

The Impact of Teaching Critical Thinking on the Reading and Writing Abilities of Iranian EFL Learners

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Abstract

Recent research suggests that critical thinking is not typically an intrinsic part of instruction at any level. Students come without any training in it, while faculties tend to take it for granted as an automatic by-product of their teaching. Yet without critical thinking systematically designed into instruction, learning is transitory and superficial. Therefore, the purpose of the present study is to investigate the impacts of teaching critical thinking skills on the development of the reading and writing abilities of Iranian EFL learners, in line with other studies confirming the positive relationship between critical thinking and language skills. The treatment consisted of 18 instructional sessions of 20 minutes on critical thinking. The participants of the study were 50 male and female students with pre-advanced proficiency level. The students in the experimental group were taught critical thinking skills beside other materials while the students in the control group did not have critical thinking instruction. The data were analyzed using several independent t-tests which were administered across pre-test and post-test scores. The results indicated that critical thinking led to students' significant improvement in reading and writing abilities in the experimental group. The results have implications for teachers, institutes and material designers.

Keywords

Critical thinking, English as a Foreign Language (EFL), Problem-solving tasks, Reading ability, Writing ability.

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Introduction

Critical thinking is a very hotly debated topic these days. All educators are now aware of the importance of equipping learners with critical thinking techniques, and teachers are making efforts to teach these techniques in the most appropriate way. Critical thinking is the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action (Scriven, 1996).

Children are not born with critical thinking skills and there is a need for a systematic direct instruction to develop effective thinking skills (Alwehaibi, 2013 & Fischer & Scriven, 1997). So how can we make critical thinkers out of children to succeed in their whole life? To start with, education could be the first step for promoting critical thinking among children. As Bensely (1998) and Fisher (2003) state critical thinking skills are required to be taught since students' thinking skills are not enough to face the problems students deal with either in education or in daily life. Therefore, educators are required to focus on teaching critical thinking to inform them how to learn instead of just transmitting information. Emphasizing on making critical thinking as a part of educational courses, scholars have suggested that critical thinking can be taught in different classroom areas, such as those suggested by Shafersman (1991) including lectures, laboratories, writing activities, term papers, exam questions, homework, and quantitative exercises.

Cottrell (2005, p. 2) holds that critical thinking is a complex process of deliberation which involves a wide range of skills and attributes including:

- Identifying other people's positions, arguments, and conclusions;
- Evaluating the evidence for alternative points of view;
- Weighing up opposing arguments and evidence fairly;

- Being able to read between the lines, seeing behind surfaces, and identifying false or unfair assumptions;
- Recognizing techniques used to make certain more positions appealing than others such as false logics and persuasive devices;
- Reflecting on issues in structured way, bringing logic and insight to bear;
- Drawing conclusions about whether arguments are valid and justifiable, based on good evidence and sensible assumptions;
- Presenting a point of view in a clear, structured well-reasoned way that convinces others.

At each educational level, thinking must be practiced in each content field, which means hard work for the teacher. It's much easier to teach students to memorize facts and then assess them with multiple-choice tests. In a course that emphasizes thinking, objectives must include application and analysis, divergent thinking, and opportunities to organize ideas and support value judgments. When more teachers recognize that the facts they teach today will be replaced by the discoveries of tomorrow, the content-versus-process controversy may be resolved.

Most scholars are thinking about the new ways of dealing with students' problems. Teachers who have attempted to incorporate higher level questioning in their discussions with their students are usually dismayed at the preliminary results. Unless the students have been prepared for the change in expectations, they are likely to experience frustration.

Thus, we can conclude that critical thinking is quite complicated, and it is difficult for a child to develop such a complex ability without receiving aids from outside. Therefore, we understand that the task of teachers as people who play the pivotal role of training critical thinkers is very crucial, particularly in a language classroom in which students should get the opportunity to express themselves and evaluate the arguments of their peers. Up to this date, little is known about the importance of teaching critical thinking skills in language classroom (Malmir & Soorcheh, 2012).

To eliminate this issue, the present study aims at investigating the effects of teaching these skills in a language classroom. In order to reach this target, in this study students of the control group received training on critical thinking for 18 sessions and their performance in reading and writing skills were compared to the students of control group that did not benefit any instruction in this regard.

Literature Review

Freely and Steinberg (2000) highlight the important role of debates, group discussions, and individual problem solving activities to enhance critical thinking in the students. They argue that debates improve critical thinking if the ideal opportunity is provided by the instructor for students. As far as it is a process of asking and answering questions and finding information to arrive at a reasoned judgment on a proposition, students have got the chance of coming against a theory. In that case, they not only increase their knowledge but also try to win a decision. Consequently, they greatly use their ability of critical thinking.

By setting group discussions, students are made to come up with a single decision through a collaborative activity analyzing others' beliefs, using the same standards and values of the members of the group, and taking the responsibility of supporting the group.
(Freely & Steinberg, 2000, p.9)

Setting some sort of activities upon which individual decisions are made can promote critical thinking skills in students. It would be a kind of individual decision making while all the dimensions of a problem are controlled by the person without any further support. In this way, the person reflects on his own opinion, monitors himself, and makes the final decision on his own (Fahim & Saeepour, 2011).

Some instructors might think that critical thinking cannot be taught through lecturing. Critical thinking is an active process whose skills are analysis, synthesis, reflection, and many other factors that must be thought through practice. Thus, lecturing is considered as a passive activity when students just listen to the lectures passively. However, it is possible to make lectures active tasks by stopping students while

giving lectures and asking them some thoughtful questions about the materials which have been just presented. Courses held in laboratories are considered to be beneficial since students have the opportunity to practice their critical thinking. Because they are learning scientific method in which discovery learning is emphasized, critical thinking leads to discovery learning with relevant information and perceived inferences.

Writing activities are the best way to teach critical thinking. Writing is an activity which forces students to organize their thoughts, think deeply about their topic and present their conclusions in a persuasive manner. Goatly (2000) and Gorjian, Pazhakh & Parang (2012) state that one reason that we might expect writing to improve critical thinking is through some sort of writing such as persuasive or argumentative writing which would be difficult for the students . Some of the strategies for teaching critical thinking are: CAT (Classroom Assessment Techniques), Cooperative Learning Strategies, Case Study /Discussion Method, Using Questions (Reciprocal Peer Questioning, Reader's Questions), Conference Style Learning, Use Writing Assignments, Dialogues (Written dialogues, Spontaneous Group Dialogue) and Ambiguity, Allegretti (1995), Bernstein (1985) and Mills (1995).

Reading and Writing Abilities

Reading and writing are linked skills and therefore there are common elements in the reading and writing processes. Writers develop ideas for a text, while readers predict what a text is about. Readers search for information on a page of text using their familiarity of words, syntax, and semantics to understand the text, while writers use that same knowledge to produce meaningful text. Writers use similar information about language and language processes as readers do. Since the writing a writer produces becomes reading, the two acts come together. Readers and writers both reread the text to confirm that they are right or to self correct. In writing, this is part of the revision and editing processes and in reading this is part of problem solving and monitoring. "In reading we turn print into language and the

language into print to confirm. In writing, we turn language into print then print into language to confirm” (Mooney, 2003). The processes are complementary.

In addition to the processes of reading and writing, there are features of text that are important to comprehending during reading that can be developed through both reading and writing. An understanding of various genres and how text structures develop as the writer tries them out in his/her writing. Also, the cohesive ties that are present in texts as an aid to understanding must be put into texts. The reciprocity of recognizing those ties as a reader and producing them as a writer help the development of children’s literacy.

Along with the interaction between reading and writing in composition and text, there are also features of print that can be reinforced through both reading and writing. Clay (1998) states that “the interactive liaison between composing and constructing a written message and reading it back provides opportunities for noticing some of the ways in which language works, while forming letters calls attention to perceptual forms and critical features” (p. 132). The early understandings that children need to learn as part of becoming literate are needed in both reading and writing. Learning that spoken words can be presented in print and that text is related to speech is an important early concept that can be developed both in reading and in writing. Going back to the days of the language experience approach, there has been an emphasis on the value of learning to write while learning to read (Stauffer, 1970). The directional principles of the English language can be taught in both reading and writing. Where do we start on the page as a reader and as a writer? Any of the conventions of print, such as punctuation and its meaning, use of capital letters, the application of letter/sound knowledge, and visual spelling knowledge all can be learned and practiced both through reading and writing.

Writing slows down thought processes and allows for categorizing and structuring thoughts. Developing a text requires linkages to background knowledge and the organization of thoughts and experiences in a way that cannot be done through talking about a text

or reading it. Asking children to respond to reading through writing also develops the ability to more thoughtfully synthesize text through the slowed down process of writing.

There are comprehension strategies that can be developed through writing. Writers need to think about their overarching idea or theme and what important details to include. Readers need to determine main idea and theme and identify important details as they read (Keene & Zimmerman, 1997). When teaching the craft of writing, primary teachers often focus on descriptive language. Teaching children to write, using description, ties directly to their ability to develop mental images, and a comprehension strategy (Zimmerman & Hutchins, 2003).

Looking at the five elements of early reading instruction (NRP, 2001) and instructional contexts in writing, we can see a close connection between what children learn as readers and what children learn as writers. Clay (1998) states: Writing allows a slow analysis of detail in print; both reading and writing draw on the same sources of knowledge about letters, sounds, chunks, words, syntax (or grammar and sentence construction), the rules of discourse, and narrative structures and genre differences; “dipping into a large pool of both reading and writing may help those with limited knowledge of the language, and may have cognitive advantages”. (p. 139)

There are connections between learning to read and write that can be useful to beginning readers (Langer & Flihan, 2000; Teale & Yokota, 2000). These connections help children link written language processes which make learning to both read and write more successful. What is being advocated is not using writing in service of learning to read, but not neglecting writing in the push for improving reading. Learning to write has importance in its own, but the two processes of both reading and writing can better be developed together.

As mentioned earlier, writing activities are the best way to teach critical thinking; thus writing and consequently reading ability are expected to improve after teaching critical thinking skills. Many

scholars have investigated the impact of teaching critical thinking skills to language learners on their improvement in reading and writing skills. Assadi, Davatgar and Jafari (2013) designed a study to find out the effect of critical thinking on enhancing writing among Iranian EFL learners. The participants wrote a pretest writing, then the experimental group received treatment about successful critical thinking strategies based on Bloom's taxonomy of thinking skills. After the administration of posttest of writing, the results revealed that critical thinking instruction had a significant effect on writing performance of the participants.

Soleimani & Ghavami (2014) investigated the effects of critical thinking on writing skill of the learners of teaching language as a foreign language, TEFL, students in Tehran Payame Noor University, Iran. Participants of the study were pretested before the treatment and received a posttest after that in the form of two writings. A 4-point Likert scale questionnaire was also given to the subjects before and after the treatment and all the procedure of the study was done via the Internet. The results of the research revealed that enhancing critical thinking skills had a statistically significant impact on TEFL subjects' writings. Alkoudari, 2015 explored the effect of integrating critical thinking on learners' performance in writing. The results of this mix-method design study also confirmed that integrating critical thinking in teaching the writing skills would enhance students' writing performance and creativity.

Fahim & Saeepour (2011) investigated the impact of teaching critical thinking skills on reading comprehension ability, as well as the effect of applying debate on critical thinking of EFL learners. For this purpose, a reading comprehension and a critical thinking appraisal pretest were administered to the two groups. The experimental group received 8 sessions of treatment using debate as a classroom activity. To compare the two groups they were given the same tests as a posttest. The analysis of collected data showed significant difference between the two groups on reading comprehension test, but the difference on critical thinking test was non-significant. However, the

results indicate that teaching critical thinking skills in EFL context can improve language learning.

Alizamani et al. (2013) investigated the effects of teaching critical thinking strategies on Iranian EFL learners' reading comprehension ability. First, pre-tests of reading comprehension were administered to experimental and control groups to assess their knowledge of reading comprehension before the treatment. The experimental group was then exposed to teaching critical thinking strategies training. Finally, post-tests of reading comprehension were administered to students of both groups at the end of the treatment to assess possible difference of performance of experimental and control groups. Statistical analysis of the results provided evidence in support of the positive effect of critical thinking knowledge on reading comprehension ability.

In line with the studies confirming the positive relationship between critical thinking ability and language proficiency, the present study intended to investigate the impact of teaching critical thinking skills on reading and writing ability of the Iranian language learners.

Statement of the problem

Critical thinking has gained widespread popularity in various disciplines nowadays. Educators have realized the importance of nurturing students who are critical thinkers and have a critical eye to look at the world surrounding them. Critical thinking skills figure prominently among the goals for education, whether one asks developers of curricula, educational researchers, parents, or employers. Although lots of studies have been conducted in various fields to examine the significance of critical thinking and the methods of teaching it, much is not known about the relationship between critical thinking and language learning. In other words, our knowledge about the effects of explicit instruction of critical thinking skills on language learning ability is far from perfect. To shed more light on this issue, the researcher embarked on the task of investigating the impacts of teaching critical thinking skills on reading and writing abilities of language learners. The following questions are investigated in the present study: 1. Does teaching critical thinking skills have any

significant effect on the development of reading ability of Iranian EFL learners? 2. Does teaching critical thinking skills have any significant effect on the development of writing ability of Iranian EFL learners?

Method

Participants

The participants of the present study were 50 pre advanced English learners studying at Simin language institute, Tehran, Iran. They had already passed 15 courses in English and were at pre advanced level of English proficiency. They were attending a class in which all reading, writing, listening and speaking skills were taught based on New Interchange book (4 last units of Interchange 3, 4th edition). There were both male and female learners in class. The learners were between 15 and 24 years of age. The participants were randomly assigned to control and experimental groups, each group consisting of 25 people. There was almost the same number of male and female learners in each group.

Instruments

The 2006 version of paper-based Test of English as a Foreign Language (TOEFL) was administered to the control and experimental groups at the beginning of the study in order to make sure they were homogeneous in terms of their language ability. The reading and writing sections of the TOEFL were used to assess learner's reading and writing abilities at the beginning of the study. After the treatment, the 2007 version of TOEFL was administered to the control and the experimental groups in order to see if critical thinking had a significant effect on promoting learners' reading and writing skills in the experimental group. The reading section of the pretest and posttest was composed of 40 multiple choice questions that was scored by the researcher. The writing section required the students to write a 150-250 word essay in 30 minutes about the given topic. In order to increase the reliability, the writings were scored by the researcher and another qualified teacher based on the TOEFL test scoring criteria. In the cases that the raters gave different scores to the same writing, the

mean of the 2 scores was considered as the writing score of the participant.

Procedures

Fifty language learners taking term 16 (4 last units of Interchange 3) at Simin Language Institute were selected and randomly assigned to the control and experimental groups. In order to ensure that learners were homogenous in terms of their linguistic ability which was supposed to be pre-advanced, a paper-based TOEFL test was administered to learners at the beginning of the semester. The course consisted of 18 sessions, each lasting one and a half hours. The researcher taught both the experimental and the control groups. In both classes, similar units and skills were taught. The teacher played the role of instructor and observer while students went through activities. The students were required to do the homework that contained all 4 language skills of each session. Everything was the same for the control and experimental group except for the treatment. In the experimental class, in addition to going through the lessons and activities in Interchange book, the teacher devoted 20 minutes for teaching critical thinking techniques during the class time. In the very first session, the teacher explicitly explained what critical thinking is and how significant it is to have a critical mind in modern life. Then, during the following sessions the teacher taught critical thinking techniques for about 20 minutes and gave them time to practice them. These skills included involving learners in problem solving activities, raising questions, teaching logical reasoning, evaluating others' arguments, etc. that could be found in detail below:

- **CAT (Classroom Assessment Techniques):** Angelo (1995) stresses the use of ongoing classroom assessment as a way to monitor and facilitate students' critical thinking. An example of a CAT is to ask students to write a "Minute Paper" responding to questions such as "What was the most important thing you learned in today's class? What question related to this session remains uppermost in your mind?" The teacher selects some of the papers and prepares responses for the next class meeting.

- **Cooperative Learning Strategies:** Cooper (1995) argues that putting students in group learning situations is the best way to foster critical thinking. "In properly structured cooperative learning environments, students perform more of the active, critical thinking with continuous support and feedback from other students and the teacher" (p. 8).
- **Case Study /Discussion Method:** McDade (1995) describes this method as the teacher presenting a case (or story) to the class without a conclusion. Using prepared questions, the teacher then leads students through a discussion, allowing students to construct a conclusion for the case.
- **Using Questions:** King (1995) identifies ways of using questions in the classroom:
 - ✓ *Reciprocal Peer Questioning:* Following lecture, the teacher displays a list of question stems (such as, "What are the strengths and weaknesses of..."). Students must write questions about the lecture material. In small groups, the students ask each other the questions. Then, the whole class discusses some of the questions from each small group.
 - ✓ *Reader's Questions:* Require students to write questions on assigned reading and turn them in at the beginning of class. Selecting a few of the questions as the impetus for class discussion is the next step.
- **Conference Style Learning:** The teacher does not "teach" the class in the sense of lecturing. The teacher is a facilitator of a conference. Students must thoroughly read all required material before class. Assigned readings should be in the zone of proximal development. That is, readings should have the quality to be understood by students, and challenging. Students should ask each other questions and discuss them. The teacher does not remain passive, but rather, helps "direct and mold discussions by posing strategic questions and helping students build on each others' ideas" (Underwood & Wald, 1995, p. 18).
- **Use Writing Assignments:** Wade sees the use of writing as fundamental to developing critical thinking skills. "With written

assignments, an instructor can encourage the development of dialectic reasoning by requiring students to argue both [or more] sides of an issue" (p. 24).

- **Dialogues:** Robertson and Rane-Szostak (1996) identify two methods of stimulating useful discussions in the classroom:
 - ✓ *Written dialogues:* Give students written dialogues to analyze. In small groups, students must identify the different viewpoints of each participant in the dialogue. They must look for biases, presence or exclusion of important evidence, alternative interpretations, misstatement of facts, and errors in reasoning. Each group must decide which view is the most reasonable. After coming to a conclusion, each group acts out the dialogue and explains the analysis of it.
 - ✓ *Spontaneous Group Dialogue:* One group of students is assigned roles to play in a discussion (such as leader, information giver, opinion seeker, and disagreeer). Four observer groups are formed with the functions of determining what roles are being played by whom, identifying biases and errors in thinking, evaluating reasoning skills, and examining ethical implications of the content.
- **Ambiguity:** Strohm & Baukus advocate producing much ambiguity in the classroom. Don't give students clear cut material. Give them conflicting information that to think their way through.

Based on the above-mentioned techniques, in order to raise the students' critical thinking ability in the experimental group, the teacher asked the students to write a paragraph about what they found interesting or the questions that remained unanswered as homework at the end of each session. The paragraphs were discussed at the beginning of the following session as warm up. Most class activities were done in pairs or groups to provide more discussion and interaction opportunities for the students.

None of the reading comprehension texts that were presented at the

end of each unit was taught by the teacher. Instead, 3 or 4 students were assigned to teach each text to the whole class as a conference. The other students were supposed to take notes while listening to the lectures, discuss what they understood and the vague parts in groups and then ask their questions from the lecturers.

During the treatment period, the students were given two topics as writing assignment to discuss pros and cons of “plastic surgery operations” and “abortion”. They were then asked to read the writing of one of their peers and evaluate its reasoning skill. They were also given two written dialogues and asked to discuss the viewpoints of the characters and their reasoning ability in pairs. The teacher finally asked the pairs to share their answers with the whole class and analyzed the dialogue critically.

Design

The design of the present study was a quasi-experimental design in which there were participants who were randomly assigned to the control and experimental groups. Due to logistic constraints, it was not feasible for the researcher to randomly select the participants of the study. Therefore, the researcher used subjects of convenience and random assignment of the participants to the control and experimental design was done.

Data Analysis and Results

After administering the TOEFL test at the outset, in order to make sure that the control and experimental groups had almost the same level in our specific areas of interest (reading and writing) at the beginning of the study, two independent *t*-tests were carried out; the first one was carried out between the experimental and control groups in reading pre-test. The results presented in table 1 indicate that the means of both groups in reading were very close and there was no significant difference in the results. Thus, we could conclude that the experimental group with the mean of 14.40 and the control group with the mean of 14.56 were equivalent in terms of reading level at the beginning of the study.

Table 1. Independent t-test of differences across two groups for reading pre-test scores

Groups	<i>n</i>	<i>M</i>	<i>S</i>	<i>df</i>	<i>t</i>	<i>Sig.</i>
G1	25	14.56	2.02	48	.24	.81
G2	25	14.40	2.61			

$p < .05$, G1= Control group, G2= Experimental group

The second independent *t*-test was between the experimental and control group in writing pre-test. The results presented in table 2 indicate that the means of both groups in writing, 14.64 for the experimental group and 14.16 for the control group, were very close and there was no significant difference in the results. Thus, the researcher concluded that there were equal groups in writing level at the beginning of the study.

Table 2. Independent t-test of differences across two groups for writing pre-test scores

Groups	<i>n</i>	<i>M</i>	<i>S</i>	<i>df</i>	<i>t</i>	<i>Sig.</i>
G1	25	14.16	2.07	48	- .77	.44
G2	25	14.64	2.28			

$p < .05$

Having gone through the experimentation phase, an independent sample *t*-test was employed to compare the mean scores of the control and experimental groups on final reading and writing tests. Alpha level at .05 ($P=.05$) was set. As the mean score of the experimental group was statistically larger than the mean score of the control group, the researcher could conclude that critical thinking instruction had a significant effect on the reading and writing abilities of the learners since everything was the same for both groups except the treatment.

The first research question of this study was 1. Does teaching critical thinking skills have any significant effect on the development of reading ability of Iranian EFL learners? It includes two variables: (1) critical thinking (the independent variable), and achievement in reading (the dependent variable). Pair wise comparison between the mean scores of the experimental and control group in reading scores, that were 18.04 and 14.86 respectively, indicates a statistically significant effect for critical thinking on students' achievement in reading; thus the first null hypothesis is rejected. This means that when students were given the opportunity to have critical thinking in

their schedules, they displayed statistically higher achievement in reading than when solely exposed to teacher as the only tutor in the classroom. The results are presented in table 3 below.

Table 3. Independent t-test of differences across two groups for reading post-test scores

Groups	<i>n</i>	<i>M</i>	<i>S</i>	<i>df</i>	<i>t</i>	<i>Sig.</i>
G1	25	14.86	1.83	48	-5.80	.00
G2	25	18.04	2.15			

$p < .05$

The second research question of the study was 2. Does teaching critical thinking skills have any significant effect on the development of writing ability of Iranian EFL learners? It includes two variables: (1) critical thinking (the independent variable), and (2) achievement in writing (the dependent variable). Pair wise comparison between the mean score of the experimental group, 17.56, and the control group, 15.20, in writing scores indicates a statistically significant effect for critical thinking on students' achievement in writing. Here, the second null hypothesis is also rejected and it can be said that critical thinking in this study did enhance achievement in writing. The results could be observed in table 4.

Table 4. Independent t-test of differences across two groups for writing post-test scores

Groups	<i>n</i>	<i>M</i>	<i>S</i>	<i>df</i>	<i>t</i>	<i>Sig.</i>
G1	25	15.20	2.08	48	-4.23	.00
G2	25	17.56	1.85			

$p < .05$

Discussion

The aim of this study was to examine whether critical thinking has a meaningful effect on reading on writing skills of the Iranian EFL learners. As illustrated in the previous section, the results of this study confirmed the significant contributions of teaching critical thinking skills in EFL classroom on students' performance in reading and writing. The results of the study are in line with findings reported by other Iranian researchers of critical thinking (Assadi, 2013) who demonstrated that critical thinking had significant effects on the

writings of the group of language learners who received proper treatments. The study conducted by Fahim and Saeepour (2011) also confirmed the improvement of language learners in reading skill after receiving 8 sessions of treatment in critical thinking using debate.

Applying critical thinking in educational environment has become an important topic, and is receiving a great amount of attention in different disciplines. Some claim that thinking and reasoning skills can be taught as if they are generalizable and transferrable skills (Davidson & Hawkins, 1998), while others believe that critical thinking is not an autonomous, cognitive skill that can be learned out of context; domain knowledge and domain practice are essential for critical thinking practice both inside and outside the classroom (Atkinson & Pennycook, 1999).

With regard to the findings of the previous studies and the results of the current research, it could be realized that critical thinking has a statistically significant effect on many aspects of human life and skills including reading and writing abilities.

Pedagogical implications

Considering the pivotal contributions of including critical thinking principles in educational programs, the results of the present study has pedagogical implications for syllabus and material designers, teachers, students and test developers. The syllabus and material designers are suggested to include critical thinking instruction in text books and teacher training courses. Students require materials that invoke their critical thinking and teachers should be trained to change their attitudes toward students and themselves (Kabilan, 2000). Teachers are recommended to include critical thinking techniques such as dialogues, writing assignments, cooperative learning strategies, conferences, etc. in every session to improve communicative competence and intellectual abilities of the students (Cole, 2008). They are also suggested to have the role of a patient facilitator, guiding students to be critical thinkers.

Test developers are also addressed in this study. As the aim of testing is to evaluate the curriculum and the development of the

learners, this study suggests the test developers to design tests in a way that affects the teaching quality and improves the students' critical thinking ability. It is, therefore, evident how evoking critical thinking ability of the learners could facilitate their learning in all disciplines. However, further studies are required to provide empirical evidence for this claim.

Suggestions for further research

The present study investigated the efficacy of critical thinking in the development of reading and writing skills of Iranian pre-advanced learners. The researchers are, therefore, suggested to investigate the impact of teaching critical thinking skills on the improvement of other language skills and sub-skills such as listening, speaking, vocabulary and grammar. The participants of the present study were pre-advanced adults. Thus, future studies could be conducted to examine the efficacy of critical thinking on basic proficiency level language learners and kids. The design of this study and most other studies that have been conducted so far have been experimental. Qualitative and long-term studies might reveal different results.

This study investigated the impact of critical thinking on language learners in the language institute. Further studies can be held in other settings such as universities, schools, kindergartens, etc. It is also suggested that other researchers investigate which teaching strategies and assessments are best adapted to critical thinking to help the material and test developers.

Conclusion

Beyer (1995) believes that the teaching of critical thinking is very important. He argues that to live successfully in a democracy, people must be able to think critically in order to make sound decisions about personal and civic affairs. If students learn to think critically, then they can use good thinking as the guide by which they live their lives.

Accordingly, the results of the present study, in line with similar findings in previous studies by Alizamani et al. (2013) and Mehdipour

& Yaghoubi (2015), proves the significant role of critical thinking in improving learners' reading and writing skills, are applicable for a number of groups. Alizamani et al. (2013) investigated the effects of teaching critical thinking strategies on Iranian EFL learners' reading comprehension ability. The results of the study showed that critical thinking knowledge helped students in a better understanding of English language texts. Mehdipour and Yaghoubi (2015) investigated the impact of teaching critical thinking tasks among EFL learners. The results showed that teaching critical thinking tasks can make a valuable contribution to learners to become competent writers with regard to coherency. The teachers of English as a foreign language can realize that teaching critical thinking skills is a worthwhile activity. As the findings of the study prove that promoting critical thinking in learners is possible and beneficiary, teachers can use these techniques to boost students' learning. Students can also benefit from the findings of this study since becoming critical thinker is the goal of many disciplines including language learning, Hatcher, 2013. Stakeholders and material developers may also come to the conclusion that new policies should be chosen and new materials should be prepared to incorporate techniques that are necessary to foster language learners' thinking abilities.

References

- Alizamani, H., Khodabandehlou, M., & Mobashernia, R. (2013). The effects of teaching critical thinking strategies on Iranian EFL learners' reading comprehension ability. *Indian Journal of Fundamental and Applied Life Sciences*, 3(3), 133-141.
- Alkoudary, Y. A. M. (2015). The effect of teaching critical thinking on Al-Buraimi University college students' writing skills: A case study, *International Journal of applied linguistics and English literature*, 4(6), 212-219.
- Allegretti C. L. & Frederick J. N. (1995). A model for thinking critically about ethical issues, *Teach Psychol*, 22, 46-48.
- Alwehaibi, H. U. (2013). Novel program to promote critical thinking among higher education students: Empirical study from Saudi Arabia. *Asian Social Science*, 8(11), 193-204.

- Angelo, T. A. (1995). Beginning the dialogue: Thoughts on promoting critical thinking: Classroom assessment for critical thinking. *Teaching of Psychology*, 22(1), 6-7.
- Armbruster, B. B., Lehr, F., & Osborn, J. (2001). *Put reading first: The research building blocks for teaching children to read*. Washington, DC: National Institute for Literacy.
- Assadi, N., Davatgar, H., & Jafari, P. (2013). The effect of critical thinking on enhancing writing among Iranian EFL learners. *International Journal of scientific and engineering research*, 4(3), 1-7.
- Bernstein, D. (1985). A negotiation model for teaching critical thinking. *Teach Psychol*, 22, 22-24.
- Beyer, B. K. (1995). *Critical thinking*. Bloomington. IN: Phi Delta Kappa Educational Foundation.
- Black, B. & Thompson, A. (2012). *An A to Z of critical thinking*. London: Continuum.
- Brown, H. D. (2002). *An interactive approach to language pedagogy*. NY: Pearson production.
- Clay, M. M. (1998). *By different paths to common outcomes*. York, ME: Stenhouse.
- Cortell, S. (2005). *Critical thinking skills: Developing effective analysis and argument*. New York: Palgrave Macmillan.
- Facione, P. A. (2007). *Critical thinking: What it is and what it counts*. Retrieved from <http://www.control-z.com/storage/what-is-ct.pdf>.
- Fahim, M. & Saeepour, M. (2011). The impact of teaching critical thinking skills on reading comprehension of Iranian EFL learners. *Journal of Language Teaching and Research*, 2(4), 867-874.
- Fisher, A. & Scriven, M. (1997). *Critical thinking: Its definition and assessment*. CA: Edge Press.
- Ghavami, M. & Soleimani, H. (2014). Critical thinking and writing: The effects of critical thinking on writing skill among Iranian University students majoring in TEFL. *International Journal of language learning and applied linguistics world*, 5(4), 254-266.
- Goatly, A. (2000). *Critical reading and writing*. London: English Route.
- Gorgian, B., Parang, K., & Pazhakh, A. (2012). An Investigation on the Effect of Critical Thinking Instructions on Iranian EFL learners descriptive writing: A case of gender study. *Advances in Asian social science*, 1(1), 114-118.
- Hansberry, L. (1959). *A raisin in the Sun*. New York: Vintage books.
- Hatcher, Donald L. (2013). Is critical thinking across the curriculum a plausible goal?. *OSSA Conference Archive*, 69.

- Hemigway, E. (1925). *A soldier's home*. New York: Boni & Liveright.
- King, A. (1995). Designing the instructional process to enhance critical thinking across the curriculum: Inquiring minds really do want to know: Using questioning to teach critical thinking. *Teaching of Psychology*, 22(1), 13-17.
- Malmir, A. & Soorcheh, S. (2012). An investigation of the impact of teaching critical thinking on the Iranian EFL learners' speaking skill. *Journal of language teaching and research*, 3(4), 608-617.
- Mehdipour, D. & Yaghoubi, A. (2015). The impact of teaching critical thinking tasks on coherence in argumentative essay writing among EFL learners. *Mediterranean journal of social sciences*, 6(6), 460-468.
- Mills J. (1995). Better teaching through provocation. *College Teach*, 46, 21-25.
- Mishoe, S. C. & Welch, M. A. (2002). *Critical thinking in respiratory care: A problem-based learning approach*. New York: McGraw-Hil.
- Mooney, M. (2003). Reading with the pen and writing in the head. *National Reading Recovery and Descubriendo la Lectura Conference*, Columbus, OH.
- Richard, J.C. & Renandya, W.A. (2002). *Methodology in language teaching*. Cambridge: Cambridge University Press.
- Richards, J.C. & Schmidt, R. (2002). *Longman dictionary of language teaching and applied linguistics*. London: Pearson Education.
- Richards, J.C., Janathan, H., & Proctor, S. (2016). *Interchange 3*, 4th ed., Cambridge: Cambridge University Press.
- Robertson, J. F. & Rane-Szostak, D. (1996). Using dialogues to develop critical thinking skills: A practical approach. *Journal of adolescent & adult literacy*, 39(7), 552-556.
- Schmitt, N. (2002). *An Introduction to Applied Linguistics*. Oxford: Oxford University Press.
- Stauffer, R. (1970). *The language-experience approach to the teaching of reading*. New York: Harper & Row.
- Teale, W. H. & Yokota, J. (2000). *Beginning reading and writing: Perspectives on instruction*. DE: International Reading Association.
- Todd Caroll, R. (2005). Teaching Critical Thinking. *The Amazing Meeting Conference*, Las Vegas.
- Wallance, M. & Wray, A. (2011). *Critical Reading and Writing for Postgraduates*. London: SAGE Publications Ltd.

Appendices

Text 1- Written dialogue

Extracted from "A Raisin in the Sun by Lorraine Hansberry"

Mama: Oh - So now it's life. Money is life. Once upon a time freedom used to be life - now it's money. I guess the world really do change.

Walter: No - it was always money, Mama. We just didn't know about it.

Mama: No . . . something has changed. You something new, boy. In my time we was worried about not being lynched. You ain't satisfied or proud of nothing we done. I mean that you had a home; that we kept you out of trouble till you was grown; that you don't have to ride to work on the back of nobody's streetcar. You my children - but how different we done become.

1. What is the difference between the viewpoints of the two characters about money?
2. How strongly can mama convince her son in this dialogue?
3. What might be the following reply of Walter?

Text 2- Written dialogue

Extracted from A soldier's home, Earnest Hemingway

Mom: God has some work for everyone to do. There can't be no idle hands in His Kingdom.

Krebs: I'm not in His Kingdom.

Mom: We are all of us in His Kingdom. I've worried about you so much. I know the temptations you must have been exposed to. I know how weak men are. I know what your own dear grandfather, my own father, told us about the Civil War and I have prayed for you. I pray for you all day long.

1. Explain the conflicting viewpoints of Krebs and his mom.
2. What type of characteristic each of them have?
3. What is Krebs probably thinking and feeling?

Reading Pretest

Questions 1-14 are based on the following passage.

Extinction of the Dinosaurs

Paleozoic Era	334 to 248 million years ago
Mesozoic Era	245 to 65 million years ago
-Early Mesozoic Era-Triassic Period -Mid Mesozoic Era-Jurassic Period -Late Mesozoic Era-Cretaceous Period	
Cenozoic Era	65 million years ago to the present

1. Paleontologists have argued for a long time that the demise of the dinosaurs was caused by climatic alterations associated with slow changes in the positions of continents and seas resulting from plate tectonics. Off and on throughout the Cretaceous (the last period of the Mesozoic era, during which dinosaurs flourished), large shallow seas covered extensive areas of the continents. Data from diverse sources, including geochemical evidence preserved in seafloor sediments, indicate that the Late Cretaceous climate was milder than today's. The days were not too hot, nor the nights too cold. The summers were not too warm, nor the winters too frigid. The shallow seas on the continents probably buffered the temperature of the nearby air, keeping it relatively constant.
2. At the end of the Cretaceous, the geological record shows that these seaways retreated from the continents back into the major ocean basins. No one knows why. Over a period of about 100,000 years, while the seas pulled back, climates around the world became dramatically more extreme: warmer days, cooler nights; hotter summers, colder winters. Perhaps dinosaurs could not tolerate these extreme temperature changes and became extinct.
3. If true, though, why did cold-blooded animals such as snakes, lizards, turtles, and crocodiles survive the freezing winters and torrid summers? These animals are at the mercy of the climate to maintain a livable body temperature. It's hard to understand why they would not be affected, whereas dinosaurs were left too crippled to cope, especially if, as some scientists believe, dinosaurs were warm-blooded. Critics also point out that the shallow seaways had retreated from and advanced on the continents numerous times during the Mesozoic, so why did the dinosaurs survive the climatic changes associated with the earlier fluctuations but not with this one? Although initially appealing, the hypothesis of a simple climatic change related to sea levels is insufficient to explain all the data.
4. Dissatisfaction with conventional explanations for dinosaur extinctions led to a surprising observation that, in turn, has suggested a new hypothesis. Many plants and animals disappear abruptly from the fossil record as one moves from layers of rock documenting the end of the Cretaceous up into rocks representing the beginning of the Cenozoic (the era after the Mesozoic). Between the last layer of Cretaceous rock and the first layer of Cenozoic rock, there is often a thin layer of clay. Scientists felt that they could get an idea of how long the extinctions took by determining how long it took to deposit this one centimeter of clay and they thought they could determine the time it took to deposit the clay by determining the amount of the element iridium (Ir) it contained.
5. Ir has not been common at Earth's surface since the very beginning of the planet's history. Because it usually exists in a metallic state, it was preferentially incorporated in Earth's core as the planet cooled and

consolidated. Ir is found in high concentrations in some meteorites, in which the solar system's original chemical composition is preserved. Even today, microscopic meteorites continually bombard Earth, falling on both land and sea. By measuring how many of these meteorites fall to Earth over a given period of time, scientists can estimate how long it might have taken to deposit the observed amount of Ir in the boundary clay. These calculations suggest that a period of about one million years would have been required. However, other reliable evidence suggests that the deposition of the boundary clay could not have taken one million years. So the unusually high concentration of Ir seems to require a special explanation.

6. In view of these facts, scientists hypothesized that a single large asteroid, about 10 to 15 kilometers across, collided with Earth, and the resulting fallout created the boundary clay. Their calculations show that the impact kicked up a dust cloud that cut off sunlight for several months, inhibiting photosynthesis in plants; decreased surface temperatures on continents to below freezing; caused extreme episodes of acid rain; and significantly raised long-term global temperatures through the greenhouse effect. This disruption of food chain and climate would have eradicated the dinosaurs and other organisms in less than fifty years.

1. According to paragraph 1, which of the following is true of the Late Cretaceous climate?
 - a. Summers were very warm and winters were very cold.
 - b. Shallow seas on the continents caused frequent temperature changes.
 - c. The climate was very similar to today's climate.
 - d. The climate did not change dramatically from season to season.
2. Which of the following reasons is suggested in paragraph 2 for the extinction of the dinosaurs?
 - a. Changes in the lengths of the days and nights during the Late Cretaceous period
 - b. Droughts caused by the movement of seaways back into the oceans
 - c. The change from mild to severe climates during the Late Cretaceous period
 - d. An extreme decrease in the average yearly temperature over 10,000 years
3. Why does the author mention the survival of "snakes, lizards, turtles, and crocodiles" in paragraph 3?
 - a. To argue that dinosaurs may have become extinct because they were not cold-blooded animals
 - b. To question the adequacy of the hypothesis that climatic change related to sea levels caused the extinction of the dinosaurs
 - c. To present examples of animals that could maintain a livable body temperature more easily than dinosaurs

- d. To support a hypothesis that these animals were not as sensitive to climate changes in the Cretaceous period as they are today
- 4. The word "cope" in paragraph 3 is closest in meaning to
 - a. adapt
 - b. move
 - c. continue
 - d. compete
- 5. According to paragraph 3, which of the following is true of changes in climate before the Cretaceous period and the effect of these changes on dinosaurs?
 - a. Climate changes associated with the movement of seaways before the Cretaceous period did not cause dinosaurs to become extinct.
 - b. Changes in climate before the Cretaceous period caused severe fluctuations in sea level, resulting in the extinction of the dinosaurs.
 - c. Frequent changes in climate before the Cretaceous period made dinosaurs better able to maintain a livable body temperature.
 - d. Before the Cretaceous period there were few changes in climate, and dinosaurs flourished.
- 6. The word "fluctuations" in paragraph 3 is closest in meaning to
 - a. extremes
 - b. retreats
 - c. periods
 - d. variations
- 7. Which of the sentences below best expresses the essential information in the highlighted sentence in paragraph 4? Incorrect choices change the meaning in important ways or leave out essential information.
 - a. The fossil record suggests that there was an abrupt extinction of many plants and animals at the end of the Mesozoic era.
 - b. Few fossils of the Mesozoic era have survived in the rocks that mark the end of the Cretaceous.
 - c. Fossils from the Cretaceous period of the Mesozoic up to the beginning of the Cenozoic era have been removed from the layers of rock that surrounded them.
 - d. Plants and animals from the Mesozoic era were unable to survive in the Cenozoic era.
- 8. In paragraph 4, all the following questions are answered EXCEPT:
 - a. Why is there a layer of clay between the rocks of the Cretaceous and Cenozoic?
 - b. Why were scientists interested in determining how long it took to deposit the layer of clay at the end of the Cretaceous?
 - c. What was the effect of the surprising observation scientists made?

- d. Why did scientists want more information about the dinosaur extinctions at the end of the Cretaceous?
9. The word "bombard" in paragraph 5 is closest in meaning to
- approach
 - strike
 - pass
 - circle
10. Paragraph 5 implies that a special explanation of the Ir in the boundary clay is needed because
- the Ir in microscopic meteorites reaching Earth during the Cretaceous period would have been incorporated into Earth's core
 - the Ir in the boundary clay was deposited much more than a million years ago
 - the concentration of Ir in the boundary clay is higher than in microscopic meteorites
 - the amount of Ir in the boundary clay is too great to have come from microscopic meteorites during the time the boundary clay was deposited
11. The word "disruption" in paragraph 6 is closest in meaning to
- exhaustion
 - disturbance
 - modification
 - disappearance
12. Paragraph 6 mentions all of the following effects of the hypothesized asteroid collision EXCEPT:
- a large dust cloud that blocked sunlight
 - an immediate drop in the surface temperatures of the continents
 - an extreme decrease in rainfall on the continents
 - a long-term increase in global temperatures
13. Directions: Look at the part of the passage displayed below with the letters A, B, C and D. Where would the following sentence best fit?

Consequently, the idea that the Ir in the boundary clay came from microscopic meteorites cannot be accepted.

Ir has not been common at Earth's surface since the very beginning of the planet's history. Because it usually exists in a metallic state, it was preferentially incorporated in Earth's core as the planet cooled and consolidated. Ir is found in high concentrations in some meteorites, in which the solar system's original chemical composition is preserved. Even today, microscopic meteorites continually bombard Earth, falling on both land and sea. By measuring how many of these meteorites fall to Earth over a given period of time, scientists can estimate how long it might have taken to deposit the observed amount of Ir in the boundary clay. A. These calculations suggest that a period of about one million

years would have been required. B. However, other reliable evidence suggests that the deposition of the boundary clay could not have taken one million years. C. So the unusually high concentration of Ir seems to require a special explanation. D.

14. Directions: An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the 3 answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage.

This question is worth 2 points.

Choose 3 answers.

Introductory sentence: For a long time, scientists have argued that the extinction of the dinosaurs was related to climate change.

Answer Choices:

- a. Extreme changes in daily and seasonal climates preceded the retreat of the seas back into the major ocean basins.
- b. A simple climate change does not explain some important data related to the extinction of the dinosaurs at the end of the Cretaceous.
- c. The retreat of the seaways at the end of the Cretaceous has not been fully explained.
- d. The abruptness of extinctions at the end of the Cretaceous and the high concentration of Ir found in clay deposited at that time have fueled the development of a new hypothesis.
- e. Some scientists hypothesize that the extinction of the dinosaurs resulted from the effects of an asteroid collision with Earth.
- f. Boundary clay layers like the one between the Mesozoic and Cenozoic are used by scientists to determine the rate at which an extinct species declined.

Questions 15-28 are based on the following passage.

Running Water on Mars?

- 1. Photographic evidence suggests that liquid water once existed in great quantity on the surface of Mars. Two types of flow features are seen: runoff channels and outflow channels. Runoff channels are found in the southern highlands. These flow features are extensive systems-sometimes hundreds of kilometers in total length- of interconnecting, twisting channels that seem to merge into larger, wider channels. They bear a strong resemblance to river systems on Earth, and geologists think that they are dried-up beds of long-gone rivers that once carried rainfall on Mars from the mountains down into the valleys. Runoff channels on Mars speak of a time 4 billion years ago (the age of the Martian highlands), when the atmosphere was thicker, the surface warmer, and liquid water widespread.
- 2. Outflow channels are probably relics of catastrophic flooding on Mars long ago. They appear only in equatorial regions and generally do not form extensive interconnected networks. Instead, they are probably the paths taken

by huge volumes of water draining from the southern highlands into the northern plains. The onrushing water arising from these flash floods likely also formed the odd teardrop-shaped "islands" (resembling the miniature versions seen in the wet sand of our beaches at low tide) that have been found on the plains close to the ends of the outflow channels. Judging from the width and depth of the channels, the flow rates must have been truly enormous—perhaps as much as a hundred times greater than the 105 tons per second carried by the great Amazon River. Flooding shaped the outflow channels approximately 3 billion years ago, about the same time as the northern volcanic plains formed.

3. Some scientists speculate that Mars may have enjoyed an extended early period during which rivers, lakes, and perhaps even oceans adorned its surface. A 2003 Mars Global Surveyor image shows what mission specialists think may be a delta—a fan-shaped network of channels and sediments where a river once flowed into a larger body of water, in this case a lake filling a crater in the southern highlands. Other researchers go even further, suggesting that the data provide evidence for large open expanses of water on the early Martian surface. A computer-generated view of the Martian north polar region shows the extent of what may have been an ancient ocean covering much of the northern lowlands. The Hellas Basin, which measures some 3,000 kilometers across and has a floor that lies nearly 9 kilometers below the basin's rim, is another candidate for an ancient Martian sea.
4. These ideas remain controversial. Proponents point to features such as the terraced "beaches" shown in one image, which could conceivably have been left behind as a lake or ocean evaporated and the shoreline receded. But detractors maintain that the terraces could also have been created by geological activity, perhaps related to the geologic forces that depressed the Northern Hemisphere far below the level of the south, in which case they have nothing whatever to do with Martian water. Furthermore, Mars Global Surveyor data released in 2003 seem to indicate that the Martian surface contains too few carbonate rock layers—layers containing compounds of carbon and oxygen—that should have been formed in abundance in an ancient ocean. Their absence supports the picture of a cold, dry Mars that never experienced the extended mild period required to form lakes and oceans. However, more recent data imply that at least some parts of the planet did in fact experience long periods in the past during which liquid water existed on the surface.
5. Aside from some small-scale gullies (channels) found since 2000, which are inconclusive, astronomers have no direct evidence for liquid water anywhere on the surface of Mars today, and the amount of water vapor in the Martian atmosphere is tiny. Yet even setting aside the unproven hints of ancient oceans, the extent of the outflow channels suggests that a huge total volume of water existed on Mars in the past. Where did all the water go? The answer may be that virtually all the water on Mars is now locked in the permafrost layer under the surface, with more contained in the planet's polar caps.

For each question, choose 1 answer unless there are special directions.

15. The word "merge" in paragraph 1 is closest in meaning to
- A. expand
 - B. separate
 - C. straighten out
 - D. combine
16. What does the discussion in paragraph 1 of runoff channels in the southern highlands suggest about Mars?
- A. The atmosphere of Mars was once thinner than it is today.
 - B. Large amounts of rain once fell on parts of Mars.
 - C. The river systems of Mars were once more extensive than Earth's.
 - D. The rivers of Mars began to dry up about 4 billion years ago.
17. The word "relics" in paragraph 2 is closest in meaning to
- A. remains
 - B. sites
 - C. requirements
 - D. sources
18. The word "miniature" in paragraph 2 is closest in meaning to
- A. temporary
 - B. small
 - C. multiple
 - D. familiar
19. In paragraph 2, why does the author include the information that 105 tons of water flow through the Amazon River per second?
- A. To emphasize the great size of the volume of water that seems to have flowed through Mars' outflow channels
 - B. To indicate data used by scientists to estimate how long ago Mars' outflow channels were formed
 - C. To argue that flash floods on Mars may have been powerful enough to cause tear-shaped "islands" to form
 - D. To argue that the force of flood waters on Mars was powerful enough to shape the northern volcanic plains
20. According to paragraph 2, all of the following are true of the outflow channels on Mars EXCEPT:
- A. They formed at around the same time that volcanic activity was occurring on the northern plains.
 - B. They are found only on certain parts of the Martian surface.
 - C. They sometimes empty onto what appear to have once been the wet sands of tidal beaches.

- D. They are thought to have carried water northward from the equatorial regions.
21. All of the following questions about geological features on Mars are answered in paragraph 3 EXCEPT:
- A. What are some regions of Mars that may have once been covered with an ocean?
 - B. Where do mission scientists believe that the river forming the delta emptied?
 - C. Approximately how many craters on Mars do mission scientists believe may once have been lakes filled with water?
 - D. During what period of Mars' history do some scientists think it may have had large bodies of water?
22. According to paragraph 3, images of Mars' surface have been interpreted as support for the idea that
- A. the polar regions of Mars were once more extensive than they are now
 - B. a large part of the northern lowlands may once have been under water
 - C. deltas were once a common feature of the Martian landscape
 - D. the shape of the Hellas Basin has changed considerably over time
23. What can be inferred from paragraph 3 about liquid water on Mars?
- A. If ancient oceans ever existed on Mars' surface, it is likely that the water in them has evaporated by now.
 - B. If there is any liquid water at all on Mars' surface today, its quantity is much smaller than the amount that likely existed there in the past.
 - C. Small-scale gullies on Mars provide convincing evidence that liquid water existed on Mars in the recent past.
 - D. The small amount of water vapor in the Martian atmosphere suggests that there has never been liquid water on Mars.
24. Which of the sentences below best expresses the essential information in the highlighted sentence in paragraph 4? Incorrect choices change the meaning in important ways or leave out essential information.
- A. But detractors argue that geological activity may be responsible for the water associated with the terraces.
 - B. But detractors argue that the terraces may have been formed by geological activity rather than by the presence of water.
 - C. But detractors argue that the terraces may be related to geological forces in the Northern Hemisphere of Mars, rather than to Martian water in the south.
 - D. But detractors argue that geological forces depressed the Northern Hemisphere so far below the level of the south that the terraces could not have been formed by water.
25. According to paragraph 4, what do the 2003 Global Surveyor data suggest about Mars?

- A. Ancient oceans on Mars contained only small amounts of carbon.
- B. The climate of Mars may not have been suitable for the formation of large bodies of water.
- C. Liquid water may have existed on some parts of Mars' surface for long periods of time.
- D. The ancient oceans that formed on Mars dried up during periods of cold, dry weather.

26. The word "hints" in paragraph 5 is closest in meaning to

- A. clues
- B. features
- C. arguments
- D. effects

27. Directions: Look at the part of the passage displayed below with the letters A, B, C and D. Where would the following sentence best fit?

These landscape features differ from runoff channels in a number of ways.

Outflow channels are probably relics of catastrophic flooding on Mars long ago. A. They appear only in equatorial regions and generally do not form extensive interconnected networks. B. Instead, they are probably the paths taken by huge volumes of water draining from the southern highlands into the northern plains. C. The onrushing water arising from these flash floods likely also formed the odd teardrop-shaped "islands" (resembling the miniature versions seen in the wet sand of our beaches at low tide) that have been found on the plains close to the ends of the outflow channels. D. Judging from the width and depth of the channels, the flow rates must have been truly enormous—perhaps as much as a hundred times greater than the 105 tons per second carried by the great Amazon River. Flooding shaped the outflow channels approximately 3 billion years ago, about the same time as the northern volcanic plains formed.

28. Directions: An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the 3 answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage.

This question is worth 2 points.

Choose 3 answers.

Introductory sentence: There is much debate concerning whether Mars once had water.

Answer Choices:

- A. Various types of images have been used to demonstrate that most of the Martian surface contains evidence of flowing water.
- B. The runoff and outflow channels of Mars apparently carried a higher volume of water and formed more extensive networks than do Earth's river systems.

- C. Mars' runoff and outflow channels are large-scale, distinctive features that suggest that large quantities of liquid water once flowed on Mars.
- D. Although some researchers claim that Mars may once have had oceans, others dispute this, pointing to an absence of evidence or offering alternative interpretations of evidence.
- E. While numerous gullies have been discovered on Mars since 2000, many astronomers dismiss them as evidence that Mars once had liquid water.
- F. There is very little evidence of liquid water on Mars today, and it is assumed that all the water that once existed on the planet is frozen beneath its surface.

Questions 29-40 are based on the following passage.

The Rise of Teotihuacán

1. The city of Teotihuacán, which lay about 50 kilometers northeast of modern-day Mexico City, began its growth by 200-100 B.C. At its height, between about A.D. 150 and 700, it probably had a population of more than 125,000 people and covered at least 20 square kilometers. It had over 2,000 apartment complexes, a great market, a large number of industrial workshops, an administrative center, a number of massive religious edifices, and a regular grid pattern of streets and buildings. Clearly, much planning and central control were involved in the expansion and ordering of this great metropolis. Moreover, the city had economic and perhaps religious contacts with most parts of Mesoamerica (modern Central America and Mexico).
2. How did this tremendous development take place, and why did it happen in the Teotihuacán Valley? Among the main factors are Teotihuacán's geographic location on a natural trade route to the south and east of the Valley of Mexico, the obsidian type of volcanic glasslike rock used for manufacturing tools and ceremonial objects resources in the Teotihuacán Valley itself, and the valley's potential for extensive irrigation. The exact role of other factors is much more difficult to pinpoint—for instance, Teotihuacán's religious significance as a shrine, the historical situation in and around the Valley of Mexico toward the end of the first millennium B.C., the ingenuity and foresightedness of Teotihuacán's elite, and, finally, the impact of natural disasters, such as the volcanic eruptions of the late first millennium B.C.
3. This last factor is at least circumstantially implicated in Teotihuacán's rise. Prior to 200 B.C., a number of relatively small centers coexisted in and near the Valley of Mexico. Around this time, the largest of these centers, Cuicuilco, was seriously affected by a volcanic eruption, with much of its agricultural land covered by lava. With Cuicuilco eliminated as a potential rival, any one of a number of relatively modest towns might have emerged as a leading economic and political power in Central Mexico. The archaeological evidence clearly indicates, though, that Teotihuacán was the center that did arise as the predominant force in the area by the first century A.D.

4. It seems likely that Teotihuacán's natural resources - along with the city elite's ability to recognize their potential-gave the city a competitive edge over its neighbors. The valley, like many other places in Mexican and Guatemalan highlands, was rich in obsidian. The hard volcanic stone was a resource that had been in great demand for many years, at least since the rise of the Olmecs (a people who flourished between 1200 and 400 B.C.), and it apparently had a secure market. Moreover, recent research on obsidian tools found at Olmec sites has shown that some of the obsidian obtained by the Olmecs originated near Teotihuacán. Teotihuacán obsidian must have been recognized as a valuable commodity for many centuries before the great city arose.
5. Long-distance trade in obsidian probably gave the elite residents of Teotihuacán access to a wide variety of exotic goods, as well as a relatively prosperous life. Such success may have attracted immigrants to Teotihuacán. In addition, Teotihuacán's elite may have consciously attempted to attract new inhabitants. It is also probable that as early as 200 B.C. Teotihuacán may have achieved some religious significance and its shrine (or shrines) may have served as an additional population magnet. Finally, the growing population was probably fed by increasing the number and size of irrigated fields.
6. The picture of Teotihuacán that emerges is a classic picture of positive feedback among obsidian mining and working, trade, population growth, irrigation, and religious tourism. The thriving obsidian operation, for example, would necessitate more miners, additional manufacturers of obsidian tools, and additional traders to carry the goods to new markets. All this led to increased wealth, which in turn would attract more immigrants to Teotihuacán. The growing power of the elite, who controlled the economy, would give them the means to physically coerce people to move to Teotihuacán and serve as additions to the labor force. More irrigation works would have to be built to feed the growing population, and this resulted in more power and wealth for the elite.

For each question, choose 1 answer unless there are special directions.

29. The word "massive" in paragraph 1 is closest in meaning to
 - A. ancient
 - B. carefully planned
 - C. very large
 - D. carefully protected
30. In paragraph 1, each of the following is mentioned as a feature of the city of Teotihuacán between A.D. 150 and 700 EXCEPT:
 - A. regularly arranged streets
 - B. several administrative centers spread across the city
 - C. many manufacturing workshops
 - D. apartment complexes

31. The word "pinpoint" in paragraph 2 is closest in meaning to
- A. identify precisely
 - B. make an argument for
 - C. describe
 - D. understand
32. The word "ingenuity" in paragraph 2 is closest in meaning to
- A. ambition
 - B. sincerity
 - C. faith
 - D. cleverness
33. Which of the following is NOT mentioned in paragraph 2 as a main factor in the development of Teotihuacán?
- A. The presence of obsidian in the Teotihuacán Valley
 - B. The potential for extensive irrigation of Teotihuacán Valley lands
 - C. A long period of volcanic inactivity in the Teotihuacán Valley
 - D. Teotihuacán's location on a natural trade route
34. Which of the following can be inferred from paragraphs 2 and 3 about the volcanic eruptions of the late first millennium B.C.?
- A. They were more frequent than historians once thought.
 - B. They may have done more damage to Teotihuacán than to neighboring centers.
 - C. They may have played a major role in the rise of Teotihuacán.
 - D. They increased the need for extensive irrigation in the Teotihuacán Valley.
35. What can be inferred from paragraph 3 about Cuicuilco prior to 200 B.C.?
- A. It was a fairly small city until that date.
 - B. It was located outside the Valley of Mexico.
 - C. It emerged rapidly as an economical and political center.
 - D. Its economy relied heavily on agriculture.
36. The word "predominant" in paragraph 3 is closest in meaning to
- A. most aggressive
 - B. most productive
 - C. principal
 - D. earliest
37. According to paragraph 4, which of the following allowed Teotihuacán to have "a competitive edge over its neighbors"?
- A. A well-exploited and readily available commodity
 - B. The presence of a highly stable elite class
 - C. Knowledge derived directly from the Olmecs about the art of toolmaking

- D. Scarce natural resources in nearby areas such as those located in what are now the Guatemalan and Mexican highlands
38. According to paragraph 4, what has recent research on obsidian tools found at Olmec sites shown?
- A. Obsidian's value was understood only when Teotihuacán became an important city.
 - B. The residents of Teotihuacán were sophisticated toolmakers.
 - C. The residents of Teotihuacán traded obsidian with the Olmecs as early as 400 B.C.
 - D. Some of the obsidian used by the Olmecs came from the area around Teotihuacán.
39. Select the TWO answer choices that are mentioned in paragraph 5 as being features of Teotihuacán that may have attracted immigrants to the city.
- A. The prosperity of the elite
 - B. Plenty of available housing
 - C. Opportunities for well-paid agricultural employment
 - D. The presence of one or more religious shrines
40. In paragraph 6, the author discusses "The thriving obsidian operation" in order to
- A. explain why manufacturing was the main industry of Teotihuacán
 - B. give an example of an industry that took very little time to develop in Teotihuacán
 - C. illustrate how several factors influenced each other to make Teotihuacán a powerful and wealthy city
 - D. explain how a successful industry can be a source of wealth and a source of conflict at the same time

Reading Posttest

Questions 1-9 are based on the following passage.

In 1972, a century after the first national park in the United States was established at Yellowstone, legislation was passed to create the National Marine Sanctuaries Program. The intent of this legislation was to provide protection to selected coastal habitats similar to that existing for land areas designated as national parks. The designation of an area as a marine sanctuary indicates that it is a protected area, just as a national park is. People are permitted to visit and observe there, but living organisms and their environments may not be harmed or removed.

The National Marine Sanctuaries Program is administered by the National Oceanic and Atmospheric Administration, a branch of the United States Department of Commerce. Initially, 70 sites were proposed as candidates for sanctuary status. Two and a half decades later, only fifteen sanctuaries had been designated, with half of these established after 1978. They range in size from the very small (less than 1 square kilometer) Fagatele Bay National Marine Sanctuary in American

Samoa to the Monterey Bay National Marine Sanctuary in California, extending over 15,744 square kilometers.

15) The National Marine Sanctuaries Program is a crucial part of new management practices in which whole communities of species, and not just individual species, are offered some degree of protection from habitat degradation and overexploitation. Only in this way can a reasonable degree of marine species diversity be maintained in a setting that also maintains the natural interrelationships that exist among these species. 20) Several other types of marine protected areas exist in the United States and other countries. The National Estuarine Research Reserve System, managed by the United States government, includes 23 designated and protected estuaries. Outside the United States, marine protected-area programs exist as marine parks, reserves, and preserves. Over 100 designated areas exist around the periphery of the Caribbean Sea. Others range 25) from the well-known Australian Great Barrier Reef Marine Park to lesser-known parks in countries such as Thailand and Indonesia, where tourism is placing growing pressures on fragile coral reef systems. As state, national, and international agencies come to recognize the importance of conserving marine biodiversity, marine protected areas. Whether as sanctuaries, parks, or estuarine reserves, will play an increasingly important role in preserving that diversity.

1. What does the passage mainly discuss?
 - A. Differences among marine parks, sanctuaries, and reserves
 - B. Various marine conservation programs
 - C. International agreements on coastal protection
 - D. Similarities between land and sea protected environments
2. The word “intent” in line 3 is closest in meaning to
 - A. repetition
 - B. approval
 - C. goal
 - D. revision
3. The word “administered” in line 8 is closest in meaning to
 - A. managed
 - B. recognized
 - C. opposed
 - D. justified
4. The word “these” in line 11 refers to
 - A. sites
 - B. candidates
 - C. decades
 - D. sanctuaries
5. The passage mentions the Monterey Bay National Marine Sanctuary (lines 13-14) as an example of a sanctuary that

- A. is not well know
 - B. covers a large area
 - C. is smaller than the Fagatele Bay National Marine Sanctuary
 - D. was not originally proposed for sanctuary status
6. According to the passage, when was the National Marine Sanctuaries Program established?
- A. Before 1972
 - B. After 1987
 - C. One hundred years before national parks were established
 - D. One hundred years after Yellowstone National Park was established
7. According to the passage, all of the following are achievements of the National Marine Sanctuaries Program EXCEPT
- A. the discovery of several new marine organisms
 - B. the preservation of connections between individual marine species
 - C. the protection of coastal habitats
 - D. the establishment of areas where the public can observe marine life
8. The word “periphery” in line 24 is closest in meaning to
- A. depth
 - B. landmass
 - C. warm habitat
 - D. outer edge
9. The passage mentions which of the following as a threat to marine areas outside the United States?
- A. Limitations in financial support
 - B. The use of marine species as food
 - C. Variability of the climate
 - D. Increases in tourism

Questions 10-17 are based on the following passage.

From their inception, most rural neighborhoods in colonial North America included at least one carpenter, joiner, sawyer, and cooper in woodworking; a weaver and a tailor for clothing production; a tanner, currier, and cordwainer (shoemaker) for fabricating leather objects; and a blacksmith for metalwork. Where stone was the local building material, a mason was sure to appear on the list of people who paid taxes. With only an apprentice as an assistant, the rural artisan provided the neighborhood with common goods from furniture to shoes to farm equipment in exchange for cash or for “goods in kind” from the customer’s field, pasture, or dairy. Sometimes artisans transformed material provided by the customer: they wove cloth of yarn spun at the farm from the wool of the family sheep; made chairs or tables from wood cut in the customer’s own woodlot; produced shoes or leather breeches from cow, deer, or sheepskin tanned on the farm.

Like their farming neighbors, rural artisans were part of an economy seen, by one historian, as “an orchestra conducted by nature.” Some tasks could not be done in the winter, other had to be put off during harvest time, and still others waited on raw materials that were 15) only produced seasonally. As the days grew shorter, shop hours kept pace, since few artisans could afford enough artificial light to continue work when the Sun went down. To the best of their ability, colonial artisans tried to keep their shops as efficient as possible and to regularize their schedules and methods of production for the best return on their investment in time, tools, and materials, While it is pleasant to imagine a woodworker, for example, 20) carefully matching lumber, joining a chest together without resort to nails or glue, and applying all thought and energy to carving beautiful designs on the finished piece, the time required was not justified unless the customer was willing to pay extra for the quality-and few in rural areas were, Artisans, therefore, often found it necessary to employ as many shortcuts and economics as possible while still producing satisfactory products.

10. What aspect of rural colonial North America does the passage mainly discuss?
- A. Farming practices
 - B. The work of artisans
 - C. The character of rural neighborhoods
 - D. Types of furniture that were popular
11. The word “inception” in line 1 is closest in meaning to
- A. investigation
 - b. location
 - c. beginning
 - d. records
12. The word “fabricating” in line 3 is closest in meaning to
- A. constructing
 - b. altering
 - c. selecting
 - d. demonstrating
13. It can be inferred from the passage that the use of artificial light in colonial times was
- A. especially helpful to woodworkers
 - b. popular in rural areas
 - c. continuous in winter
 - d. expensive
14. Why did colonial artisans want to “regularize their schedules their schedules” (line 18)?
- A. To enable them to produce high quality products
 - B. To enable them to duplicate an item many times

- C. To impress their customers
- D. To keep expenses low

15. The phrase “resort to” in line 20 is closest in meaning to

- A. protecting with
- b. moving toward
- c. manufacturing
- d. using

16. The word “few” in lines 23 refers to

- A. woodworkers
- B. finished pieces
- C. customers
- D. chests

17. It can be inferred that the artisans referred to in the passage usually produced products that were

- A. simple
- B. delicate
- C. beautifully decorated
- D. exceptionally long-lasting

Questions 18-28 are based on the following passage.

Cities develop as a result of functions that they can perform. Some functions result directly from the ingenuity of the citizenry, but most functions result from the needs of the local area and of the surrounding hinterland (the region that supplies goods to the city and to which the city furnishes services and other goods). Geographers often make a distinction between the situation and the site of a city. Situation refers to the general position in relation to the surrounding region, whereas site involves physical characteristics of the specific location. Situation is normally much more important to the continuing prosperity of a city. If a city is well situated in regard to its hinterland, its development is much more likely to continue. Chicago, for example, possesses an almost unparalleled situation: it is located at the southern end of a huge lake that forces east-west transportation lines to be compressed into its vicinity, and at a meeting of significant land and water transport routes. It also overlooks what is one of the world's finest large farming regions. These factors ensured that Chicago would become a great city regardless of the disadvantageous characteristics of the available site, such as being prone to flooding during thunderstorm activity.

Similarly, it can be argued that much of New York City's importance stems from its early and continuing advantage of situation. Philadelphia and Boston both originated at about the same time as New York and shared New York's location at the western end of one of the world's most important oceanic trade routes, but only New York possesses an easy-access functional connection (the Hudson-Mohawk lowland) to the vast Midwestern hinterland. This account does not alone explain

New York's primacy, but it does include several important factors. Among the many aspects of situation that help to explain why some cities grow and others do not, original location on a navigable waterway seems particularly applicable. Of course, such characteristic as slope, drainage, power 25) resources, river crossings, coastal shapes, and other physical characteristics help to determine city location, but such factors are normally more significant in early stages of city development than later.

18. What does the passage mainly discuss?
- A. The development of trade routes through United States cities
 - B. Contrasts in settlement patterns in United States
 - C. Historical differences among three large United States cities
 - D. The importance of geographical situation in the growth of United States cities
19. The word "ingenuity" in line 2. is closest in meaning to
- A. wealth
 - b. resourcefulness
 - c. traditions
 - d. organization
20. The passage suggests that a geographer would consider a city's soil type part of its
- A. hinterland
 - b. situation
 - c. site
 - d. function
21. According to the passage, a city's situation is more important than its site in regard to the city's.
- A. long-term growth and prosperity
 - b. ability to protect its citizenry
 - c. possession of favorable weather conditions
 - d. need to import food supplies
22. The author mentions each of the following as an advantage of Chicago's location EXCEPT its.
- A. hinterland
 - b. nearness to a large lake
 - c. position in regard to transport routes
 - d. flat terrain
23. The word "characteristics" in line 14 is closest in meaning to
- A. choices
 - b. attitudes
 - c. qualities
 - d. inhabitants

24. The primary purpose of paragraph 1 is to
- A. summarize past research and introduce a new study
 - B. describe a historical period
 - C. emphasize the advantages of one theory over another
 - D. define a term and illustrate it with an example
25. According to the passage, Philadelphia and Boston are similar to New York City in
- A. size of population
 - B. age
 - C. site
 - D. availability of rail transportation
26. The word “functional” in line 20 is closest in meaning to
- A. alternate
 - B. unknown
 - C. original
 - D. usable
27. The word “it” in line 21 refers to
- A. account
 - B. primacy
 - C. connection
 - D. hinterland
28. The word “significant” in line 26 is closest in meaning to
- A. threatening
 - B. meaningful
 - C. obvious
 - D. available

Questions 29-40 are based on the following passage.

The largest of the giant gas planets, Jupiter, with a volume 1,300 times greater than Earth's, contains more than twice the mass of all the other planets combined. It is thought to be a gaseous and fluid planet without solid surfaces. Had it been somewhat more massive, Jupiter might have attained internal temperatures as high as the ignition point for nuclear fusion reactions, and it would have flamed as a star in its own right. Jupiter and the other giant planets are of a low-density type quite distinct from the terrestrial planets: they are composed predominantly of such substances as hydrogen, helium, ammonia, and methane, unlike terrestrial planets. Much of Jupiter's interior might be in the form of liquid, metallic hydrogen. Normally, hydrogen is a gas, but under pressures of millions of kilograms per square centimeter, which exist in the deep interior of Jupiter, the hydrogen atoms might lock together to form a liquid with the properties of metal. Some scientists believe that the innermost core of Jupiter might be rocky, or metallic like the core of Earth.

Jupiter rotates very fast, once every 9.8 hours. As a result, its clouds, which are composed largely of frozen and liquid ammonia, have been whipped into alternating dark and bright bands that circle the planet at different speeds in different

latitudes. Jupiter's puzzling Great Red Spot changes size as it hovers in the Southern Hemisphere. Scientists speculate it might be a gigantic hurricane, which because of its large size (the Earth could easily fit inside it), lasts for hundreds of years.

Jupiter gives off twice as much heat as it receives from the Sun. Perhaps this is primeval heat or heat generated by the continued gravitational contraction of the planet. Another starlike characteristic of Jupiter is its sixteen natural satellites, which, like a miniature model of the Solar System, decrease in density with distance—from rocky moons close to Jupiter to icy moons farther away. If Jupiter were about 70 times more massive, it would have become a star. Jupiter is the best-preserved sample of the early solar nebula, and with its satellites, might contain the most important clues about the origin of the Solar System.

29. The word "attained" in line 4 is closest in meaning to
- A. attempted
 - B. changed
 - C. lost
 - D. reached
30. The word "flamed" in line 5 is closest in meaning to
- A. burned
 - B. divided
 - C. fallen
 - D. grown
31. The word "they" in line 6 refers to
- A. nuclear reactions
 - B. giant planets
 - C. terrestrial
 - D. substances
32. According to the passage, hydrogen can become a metallic-like liquid when it is
- A. extremely hot
 - B. combined with helium
 - C. similar atmospheres
 - D. metallic cores
33. According to the passage, some scientists believe Jupiter and Earth are similar in that they both have
- A. solid surfaces
 - B. similar masses
 - C. similar atmospheres
 - D. metallic cores
34. The clouds surrounding Jupiter are mostly composed of

- A. ammonia
 - B. helium
 - C. hydrogen
 - D. methane
35. It can be inferred from the passage that the appearance of alternating bands circling Jupiter is caused by
- A. the Great Red Spot
 - B. heat from the Sun
 - C. the planet's fast rotation
 - D. Storms from the planet's Southern Hemisphere
36. The author uses the word "puzzling" in line 15 to suggest that the Great Red Spot is
- A. the only spot of its kind
 - B. not well understood
 - C. among the largest of such spots
 - D. a problem for the planet's continued existence
37. Paragraph 3 supports which of the following conclusions?
- A. Jupiter gives off twice as much heat as the Sun.
 - B. Jupiter has a weaker gravitational force than the other planets.
 - C. Scientists believe that Jupiter was once a star.
 - D. Scientists might learn about the beginning of the Solar System by Studying Jupiter.
38. Why does the author mention primeval heat (lines 19-20)?
- A. To provide evidence that Jupiter is older than the Sun
 - B. To provide evidence that Jupiter is older than the other planets
 - C. To suggest a possible explanation for the number of satellites that Jupiter has
 - D. To suggest a possible source of the quantity of heat that Jupiter gives off
39. According to the passage, Jupiter's most distant moon is
- A. the least dense
 - B. the largest
 - C. warm on the surface
 - D. very rocky on the surface
40. Which of the following statements is supported by the passage?
- A. If Jupiter had fewer satellites, it would be easier for scientists to study the planet itself.
 - B. If Jupiter had had more mass, it would have developed internal nuclear reactions.
 - C. If Jupiter had been smaller, it would have become a terrestrial planet.
 - D. if Jupiter were larger, it would give off much less heat