …14…the years, but one thing's …15… sure- it existed long before the discovery …16…the Americas. The idea …17… using pieces …18… flat, round bread as plates came …19… the Greeks. They called them "plakuntos" and ate them …20… various simple toppings such as oil, garlic, onions, and herbs. The Roman enjoyed eating something similar and called it 'picea". …21… about 1000 A.D. …22… the city …23… Naples, "Picea" had become "pizza" and people were experimenting …25…more toppings: cheese, ham, anchovites, and finally the tomato, brought …25… Italy …26… Mexico and Peru …27… the sixteenth century. Naples became the pizza capital …28… the world. …29… 1889, King Umberto and Queen Margarita heard …30… pizza and asked …31… try it. They invited pizza maker Esposito to make it for them. He decided to make the pizza like the Itallian flag, so he used red tomatoes, mozzarella cheese, and green basil leaves. The queen loved it and the new pizza was named "pizza Margarita" in her honor.

Appendix 2: The Results of the Pilot Study

A: Reliability Measures for correlation between Cloze Test A, Cloze Test B, and the Spatial Intelligence Test

Table A1. Correlation between Participants' Test and Re-test scores on Cloze Test A

		Test	Retest
Test	Pearson Correlation	1	.820(**)
	Sig. (2-tailed)	.	.001
	N	12	12
Retest	Pearson Correlation	.820(**)	1
	Sig. (2-tailed)	.001	.
	N	12	12

** Correlation is significant at the 0.01 level (2-tailed).

Table A2. Correlation between Participants' Test and Re-test Scores on Cloze Test B

		Test	Retest
Test	Pearson Correlation	1	.851(**)
	Sig. (2-tailed)	.	.000
	N	12	12
Retest	Pearson Correlation	.851(**)	1
	Sig. (2-tailed)	.000	.
	N	12	12

** Correlation is significant at the 0.01 level (2-tailed).

Table A3. Correlation between Participants' Test and Re-test Scores on the Spatial Intelligence Test

		Test	Retest
Test	Pearson Correlation	1	.830(**)
	Sig. (2-tailed)	.	.001
	N	12	12
Retest	Pearson Correlation	.830(**)	1
	Sig. (2-tailed)	.001	.
	N	12	12

** Correlation is significant at the 0.01 level (2-tailed).

B: Validity of Cloze Tests A and B

Table B1. Correlation between Cloze Test A and Cloze Test C

		Cloze A	Cloze C
Cloze A	Pearson Correlation	1	.717(**)
	Sig. (1-tailed)	.	.004
	N	12	12
Cloze C	Pearson Correlation	.717(**)	1
	Sig. (1-tailed)	.004	.
	N	12	12

** Correlation is significant at the 0.01 level (1-tailed).

Table B2. Correlation between Cloze Test B and Cloze Test C

		Cloze B	Cloze C
Cloze B	Pearson Correlation	1	.790(**)
	Sig. (1-tailed)	.	.001
	N	12	12
Cloze C	Pearson Correlation	.790(**)	1
	Sig. (1-tailed)	.001	.
	N	12	12

** Correlation is significant at the 0.01 level (1-tailed).

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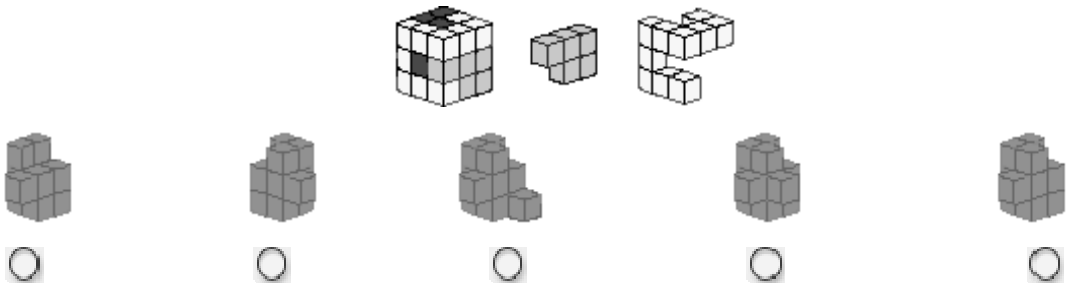
Appendix 3: A Sample of the Spatial Intelligence test

Spatial IQ Test

10 questions.

If you disassemble the block, which piece would be missing?



Appendix 4: The Michigan Test Scores and Analysis

Table 4.1. The Frequency of Participants' Raw Scores on the Michigan test

Valid	Frequency	Percent	Valid Percent	Cumulative Percent
39.00	3	5.2	7.3	7.3
40.00	4	6.9	9.8	17.1
41.00	2	3.4	4.9	22.0
43.00	2	3.4	4.9	26.8
44.00	2	3.4	4.9	31.7
45.00	1	1.7	2.4	34.1
46.00	3	5.2	7.3	41.5
47.00	1	1.7	2.4	43.9
48.00	3	5.2	7.3	51.2
49.00	2	3.4	4.9	56.1
50.00	3	5.2	7.3	63.4
51.00	3	5.2	7.3	70.7
52.00	4	6.9	9.8	80.5
53.00	1	1.7	2.4	82.9
54.00	3	5.2	7.3	90.2
55.00	3	5.2	7.3	97.6
57.00	1	1.7	2.4	100.0
Total	41	100.0	100.0	

Table 4.2. One-Sample Kolmogorov-Smirnov Test for the Michigan Test

		Proficiency
N		41
Normal Parameters(a,b)	Mean	47.6341
	Std. Deviation	5.38867
Most Extreme Differences	Absolute	.110
	Positive	.110
	Negative	-.109
Kolmogorov-Smirnov Z		.707
Asymp. Sig. (2-tailed)		.700

a Test distribution is Normal. b Calculated from data.

Appendix 5: Results of Statistical Analyses

Table 5.1. The scores and their Frequencies on Cloze Test A

Valid	Frequency	Percent	Valid Percent	Cumulative Percent
14.00	1	2.4	2.4	2.4
15.00	2	4.8	4.9	7.3
16.00	1	2.4	2.4	9.8
17.00	10	23.8	24.4	34.1
18.00	7	16.7	17.1	51.2
19.00	6	14.3	14.6	65.9
21.00	3	7.1	7.3	73.2
23.00	4	9.5	9.8	82.9
24.00	3	7.1	7.3	90.2
25.00	1	2.4	2.4	92.7
26.00	1	2.4	2.4	95.1
28.00	2	4.8	4.9	100.0
Total	41	97.6	100.0	
Total	41	100.0		

Table 5.2. One-Sample Kolmogorov-Smirnov Test for Scores on Cloze Test A

		Cloze A
N		41
Normal Parameters(a,b)	Mean	19.6098
	Std. Deviation	3.52050
Most Extreme Differences	Absolute	.227
	Positive	.227
	Negative	-.132
Kolmogorov-Smirnov Z		1.455
Asymp. Sig. (2-tailed)		.029

a Test distribution is Normal. b Calculated from data.

Table 5.3. The Frequency of Participants' Scores on Cloze Test B

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	13.00	10	23.8	24.4	24.4
	14.00	6	14.3	14.6	39.0
	15.00	7	16.7	17.1	56.1
	16.00	4	9.5	9.8	65.9
	17.00	2	4.8	4.9	70.7
	18.00	6	14.3	14.6	85.4
	19.00	5	11.9	12.2	97.6
	20.00	1	2.4	2.4	100.0
	Total	41	97.6	100.0	
Total		41	100.0		

Table 5.4. One-Sample Kolmogorov-Smirnov for Scores on Cloze Test B

		Cloze B
	N	41
Normal Parameters(a,b)	Mean	15.6098
	Std. Deviation	2.24586
Most Extreme Differences	Absolute	.168
	Positive	.168
	Negative	-.149
Kolmogorov-Smirnov Z		1.076
Asymp. Sig. (2-tailed)		.198

a Test distribution is Normal. b Calculated from data.

Table 5.5. The Scores and their Frequencies on the Spatial Intelligence Test

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2.00	1	2.4	2.4	2.4
	3.00	7	16.7	17.1	19.5
	4.00	13	31.0	31.7	51.2
	5.00	5	11.9	12.2	63.4
	6.00	6	14.3	14.6	78.0
	7.00	5	11.9	12.2	90.2
	8.00	4	9.5	9.8	100.0
	Total	41	97.6	100.0	
Total		41	100.0		

Table 5.6. One-Sample Kolmogorov-Smirnov Test for scores on the Spatial Intelligence Test

		Spatial
N		41
Normal Parameters(a,b)	Mean	4.9512
	Std. Deviation	1.67259
Most Extreme Differences	Absolute	.227
	Positive	.227
	Negative	-.109
Kolmogorov-Smirnov Z		1.456
Asymp. Sig. (2-tailed)		.029

a Test distribution is Normal. b Calculated from data.

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