

A Systematic Review of Research on Questioning as a High-level Cognitive Strategy

Mohammad Davoudi¹ & Narges Amel Sadeghi²

¹ Department of English Language and Literature, Hakim Sabzevari University, Sabzevar, Iran

² Department of English Language and Literature, Hakim Sabzevari University, Sabzevar, Iran

Correspondence: Mohammad Davoudi, Department of English Language and Literature, Hakim Sabzevari University, Sabzevar, Iran. Tel: 915-335-7590. E-mail: davoudi2100@yahoo.com

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Abstract

Given the significance of questioning as a high-level cognitive strategy in language teaching and learning in the literature on TEFL as well as in education in general, this study sought to make a systematic review of research studies conducted in the span of the last three decades on the issue of questioning across different disciplines with a special focus on second or foreign language teaching and learning. It encompasses the questioning behavior of both teachers and learners. In the first phase of the study, it reviews and synthesizes the findings of 60 studies conducted on questioning in education since 1974. It also illustrates the impact of different questioning patterns on various types of learning and literacy areas. In the second phase of the study, an in-depth review is made of 40 studies between 2000 and 2014 examining the role of questioning in different academic fields and various educational fields. The findings of the in-depth review reveal the indispensable role of teacher and student questioning in facilitating critical thinking, writing ability, reading comprehension, subject matter learning, metacognitive skills, and scaffolding learning process. Finally, the implications and applications of the research findings are mentioned along with suggestions for further research.

Keywords: high-level cognitive strategies, EFL learners, questioning, critical thinking

1. Introduction

There is no doubt that raising questions is an art which requires cultivated and practiced knowledge (Cavanaugh and Warwick, 2001). Asking questions is “one of the fundamental ways by which the teacher stimulates student thinking (Aschner, 1961) and posing questions pertinent to a specific scope of knowledge will facilitate learning process (Nelson-LeGall & Glor-Scheib, 1985; Newman, 1992). In the field of language learning and teaching, questioning, as a teaching and learning strategy, is of immense importance and is well documented (Almeida, 2010; Chin & Osborne, 2008; Graesser & Olde, 2003; Chin, 2007; Roth, 1996). The students’ level of engagement in the process of learning largely depends on the questions formulated by the teachers in the classroom that prompt and guide thinking processes (Wilén, 1991) and on the questions generated by students themselves in the process of learning and teaching (Almeida, 2010, 2012). Indeed, there is a developing focus among researchers upon the realization of questioning strategies as an indispensable element in developing, expanding, and challenging students’ thinking (Klem & Connell, 2004; Marzano, Pickering, & Pollock, 2001, Miciano, 2004).

Additionally, many researchers have pointed that learning and comprehension levels will develop when students are instructed to raise effective questions (Palincsar & Brown, 1984; Craig et al., 2000; King, 1992, 1994; Rosenshine, Meister, & Chapman, 1996). This view is in line with the Construction-Integration Model of text comprehension (Kintsch, 1998; Kintsch & Welsch, 1991; Otero & Kintsch, 1992) which explains the relationship between learning, comprehension, and question generation. According to this model, comprehension occurs during a two-step process. The first phase is *construction*, during which concepts are activated in a shape of network of the syntactic, semantic, and world knowledge of the learner. The second step is *integration*. In the integration phase, the links between concepts are strengthened and improved by other similar concepts, whereas

dissimilar concepts lose weight in the network. During this process, gradually, the mental representation of the concepts will appear. More importantly, researchers working in the field of text comprehension draw on the role of the deep-level reasoning questions in activating mental models and concepts which in turn play a vital role in regulating comprehension. According to Craig, Sullins, Witherspoon and Gholson (2006), “when content is preceded by deep-level reasoning questions, mental models are activated which play an important role in regulating comprehension” (p. 576). Stated otherwise, the application of the deep-level reasoning questions in the course content will result in self-explaining, and learners may discern mismatches between their own mental models and the models presented by the text (Craig, Sullins, Weitherspoon, & Gholson, 2006). Even the strange, unusual and challenging questions posed by teachers in class can lead to the improvement in students’ creativity and satisfaction in their sense of curiosity. This is because, as Graesser and Olde (2003) predicted, students’ questions are virtually raised when a discrepancy is noticed in the process of their learning and understanding, that is, when students experience a kind of cognitive disequilibrium.

Deed (2009) asserts that strategic questions can be viewed as a pedagogical tool for students to represent, organize, communicate, and more importantly conceptualize their abstract ideas committed to their learning. Thus, it is noteworthy that any well-designed comprehension question helps students interact with the text to create or construct meaning. Furthermore, asking adequate questions at the right time and in a skillful manner will reveal enough and necessary impressions required for evaluating those answering them.

2. The Objectives of the Study

The main purpose of this review is to assess the role of questioning as a cognitive process in education by means of reviewing various published empirical studies in different disciplines. To achieve this, the EPPI Reviewing System was employed to have a broad and comprehensive coverage of empirical research evidence of the use of questioning in education. EPPI-Reviewer is the EPPI-Center’s comprehensive online software tool for research synthesis. It is a web-based software program for managing and analyzing data in literature review. This software has been developed for all types of systematic review such as meta-analysis, framework synthesis and thematic synthesis. In EPPI reviewing system, the review process starts with stating the research questions that will provide the framework for all the other stages. Then, based on research questions, explicit inclusion and exclusion criteria have to be developed for determining which studies will be considered and included in the review. After that, the studies are appraised against the inclusion criteria for providing a key word map. Then, for the purpose of the in-depth review, the studies are screened on thematic or chronological grounds.

3. Research Questions

The major question for the keyword map, the overall thematic structure of the review process, is what empirical studies have been undertaken on the role of questioning as a cognitive process between 1990 and 2004. For the second phase of the review, in-depth analysis, we focused on only the empirical studies undertaken in association with questioning and learning process and academic achievement in general and the role of teacher and student questioning in particular. Thus, the following questions for in-depth review were posed:

- 1) What areas of learning and literacy are affected by questioning?
- 2). To what extent do teacher questioning and student questioning affect students' learning process?

4. Method

Initially, the explicit criteria based on research questions were developed for determining which studies would be selected in the review. On the basis of inclusion and exclusion criteria represented in Table 1, the review process covered studies conducted on questioning from 1974 to 2015. The studies selected for the review were all in English language, used various research designs (quantitative, qualitative and mixed-method research), focused on student and teacher questioning, included both theoretical and empirical studies and covered all types of participants from elementary to advanced students. Studies that centered on assessment of questioning or focused on domains other than language learning were excluded from this review.

Table 1. Inclusion criteria for the review

Criterion type	Inclusion criteria
Topic	Studies must be related to research questions mentioned above.
Year of publication	Studies must have been published between 1974 and 2015.
Language of the article	The studies should be in English.
Participants	All types of participants from elementary to advanced students or teachers.
Research design	Various research designs (quantitative, qualitative and mixed-method research).

The application of this selection criterion resulted in the inclusion of 60 studies in the systematic keyword map. However, for the purpose of in-depth review and synthesizing the studies, the following criterion was applied. Studies were included in in-depth review if (1) they reported on the role of questioning in specific learning situations; (2) they were published between 2000 and 2014 and (3) they reported on either student questioning or teacher questioning. The second criterion yielded a total of 40 studies for in-depth review. Following that, the summaries of the findings and research methodology of these studies were synthesized and described individually under the thematic headings of critical thinking, writing ability, reading comprehension, subject matter learning, metacognitive skills, and scaffolding learning process, to provide a thorough combination of results. Moreover, for judging the weight of evidence, the appropriateness of focus of the research for answering the review question (topic relevance) and the appropriateness of the use of the study design for addressing their research questions for each study were evaluated separately

5. Results

5.1 The Keyword Map

After a systematic review and extensive search of 100 studies published in the period between 1974 and 2014, only 60 studies which addressed the research questions above were identified. Key wording of the 60 studies yielded the following results: Most of the studies focused on elementary, secondary and university levels. They reported various learning and academic areas affected by questioning including critical thinking (n=10), reading comprehension (n=20), writing (n=2), subject matter learning (n=11), memory (n=1), language proficiency (n=1), metacognition (n=3), teachers' training program (n=7), scaffold learning (n=2), motivation for learning (n=1), learning of disabled students (n=1) and depth of knowledge (n=1). The number of studies conducted in each educational sector is reported in Table 2 below.

Table 2. Studies by learning and literacy areas, study date, and education sector (P= primary, S= secondary, U= university)

	1999-1974			2000-2009			2010-2014			Total (N=60)		
	P	S	U	P	S	U	P	S	U	P	S	U
Critical Thinking	0	1	1	0	1	1	1	4	1	1	6	3
Reading comprehension	2	1	0	4	2	2	1	2	6	7	5	8
Writing	0	0	0	0	0	0	0	2	0	0	2	0
Subject matter learning	0	0	2	1	0	1	1	4	2	2	4	5
Memory	1	0	0	0	0	0	0	0	0	1	0	0
Language proficiency	1	0	0	0	0	0	0	0	0	1	0	0
Metacognition	0	0	0	0	0	2	0	0	1	0	0	3
Teacher's training program	1	0	0	0	1	2	0	1	2	0	2	5
Scaffolding learning	0	0	0	0	0	0	1	1	0	1	1	0
Motivation for learning	1	0	0	0	0	0	0	0	0	1	0	0
Learning of disabled students	0	0	0	0	0	0	1	0	0	1	0	0
Depth of knowledge	0	0	0	0	0	0	0	0	1	0	0	1

From 1974 to 2014, 60 studies were conducted on questioning in education. 21 studies emphasized on the role of teacher questioning, 17 focused on student questioning and 22 did not mention the type of questioning in this regard. The studies focusing on teacher and student questioning are reported in Table 3. From 1974 to 2014, most of the studies were either quantitative or qualitative, and very few studies reported on mixed method (Appendix A). Moreover, in most of the studies, the native language of the participants was not mentioned. Although the studies related to the issue of questioning were carried out in various countries, almost 30% of studies were done in US.

Table 3. Studies by learning and academic outcome affected by teacher and student questioning from 1974 to 2014

Learning and literacy areas	Teacher questioning N=21	Students questioning N= 17	Neither of them N=22
Critical/creative thinking	6	3	1
Reading comprehension	4	8	8
Writing	0	0	2
Mastery in subject mater	3	2	6
Memory	1	0	0
Language proficiency	0	1	0
Metacognition	0	1	2
Teacher's training program	4	0	3
Scaffolding learning process	2	0	0
Motivation in learning	1	0	0
Learning of disabled students	0	1	0
Depth of knowledge	0	1	0

5.2 In-depth Review

After applying the second criterion for the purpose of in-depth review, 52 studies were identified which were conducted from 2001 to 2014 that shows an ongoing interest in the issue of questioning and its role in teaching and learning, but only 40 studies centered on the effect of questioning on the learning process, literacy acquisition and achievement in different academic areas. Most of these studies were conducted between 2010 and 2014.

6. Results and Findings

6.1 Research Question 1: What Areas of Learning and Literacy Are Affected by Questioning?

From 2000 to 2014, 40 studies were conducted to determine the role of questioning on language learning and literacy. These empirical studies were conducted across different levels of proficiency (elementary, intermediate and advanced students). The learning and literacy domains affected by questioning encompass critical thinking, reading comprehension, writing ability, subject matter learning, metacognition, teacher development, vicarious learning, scaffold learning process, dialogic literary inquiry, learning of disabled students and depth of knowledge. It is noteworthy that three areas of memory, motivation, and language proficiency which were investigated between 1974 and 2000 received little attention between 2000 and 2014 and almost no study was reported during this period. The reviewers attempted to explain and clarify these different areas in the following section. The role of questioning in each of the cognitive processes mentioned above is dealt with separately in the following section.

6.1.1 The Role of Questioning in Critical Thinking

Critical thinking was found to be an important area affected by questioning based on the results of 8 empirical studies from 2000 to 2014. Among them, 4 were conducted in EFL/ESL contexts. Feng (2013) illustrated the role

of teachers' higher order questioning, that is, questions that address the top cognitive processes in Bloom's Taxonomy, i.e., analysis, synthesis and evaluation questions, in enhancing EFL students' critical thinking ability. He asserted that asking higher-order questions is absolutely necessary for the development of EFL students' critical thinking ability. Unlike Feng (2013) which elaborates on the nature of teachers' questioning strategies in enhancing higher order thinking ability among EFL students at college and university, Al-Darwish (2012) explored the use of two methods of questioning including Socratic method, which has a cross-questioning format which motivates learners to find answers to their own problems by recognizing the areas where they do not know the answer, and traditional methods in EFL students at Elementary public schools. The study was conducted with 15 female English language teachers as the participants in foreign language context in Kuwait. The results showed that, in spite of the undeniable role of Socratic method of teaching which propels learners "to challenge assumptions, expose contradiction and generate new knowledge and wisdom" (p. 82), EFL teachers disregard it due to their lack of content knowledge and appropriate instructional strategies; they prefer to appeal to a more traditional approach by asking questions that have definite answers and not going beyond the lesson.

Gonzalez (2010) provided evidence of the inappropriate nature of questions asked by teachers that do not help students to adapt problem solving strategies, think critically and monitor their learning. The study was conducted in an English secondary school through the qualitative analysis of different field notes and interviews with 12 students regarding their perception toward teachers' questioning. Students were neither given the opportunities to take responsibility of their learning, nor to organize their thinking to achieve certain goals. It was believed that the teaching style was inappropriate to achieve the intended objectives. The study encourages the application of a more student-centered approach in second and foreign language context that will lead to both higher critical thinking ability and desirable learning outcomes.

Chin's (2007) study was carried out in an EFL context but in different way in comparison with previously mentioned studies. Chin strived to find out how teachers apply questions in classroom discourse to stimulate productive and critical thinking to help students gain scientific knowledge. Six out of 36 lessons taught by six teachers who were teaching grade 7 sciences were observed. By focusing on the analysis of teacher-student interaction, the researcher introduced various questioning approaches adapted by the teachers including Socratic questioning, verbal jigsaw, semantic tapestry and framing which will provoke reflection and productive thinking in the classroom discourse. This study also used qualitative method of analysis with low number of participants similar to Al-Darwish (2012) and Gonzalez (2010).

In the same line, Godfrey (2001) confirms the finding of previous studies regarding ESOL teachers' emphasis on the use of questioning in language classroom to provide more opportunities for learners to apply critical thinking ability. This study compared the mainstream teachers with ESOL teachers in using questions to enhance critical thinking skills. Issues such as cognition-level questions, wait-time behavior, use of comprehension checks, confirmation checks and clarification request, and also the length, syntactic complexity and cognitive level of students' responses were used as comparison criteria. After observing two advanced ESOL reading/writing classes, it was revealed that while mainstream teachers highlighted fostering critical thinking only in low-level writing classes, ESOL teachers believed in enhancing critical thinking ability even in a more advanced writing classes. Similar to previous studies in ESL/EFL context mentioned in this review, this study also applied qualitative approach to data analysis and only the behavior of four ESOL teachers were observed.

In order to determine the difference between questions asked by ELT students with higher and lower critical thinking ability, Seker and Komur (2008) aimed at investigating the questioning behaviors of 53 second-year students of English language teaching in Turkey. Upon finishing the calculation of students' critical thinking scores by the use of Ennis-Weir Critical Thinking Essay Test, the students were asked to produce five questions about a text. The results indicated that higher critical thinking score group asked questions out of curiosity to remove uncertainties and to seek novel ideas.

Almeida (2010a) focused on the development of the critical and creative thinking in secondary education through questioning in different disciplines. Three teachers including a Portuguese teacher, a philosophy teacher, and a chemistry teacher together with their students (n=56) formed the sample of this study. The researcher attempted to investigate the role of both teacher's and student's questions in classroom interaction to see the relationship between the questioning patterns in the classroom and the teaching strategies. Through qualitative approach, the study showed that teachers who teach different disciplines apply distinct questioning patterns. The philosophy teacher asked fewer questions but more cognitively demanding ones that promote more interactive

learning environment which in turn encourage reflection and critical thinking. Unlike the philosophy teacher, the chemistry teacher applied a *fact-based questioning* strategy requiring little divergent thinking. The Portuguese teacher also applied more low-level questions, specifically fact-based questions that would hinder creativity. The study concludes that teachers can question and criticize if the teaching strategies are in harmony with teachers' personality traits, if they are based on the content and aim of the class or even if they are discipline-dependent.

With respect to the application of questioning to foster critical thinking, Pate and Miller (2011), using an experimental design, aimed at investigating the effects of regulatory self-questioning on students' electrical circuit theory test score. Although this study did not measure the role of questioning in critical thinking directly, it investigated students' problem solving ability which requires a high degree of critical thinking skill. The results indicated that students in regulatory self-questioning group (79%) scored 80% or better than students in control group (53%). This study employed an experimental design to look at the effect of questioning on problem solving activities with a population of 68 students from four secondary-level schools in Iowa. However, the findings are under question since the study used a randomized posttest-only design which lacks pretest to homogenize students based on problem solving abilities and thus the significant difference between control and experimental group would not be valid.

The relationship between teacher questioning and respected areas of critical thinking is represented in Figure 1, and the relationship between student questioning and respected areas of critical thinking is illustrated in Figure 2.

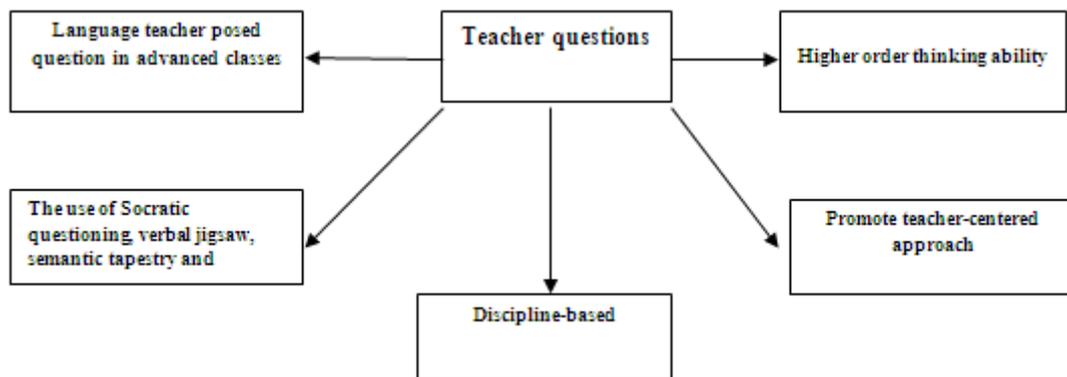


Figure 1. The relationships between teacher question and areas of critical thinking

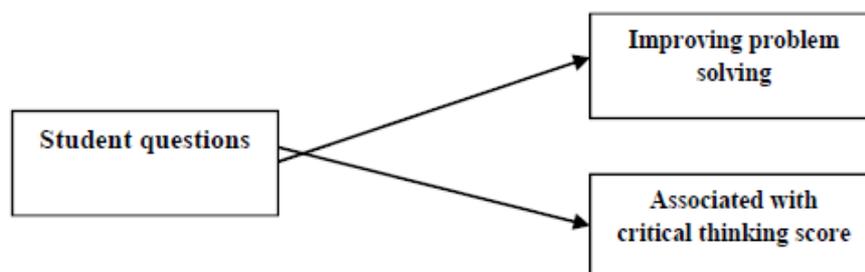


Figure 2. The relationship between student question and areas of critical thinking

6.1.2 The Role of Questioning in Reading Comprehension

From 2000 to 2014, 11 studies (5 in EFL/ESL contexts and the rest in other disciplines) were conducted in relation to the effect of questioning on cognitive reading comprehension skills and oral reading comprehension

proficiency as well. Indeed, 32% of all the studies of in-depth review regarding the effect of questioning are related to reading comprehension as an important literacy area. Taylor, Alber and Walker (2002) indicate that self-questioning is influential for improving reading comprehension. They investigated the effect of self-questioning on six graders with learning disabilities who enrolled in public elementary school in Mississippi. Only five male and female students participated in this study. The study illustrated that students with learning disabilities can use self-questioning strategies to have an improved reading comprehension.

Taylor, Alber and Walker's (2002) study is in contrast to the results of Miciano (2002). Through an experimental study, he sought to find out the role of self-questioning as a reading strategy in improving comprehension of prose texts in English, a second language for Filipinos. After comparing the performance of 47 students who were given a 50-item proficiency test in English in both control and experimental group, the researcher found that there was no alignment between self-questioning and comprehension of a prose text in English. In fact, he showed students' incapability in deep text processing and their weaknesses to ask strategic questions which require the students' detection and comprehension of the main ideas within the text.

Akkaya and Demirel (2012) also proposed that achieving an effective reading ability is closely associated with questioning strategies posed in pre-reading, during-reading and post reading activities. Their study reported that the low-level comprehension questions asked by students will not help their comprehension process thoroughly. Thus, with the purpose of identifying the cognitive level of questions that teacher candidates asked during reading process, the study was conducted with 1080 teacher candidates at a Turkish university. Through the application of quantitative analysis, the study showed that most of the participants formulated questions at the comprehension level and ignored posing questions at the higher cognitive levels of synthesis and evaluation. The reason underlying these results may be explained in the light of Taboada and Guthrie's (2006) study. They supposed that student questioning is responsible for a large amount of variance in students' reading comprehension. Thus, they asked 360 students from grade 3 and 4 to pose questions about specific texts in ecology. After coding students' questions to a four-level question hierarchy, the authors found that low- and high-level questions were associated with low and high levels of conceptual knowledge obtained from the text and thus highlighting an indispensable relationship between questioning levels and reading comprehension.

Addressing the notion that different forms of questions elicit different levels of comprehension, Day and Park (2005) presented a classification of question types. According to their classification, comprehension consist of literal comprehension, reorganization, inference, prediction, evaluation and personal response and that the forms of questions that can be seen as a checklist for language teachers are yes/no questions, alternative questions, true or false questions, wh-questions and multiple-choice ones.

Eason, et al. (2012) explored the relative importance of different factors that influence readers' reading comprehension. They added that readers' level of comprehension can vary according to the text and question types and that semantic and syntactic awareness, inference, planning or organizing all are tied to reading comprehension. The researchers aimed at examining the extent to which different cognitive skills facilitate performance on various types of texts and questions. To achieve this, they compared the performance of 10-14-year old children in comprehending narrative, expository, and functional texts. The findings illustrated the contribution of higher order cognitive skills such as reasoning, inferencing and elaboration to comprehension of more complex text and question types. At the end, they concluded that higher-order cognitive skills are the principal components of reading comprehension for later elementary and middle school students.

Following the idea that explicit teaching of comprehension strategies used by skilled readers helps readers to formulate their own questions about text, Parker and Hurry (2007) attempted to investigate the extent to which comprehension strategies are taught explicitly in 51 London classrooms. Qualitative analysis of interviews and observations showed that the most frequent and dominant strategy used was *direct teacher questioning* which determined more predictable answers, and also demonstrated the passive role of students in formulating any relevant questions. In the same line, Marzola (1988) proposed the teaching of the questioning strategies employed by good readers to poor readers in order to improve their comprehension before, during and after reading. He accentuated the influential role of three questioning strategies for primary students including Question-Answer Relationship, Request, and Reciprocal Teaching.

Another questioning technique proved to have influence on reading comprehension is Questioning the Author technique (QtA). Questioning the Author teaches students to grapple with the ideas while they read, to dig in and make sense of the ideas as they encounter them in the text. In Questioning the Author, students use three sources

to build understanding: Texts, queries and discussion. Baleghizade (2011) is one of the research studies that attempted to examine the effect of QtA technique on reading comprehension of EFL students. In this study, 98 adult students were assigned to experimental and control groups and those in experimental group received training in QtA technique. The results showed that the trained learners achieved higher scores than the other group. Indeed, the author suggested that it is an effective strategy to encourage learners to generate their own questions about text instead of applying a traditional approach of teaching reading via memory and comprehension questions.

The results of these studies were confirmed by Dorkchandra's (2013) study. He conducted a quasi-experimental study to investigate the effect of a question generating strategy on EFL reading comprehension and on their ability to use English tenses. After assigning 40 participants to control and experimental group, the learners in experimental group received a treatment during which they were taught to generate questions. The results indicated that question-generating strategy instruction helped students to both improve their reading comprehension level and use of English grammatical tenses. In the same vein, through conducting an experimental design with four students with learning disabilities and limited language proficiency, Barrera, Liu, Thurlow, and Chamberlain (2006) showed the influence of chunking and questioning aloud to improve reading comprehension of English language learners with disabilities. The findings indicated that chunking and questioning aloud strategy improved reading achievement of ELLs with learning disabilities when used in an individualized setting. The relationship between student questioning and areas of reading comprehension is depicted in Figure 3.

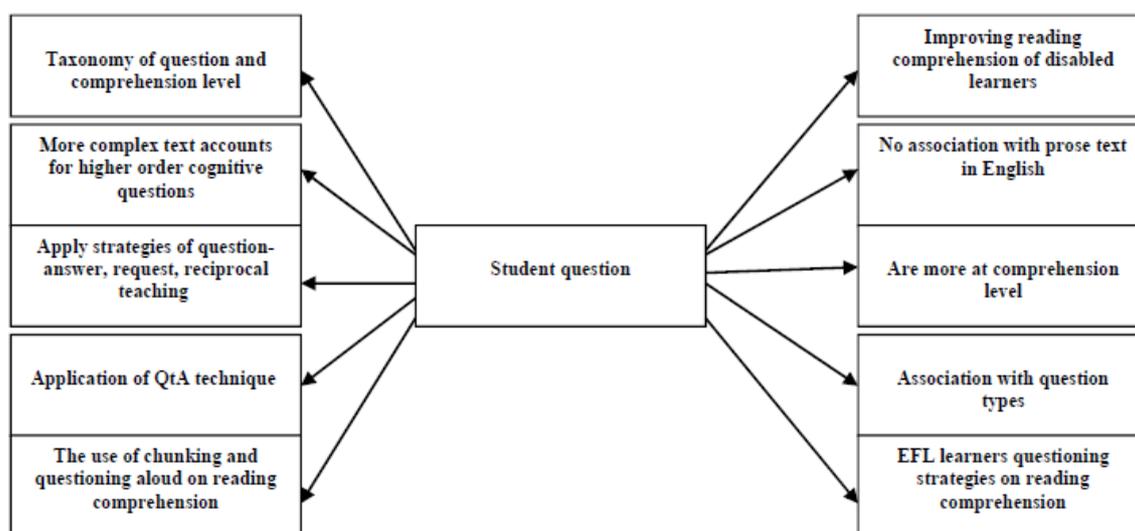


Figure 3 The relationship between student questioning and the areas of reading comprehension

6.1.3 The Role of Questioning in Subject Matter Learning

Between 2001 and 2014, 8 studies including Chang (2011), Cardoso and Albergaria-Almeida (2014), Meng, Zhao and Chattouphonexay (2011), Adedoyin (2010), Coutinho and Almeida (2014), Campbell and Mayer (2009), Kira et al. (2013), and Craig and Cairo (2005) were conducted on the role of questioning behavior in enhancing learning, thinking and teaching of subject matter. Meng, Zhao and Chattouphonexay (2012) assert that although content-based instruction has been viewed as an essential part of English language teaching planning in the US k-12 education, few studies have looked at the content-based classroom. Recognizing this shortcoming, they attempted to explore the types and functions of questions applied by teachers in content-based instruction (CBI). By focusing on 16 grade-three students and only one teacher who taught science in English and the use of observations and interviews, the researchers found that in content-based instruction, display and referential questions were the most frequently used question types used by teachers. Display questions ask the respondent to

display knowledge already known to the questioner, and referential questions request information not known by the questioner. However, in the case of teaching and learning, the most dominant type of question was *display question* used for the purpose of eliciting information or checking learners' understanding.

Similarly, Campbell and Mayer (2009) stated that question asking is an effective approach to engage students during the college lectures and improving their learning. Through an experimental design, the researchers illustrated that students in experimental group who received 25-slide PowerPoint lecture in educational psychology with inserted multiple-choice questions outperformed the control group who received lectures through only statements and not corresponding questions on a retention test. Likewise, Chang (2012) asserted that several previous studies investigated the use of questions to improve learning academic lectures. However, he added the paucity of research regarding the issue of how professors from different disciplines use distinct forms and functions of questions. After comparing various linguistic features of three academic disciplines including Humanities and Art (HA), Social Sciences & Education (SS), and Physical sciences and Engineering (PS), the study revealed more commonalities rather than differences across disciplines.

Adedoyin (2010) also investigated the role of questioning in learning subject matter and content with special focus on learning and achievement in mathematics. This study was merely quantitative in which 471 students were asked to complete a Likert scale questionnaire consisting of the statements about how they perceived the role of their teacher's questions in their own achievement in mathematics. The results amplified the students' negative impression on the effect of teacher classroom questions in their mathematics achievement. This study is in contrast with previous studies in which the positive effect of teachers' questions on learning academic content and disciplines were proved.

Craig and Cairo (2005) examined the influence of application of QUILT (Questioning and Understanding to Improve Learning and Thinking program in mathematics achievement. QUILT is a framework consisting of five stages: (1) question preparation, (2) presentation of questions, (3) prompting, (4) processing of student responses, and (5) reflection on questioning practice. In this study, 28 elementary school teachers were trained to use QUILT as a teaching and learning strategy in instructing mathematics. By observing the mathematics instructional sessions, the researchers found that teachers implemented only some QUILT questioning behaviors. The findings indicated that a well-controlled, randomized control trial is needed to examine the efficacy of QUILT as an effective instructional technique.

By emphasizing the significance of questioning in fostering achievement in different content areas, Cardoso and Almeida (2014) designed and implemented Science-Technology-Society (STS), which stands for a wide range of materials which use contexts and applications as a starting point for developing an understanding of scientific ideas to promote learner questioning in the study of photosynthesis. Although the results revealed that, by implementing STS strategy, students tended to ask a large number of low-level questions which include questions at the level of knowledge, memory and integration, through practical activity on florescence, students formulated high level cognitive questions. In the same line, Coutinho and Almeida (2014) aimed at investigating and analyzing the number and kind of questions posed by students in three different question promoting contexts in natural science including watching a movie, laboratory work and reading a text in which students were encouraged to ask questions. The results indicated that the number of closed question decreased across the three strategies while the use of open questions augmented.

Kira, Komba, Kafanabo and Tilya (2013) also attempted to see teachers' ability in applying questioning technique to promote students' learning and teaching ability during chemistry lessons. Interviews with 10 chemistry teachers showed the teachers' moderate ability in using questioning technique and that they tended to interact with only active students. Additionally, the results showed the teachers' incapability in handling the use of open-ended and closed-ended questions in class as well as the convergent and divergent questions. This study suggested the necessity of using an in-service program to help teachers strengthen their classroom questioning behavior.

6.1.4 The Role of Questioning in Writing

To investigate the significant role of question generation in improving writing ability, Marzban and Jalili (2014) focused on two aspects related to the formulation stage of writing including frequency of solving formulation problems and time devoted to solving formulation problems in general and as a function of the class of problems. Initially, they assumed that Iranian EFL learners' level of critical thinking would affect their writing in English, and then they showed that critical thinking was reinforced through questioning instruction in English. In this study, in

six weeks, learners were subjected to a kind of treatment of posing and answering questions in English in harmony with Bloom's taxonomy of educational goals. Although question instruction paved the way for spending much more time on refining and amending the class of problems, it showed no significant impact on the frequency of solving problems which was assumed in the beginning of the study.

Arguably, by accepting the idea that good writing is derived from good thinking, Etemadzadeh, Seifi, and Roohbakhsh Far (2013) attempted to investigate the impact of questioning technique on developing critical thinking in second language learners and consequently enhancing the writing process. The participants in this study were 60 Malaysian secondary students particularly selected from lower achievers. The study aimed at empowering them and facilitating their learning process. However, classification based on gender, race, ethnicity, or social background was ignored. After exposing students to two-week treatments in which the types of questions and their use were taught, the researchers observed an outstanding improvement in the quality of the students' writing. Moreover, the study showed that by using such technique, the students could actively participate in the discussion and in meaningful communicative language.

6.1.5 The Role of Questioning in Promoting Metacognition

Choi, Land and Turgeon (2005) proposed a peer-questioning scaffolding framework to facilitate reflective thinking and metacognition. This study focused on providing online scaffolding as a treatment to increase the frequency of student questioning behavior during online instruction by promoting metacognition and thinking. Using an experimental design and focusing on thirty-nine students who studied Management Science, the study revealed that peer-questioning scaffolding was influential in increasing the frequency of student questioning during discussion but had no such effect on the quality of questions and learning outcomes. Similarly, by drawing on the theory of metacognition, Deed (2009) stated that strategic questions are useful in providing metacognitive knowledge and enabling teachers to examine a learning experience. It was concluded that the use of strategic questions was a helpful reflective approach to learning.

Byun, Lee, and Cerreto (2014) also attempted to investigate the impact of applying different question-prompt strategies on enhancing metacognitive skill and specifically their performance on an ill-structured problem solving task. The participants in this study were categorized into three groups that received different treatments. One group was exposed to instructor-generated question prompts, the other was organized based on peer-generated questions and the third developed their own questions but by the help of instructor. The study revealed that instructor-generated question prompts were effective in promoting metacognitive skills and thus better performance in ill-structured problem solving. Based on these studies, three techniques emerged to promote metacognitive skills through questioning which are demonstrated in Figure 4.

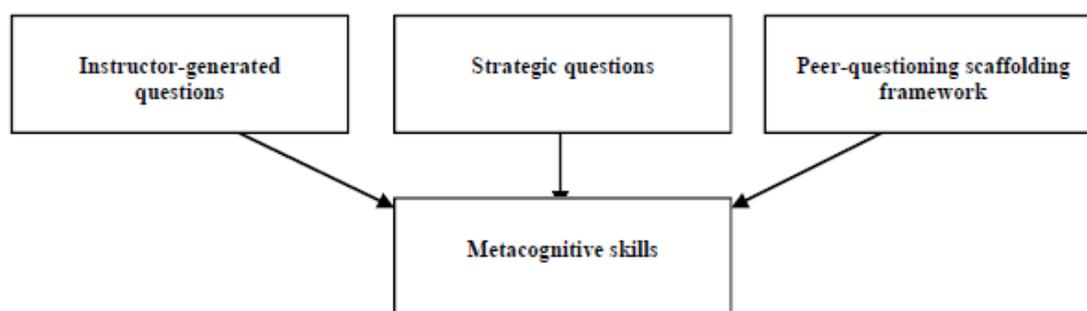


Figure 4. The questioning techniques that affect metacognitive skills

6.2 Results: Answering Research Question 2

Kim (2010) investigated the role of scaffolding through questioning in the linguistic and cognitive development of ESL students. The study observed two teachers' questioning behaviors during three years and also their students' learning process. Through constant comparative analysis of data, three themes emerged. In fact, the results indicated that teachers used questions to share their own expectations for establishing a supportive

classroom environment, to deepen student understanding of input and to engage students in sharing their personal experiences. These two teachers utilized coaching, facilitating and collaborating questions to assist students' language learning. The findings also suggested that the teachers' questioning behavior positively influenced students' engagement in their own language learning. Likewise, Yaqubi and Mozaffari (2011) examined how EFL teachers can scaffold learning process through questioning. Seven intermediate-level teachers participated in this study. Through videotaping the classroom interactions and the teachers' practices and then the microanalysis of transcripts, the study revealed the frequent use of four question types which were simplifying questions, promoting questions and asking for agreement questions, and provided evidence that these different question types improved students' learning considerably.

7. Conclusion

This systematic review analyzed empirical studies conducted on the issue of questioning as a high-level cognitive process since 1974 to 2014. The chief reason behind this review was to depict the role of questioning, both student- and teacher-generated questions, in education and various learning areas. In an attempt to answer the first research question with respect to the learning/literacy areas affected by questioning, several key themes from these studies emerged which are addressed below.

From the studies conducted on the relationship between questioning and critical thinking, the following issues were revealed. Asking higher level questions is absolutely necessary for the development of learners' critical thinking ability. Learners use questioning to remove uncertainties and seek novel ideas. It was found that teachers used Socratic questioning method, verbal jigsaw, semantic tapestry and framing for enhancing their learners' critical thinking ability. In some cases, teachers' inappropriate questions hinder critical thinking. One problem which was observed was that some teachers were not aware of the existence of Socratic questioning, which is one of the most significant questioning strategies, and thus they did not employ it in their classrooms.

With respect to the role of questioning in reading comprehension, the reviewed studies illustrated the following notions: Most students ask lower-level questioning strategies which address knowledge and memory and fail to pose higher-level questions. This is unfortunate owing to the fact that higher-level cognitive questions, such as reasoning, inferential and elaborative questions highly contribute to deep comprehension and comprehension of more elaborate texts. Students' inability in deep text processing is assumed to be the prime reason of their weakness in asking strategic questions. Self-questioning improves reading comprehension and contributes to active reading. In analyzing teacher questioning, the literature shows that the most frequent and dominant type of questioning strategy used in classrooms is display questions which address lower-level cognitive processes and have predictable answers. Three questioning strategies were found to be influential in deep comprehension: Questioning the Author, Socratic Method and reciprocal teaching. Studies on teachers' questioning also revealed that chunking, questioning aloud strategies and question-generation strategy instruction all improve readers' comprehension level.

Subject matter learning was another area of research that is influenced by questioning strategies. The literature showed the impact of questioning strategies in higher achievement levels in Science, Mathematics, Chemistry and Biology. Specifically, QUILT strategy was highly influential for mathematics students. It was revealed that questioning behavior have high impacts on the quality of content-based instruction and learning from academic lectures. The shortcoming that was observed was that many teachers were incapable of asking open-ended, divergent and convergent questions which call for in-service programs to help teachers strengthen their classroom questioning behavior. With respect to students' attitude toward teachers' questioning, few students have a negative evaluation of the role of teachers' questioning in enhancing learning from text.

The role of questioning strategies in students' writing ability and metacognitive knowledge development was also illustrated by studies conducted on questioning. Studies have shown that high-level questions improve critical thinking and critical thinking, in turn, improves students' writing ability. Also, strategic questioning has proved to be useful in developing metacognitive awareness. Teacher-generated question prompts are effective in promoting metacognitive skills.

There are shortcomings and gaps in research on questioning. There seems to be a scarcity of research on the role of questioning in listening comprehension. Also, few studies have been conducted on questioning in social sciences with the exception of language and linguistics-related disciplines. Hence, future researches are recommended to conduct studies on the role of questioning behavior in social sciences and listening and lecture comprehension. Moreover, it is suggested that future researchers explore the role of students' questioning in text

comprehension owing to the fact that the majority of studies on questioning have focused on teacher questioning.

References

- Adams, M. J. (1993). *Beginning to read: An overview*. In R. Beard (Ed.), *Teaching literacy balancing perspectives* (pp. 204-215). London: Hodder and Stoughton.
- Akkaya, N., & Demirel, M. (2012). Teachers' candidates' use of questioning skills in during-reading and post-reading strategies. *Procedia - Social and Behavioral Sciences*, 46, 4301-4305. <http://dx.doi.org/10.1016/j.sbspro.2012.06.244>
- Aschner, M. J. (1961). Asking questions to trigger thinking. *NEA Journal*, 50, 44-46.
- Al-Darwish, S. (2012). The role of teacher questions and the Socratic method In EFL classrooms in Kuwait. *World Journal of Education*, 2(4), 76-84. <http://dx.doi.org/10.5430/wje.v2n4p76>
- Adedoyin, O. (2010). An investigation of the effects of teachers' classroom questions on the achievements of students in mathematics: Case study of Botswana community junior secondary schools. *European Journal of Educational Studies*, 2(3), 313-329.
- Almeida, A. P. (2010a). Questioning patterns and teaching strategies in secondary education. *Procedia Social and Behavioral Sciences*, 2, 751-756. <http://dx.doi.org/10.1016/j.sbspro.2010.03.096>
- Almeida, A. P. (2010b). Classroom questioning: Teachers' perceptions and practices. *Procedia Social and Behavioral Sciences*, 2, 305-309. <http://dx.doi.org/10.1016/j.sbspro.2010.03.015>
- Almeida, A. P. (2012) Can I ask a question? The importance of classroom questioning. *Procedia - Social and Behavioral Sciences*, 31, 634-638. <http://dx.doi.org/10.1016/j.sbspro.2011.12.116>
- Baleghizadeh, S. (2011). The Impact of students' training in questioning the author technique on EFL reading comprehension. *Procedia - Social and Behavioral Sciences*, 29, 1668-1676. <http://dx.doi.org/10.1016/j.sbspro.2011.11.410>
- Barrera, M., Liu, K., Thurlow, M., & Chamberlain, S. (2006). *Use of chunking and questioning aloud to improve the reading comprehension of English language learners with disabilities*. Minneapolis, MN: University of Minnesota, National Center on Educational Outcomes.
- Byun, H., Lee, J., & Cerreto, F. (2014). Relative effects of three questioning strategies in ill-structured, small group problem solving. *Instructional Science*, 42(2), 229-250. <http://dx.doi.org/10.1007/s11251-013-9278-1>
- Campbell, J., & Mayer, R. (2009). Questioning as an instructional method: Does it affect learning from lectures? *Applied Cognitive Psychology*, 23, 747-759. <http://dx.doi.org/10.1002/acp.1513>
- Cardoso, M., Almeida, P. (2014). Fostering student questioning in the study of photosynthesis. *Procedia - Social and Behavioral Sciences*, 116, 3776-3780. <http://dx.doi.org/10.1016/j.sbspro.2014.01.840>
- Cavanaugh, M. P., & Warwick, C. (2001). Questioning is an art. *Language Arts Journal of Michigan*, 17(2), 35-38. <http://dx.doi.org/10.9707/2168-149X.1320>
- Chang, Y. (2012). The use of questions by professors in lectures given in English: Influences of disciplinary cultures. *English for Specific Purposes*, 31, 103-116. <http://dx.doi.org/10.1016/j.esp.2011.08.002>
- Chin, C. (2007). Teacher questioning in science classrooms: Approaches that stimulate productive thinking. *Journal of Research in Science Teaching*, 44(6), 815-843. <http://dx.doi.org/10.1002/tea.20171>
- Chin, C., & Osborne, J. (2008). Students' questions: A potential resource for teaching and learning science. *Studies in Science Education*, 44, 1-39. <http://dx.doi.org/10.1080/03057260701828101>
- Choi, I., Land, S. M., & Turgeon, A. J. (2005). Scaffolding peer-questioning strategies to facilitate metacognition during online small group discussion. *Instructional Science*, 33, 483-511. <http://dx.doi.org/10.1007/s11251-005-1277-4>
- Coutinho, M., & Almeida, P. (2014). Promoting student questioning in the learning of natural sciences. *Procedia - Social and Behavioral Sciences*, 116, 3781-3785. <http://dx.doi.org/10.1016/j.sbspro.2014.01.841>
- Craig, J., & Cairo, L. (2005). *Assessing the relationship between questioning and understanding to improve learning and thinking (QUILT) and student achievement in mathematics: A pilot Study*. Appalachia Educational Laboratory at Edvantia, Inc. Charleston, West Virginia.

- Craig, S. D., Sullins, J., Witherspoon, A., & Gholson, B. (2006). The deep-level-reasoning-question effect: The role of dialogue and deep-level-reasoning questions during vicarious learning. *Cognition and Instruction*, 24(4), 565-591. http://dx.doi.org/10.1207/s1532690xci2404_4
- Culligan, N. (2005). *Theoretical Understandings of Adult Literacy: A Literature Review*. Palmerston North: Massey University.
- Day, R., & Park, G. S. (2005). Developing reading comprehension questions. *Reading in a Foreign Language*, 17(1), 60-73.
- Deed, C. (2009). Strategic Questions: A means of building metacognitive language. *International Journal of Teaching and Learning in Higher Education*, 20(3), 481-487.
- Dorkchandra1, D. (2013). The effects of question generating strategy instruction on EFL freshmen's reading comprehension and use of English tenses. *Journal of Liberal Arts*, 5(2), 32-45.
- Eason, S. H., Goldberg, L. F., Young, K. M., Geist, M. C., & Cutting, L. E. (2012). Reader-text interactions: How differential text and question types influence cognitive skills needed for reading comprehension. *Journal of educational psychology*, 104(3), 515-528. <http://dx.doi.org/10.1037/a0027182>
- Etemadzadeha, A., Seifi S., & Roohbakhsh Far, H. (2013). The role of questioning technique in developing thinking skills: The ongoing effect on writing skill. *Procedia - Social and Behavioral Sciences*, 70, 1024-1031. <http://dx.doi.org/10.1016/j.sbspro.2013.01.154>
- Evidence for Policy and Practice Information and Co-ordinating Centre (EPPI-Centre). (2007). *EPPI-Centre methods for conducting systematic reviews*. London: EPPI-Centre, Social Science Research Unit, Institute of Education, University of London.
- Farahani, D. B., & Mirsharifi, F. (2008). Effective and less effective teacher questioning and corrective feedback behavior in an EFL context. *Pazhuhesh-e Zabanha-ye Khareji*, 41, 5-23.
- Feng, Z. (2013). Using teacher questions to enhance EFL students' critical thinking ability. *Journal of Curriculum and Teaching*, 2(2), 147-153.
- Fulcher, G. (2010). *Practical Language Testing*. London: Hodder Education.
- Godfrey, K. A. (2001). *Teacher questioning techniques, student responses and critical thinking*. Master's Thesis, Portland State University.
- González, A. L. (2010). Researching classroom questioning. *Encuentro*, 19, 52-59.
- Goodman, K. S. (1967). Reading: A psycholinguistic guessing game. *Journal of the reading specialist*, 6(1), 126-135. <http://dx.doi.org/10.1080/19388076709556976>
- Goody, J. (1986). *The Logic of Writing and the Organization of Society*. Cambridge: Cambridge University Press. <http://dx.doi.org/10.1017/CBO9780511621598>
- Goody, J. (1987). *The Interface between the Written and the Oral*. Cambridge: Cambridge University Press.
- Graesser, A., & Olde. (2003). How does one know whether a person understands a device? The quality of the questions the person asks when the device breaks down. *Journal of Educational Psychology*, 95, 524-536. <http://dx.doi.org/10.1037/0022-0663.95.3.524>
- Griffee, D. (2011). Exploring a question and answer pedagogical model for International Teaching Assistant (ITA) Training. *Texas papers in Foreign Language Education*, 15(1), 17-29.
- Hussin, H. (2006). Dimensions of questioning: A qualitative study of current classroom practice in Malaysia. *Tesl-EJ*, 10(2), 1-17.
- Kim, Y. (2010). Scaffolding through questions in upper elementary ELL learning. *Literacy Teaching and Learning*, 15(1 & 2), 109-137.
- King, A. (1992). Comparison of self-questioning, summarizing, and notetaking-Review as strategies for learning from lectures. *American Educational Research Journal*, 29(2), 303-323. <http://dx.doi.org/10.3102/00028312029002303>
- King, A. (1994). Guiding knowledge construction in the classroom: Effect of teaching children how to question and explain. *American Educational Research Journal*, 31, 338-368.

- <http://dx.doi.org/10.3102/00028312031002338>
- Kintsch, W. (1998). *Comprehension: A paradigm for cognition*. New York: Cambridge University Press.
- Kintsch, W., & Welsch, D. M. (1991). The construction–integration model: A framework for studying memory for text. In W. E. Hockley, & S. Lewandowsky (Eds.), *Relating theory and data: Essay on human memory in honor of Bennett B. Murdock* (pp. 367-385). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.
- Kira, E., Komba, S., Kafanabo, E., & Tilya, F. (2013). Teachers' questioning techniques in advanced level chemistry lessons: A Tanzanian perspective. *Australian Journal of Teacher Education*, 38(12), 65-79. <http://dx.doi.org/10.14221/ajte.2013v38n12.7>
- Klem, A. M., & Connell, J. P. (2004). Relationship matter: Linking teacher support to student engagement and achievement. *Journal of School Health*, 74(4), 262-273. <http://dx.doi.org/10.1111/j.1746-1561.2004.tb08283.x>
- Larson, J. (1996). Challenging autonomous models of literacy: Street's call to action. *Linguistics and Education*, 8, 439-445. [http://dx.doi.org/10.1016/S0898-5898\(96\)90020-0](http://dx.doi.org/10.1016/S0898-5898(96)90020-0)
- Marzano, R. J., Pickering, D. J., & Pollock, J. E., (2001). *Classroom instruction that works: Research-based strategies for increasing student achievement*. Alexandria, VA: ASCD
- Marzban, A., & Jalili, Z. (2014). The Impact of teaching questioning on the Iranian EFL learners' problem-solving in writing. *Theory and Practice in Language Studies*, 4(5), 958-964. <http://dx.doi.org/10.4304/tpls.4.5.958-964>
- Marzola, E. S. (1988). Interrogating the text: Questioning strategies designed to improve reading comprehension. *Journal of reading, writing, and learning disabilities international*, 4(4), 243-258. <http://dx.doi.org/10.1080/0748763880040403>
- McDade, S. A. (1995). Case study pedagogy to advance critical thinking. *Teaching of Psychology*, 22(1), 9-10. http://dx.doi.org/10.1207/s15328023top2201_3
- Meng, J., Zhao, T., & Chattouphonexay, A. (2012). Teacher questions in a content-based classroom for EFL young learners. *Theory and Practice in Language Studies*, 2(12), 2603-2610. <http://dx.doi.org/10.4304/tpls.2.12.2603-2610>
- Miciano, R. (2004). Self-questioning and prose comprehension: A Sample case of ESL reading. *Asia Pacific education review*, 2(3), 210-216.
- Nelson-LeGall, S., & Glor-Scheib, S. (1985). Help-seeking in elementary classrooms: An observational study. *Contemporary Educational Psychology*, 10, 58-71. [http://dx.doi.org/10.1016/0361-476X\(85\)90006-2](http://dx.doi.org/10.1016/0361-476X(85)90006-2)
- Newman, R. S. (1992). Goals and self-regulated learning: What motivates children to seek academic help? In M. L. Maehr, & P. R. Pintrich (Eds.), *Advances in motivation and achievement: Goals and self-regulatory processes?* Greenwich, CT: JAI Press.
- Otero, J., & Kintsch, W. (1992). Failures to detect contradictions in text: What readers believe vs. what they read. *Psychological Science*, 3, 229-234. <http://dx.doi.org/10.1111/j.1467-9280.1992.tb00034.x>
- Palincsar, A. S., & Brown, A. (1984). Reciprocal teaching of comprehension-fostering and comprehension-monitoring activities. *Cognition and Instruction*, 1, 117-175. http://dx.doi.org/10.1207/s1532690xci0102_1
- Parker, M., & Hurry, J. (2007) Teachers' use of questioning and modeling comprehension skills in primary classrooms, *Educational Review*, 59(3), 299-314. <http://dx.doi.org/10.1080/00131910701427298>
- Pate, M. L., & Miller, G. (2011). Effects of regulatory self-questioning on secondary–level students' problem–solving performance. *Journal of Agricultural Education*, 52(1), 72-84. <http://dx.doi.org/10.5032/jae.2011.01120>
- Perez, B. (Ed.) (2004). *Sociocultural contexts of language and literacy* (2nd ed). Mahwah, NJ: Erlbaum.
- Rosenshine, B., Meister, C., & Chapman, S. (1996). Teaching students to ask questions: A review of intervention studies. *Review of Educational Research*, 66, 181-221. <http://dx.doi.org/10.3102/00346543066002181>
- Roth, W. M. (1996). Teacher questioning in an open-inquiry learning environment: Interactions of context,

- content, and student responses. *Journal of Research in Science Teaching*, 33, 709-736. [http://dx.doi.org/10.1002/\(SICI\)1098-2736\(199609\)33:7%3C709::AID-TEA2%3E3.0.CO;2-R](http://dx.doi.org/10.1002/(SICI)1098-2736(199609)33:7%3C709::AID-TEA2%3E3.0.CO;2-R)
- Sahin, A. (2013). Teachers' awareness and acquisition of questioning strategies: A case study. *Sakarya University Journal of Education*, 3(3), 17-36.
- Şeker, H., & Kömür, S. (2008). The relationship between critical thinking skills and in - class questioning behaviors of English language teaching students. *European Journal of Teacher Education*, 31(4), 389-402. <http://dx.doi.org/10.1080/02619760802420784>
- Street, B. V. (1984). *Literacy in theory and practice*. Cambridge: Cambridge University Press.
- Street, B. V., & Lefstein, A. (2007). *Literacy: An advanced resource book*. Routledge applied linguistics: New York. <http://dx.doi.org/10.4324/9780203463994>
- Taboada, A., & Guthrie, T. (2006). Contributions of student questioning and prior knowledge to construction of knowledge from reading information text. *Journal of literacy research*, 38(1), 1-35. http://dx.doi.org/10.1207/s15548430jlr3801_1
- Taylor, L. K., Alber, S. R., Walker, D. (2002). The Comparative effects of a modified self-questioning strategy and story mapping on the reading comprehension of Elementary Students with Learning Disabilities. *Journal of Behavioral Education*, 11(2), 69-87. <http://dx.doi.org/10.1023/A:1015409508939>
- Vygotsky, L. S. (1978). *Mind in Society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.
- Wilén, W. W. (1991). *Questioning Skills for teachers* (3rd Ed.). Washington: National Education Association of the United States.
- Yaqubi, B., & Mozaffari, F. (2011). EFL teacher questions to scaffold learning process: A conversation analytic study. *The Journal of Applied Linguistics*, 4(1), 228-259.
- Yesila, R., & Korkmaz, O. (2010). A comparison of different teaching applications based on questioning in terms of their effects upon pre-service teachers' good questioning skills. *Procedia Social and Behavioral Sciences*, 2, 1075-1082. <http://dx.doi.org/10.1016/j.sbspro.2010.03.151>

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