# Teaching Critical Thinking through a Dialogic Approach: The infusion model

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**Abstract**
Recent interest in teaching thinking has lead different researchers to examine different approaches in education to find effective methods and approaches for teaching thinking. Through a qualitative case analysis, this study attempted to identify the effects of the infusion model of teaching thinking implemented through a dialogic approach on a PhD candidate's critical thinking skills. The study occurred over a semester in a PhD course which aimed at reviewing and discussing language teaching issues critically. A number of interactions and reflective journals produced by the participant during the course was analyzed qualitatively for finding different thinking abilities and elements. A number of thinking abilities and elements proposed by Paul and Nosich (1993) in a higher order thinking assessment model was used for analysis. Analysis of the interactions and reflective journals showed that the number of thinking abilities and elements increased over the course which was indicative of the effectiveness of the infusion model used through a dialogic teaching approach in developing critical thinking skills.

**Keywords**: Critical thinking; dialogic teaching; infusion model; interactions; reflective journal

## Introduction

Dialogic teaching is a reciprocal teaching in which both learners and teachers contribute collectively which results in learners' understanding, thinking, and knowledge construction (Alexander, 2005; Mercer & Littleton, 2007). On the one hand, "dialogic teaching refers therefore to the kinds of verbal interaction that provide cognitive stimulus, expand consciousness and enlarge the dialogic space for thinking in children's minds" (Fisher, 2007, p. 617). on the other hand, "dialogical learning is the reciprocal exchange between persons who are open to one another and who, through the exchange, are in search of mutual agreement and common understanding" (Brogan & Brogan, 1995, p. 290).

As opposed to *monologic* approaches in which the teacher "knows and possesses the truth" (Bakhtin, 1984, p. 81), truth in a dialogic discussion "is born between people collectively searching for truth" (Bakhtin, 1984, p. 110). Therefore, "dialogue is used not primarily to make friends with the students but to challenge them to become critical cultural researchers and actors within their own circumstances" (Freire, 1985, p.98). According to Freir (1985), in the classes, coordinators and learners engage in dialogic interactions in which both contribute to express their ideas, challenge each other, and negotiate meaning.

Burbules (1993) referred to four types of dialogic practices used in the classroom which are dialogue as instruction, dialogue as conversation, dialogue as inquiry, and dialogue as debate. The first type, dialogic instruction, has been debatable so far since instruction requires a preplanned process while dialogue is a dynamic and developing process; however successful teachers know how to combine these two paradoxical processes and for them dialogic instruction

is "an artful performance rather than a prescribed technique" (Renshaw, 2004, p. 10). Overall, Dialogic teaching has been proved to be effective for learning and development (Mercer & Littleton, 2007; Reznitskaya et al., 2009; Reznitskaya, 2012) and Alexander (2008) suggested that teachers employ dialogic communications in the classes to improve learners' thinking ability.

According to Beyih-Marom (1993), teaching thinking provides a framework of normative, descriptive, and comparative models. In the normative model, teaching thinking makes the students aware of the experts' thinking style, while in the descriptive model, the focus is on the students' way of thinking. However, in order to improve the learners' thinking, normative models should be compared with the descriptive models. In a dialogic teaching environment, this kind of comparison can be done and learners can compare the way they think with the way experts think and consequently improve their thinking. "By making their classroom interactions more dialogic, teachers can engage students in a collaborative deliberation of complex questions and support the development of students' thinking" (Reznitskaya, 2012, p. 446). Referring to Vygotsky (1987) who considered language a psychological tool being essential for higher cognitive functions such as thinking, dialogue has a mediating role for improving thinking. "Dialogue is itself the primary thinking skill from which all others are derived" (Wegerif, 2006, p. 143). It considers both social and individual aspects which are "public distributed performance of dialogue" and "the private appropriation of dialogue for individual reflection", respectively (Renshaw, 2004, p. 1).

According to Paul and Nosich (1993, p. 80), literature on critical thinking has considered the followings as basic requirements of learning: "for all students to reason out all basic concepts and understanding, to reason all basic conclusions and solutions, and to reason through and across the curriculum". The assessment of critical thinking abilities should concentrate on four criteria of directness, systematicity, authenticity, and uniformity-relevance (Paul and Nosich, 1993). The first criterion, directness, highlights the importance of focusing on primary indicators of the ability. Systematicty addresses assessing just the critical thinking abilities, not other skills or abilities. Moreover, the assessment should occur in natural context (authenticity) and evaluate relevant abilities.

## Literature review

The question 'which approach should be used for teaching thinking?' has been taken into account in teaching thinking programs since the time that teaching thinking has become an important issue in education. There are two main approaches for teaching thinking, 'skills' or 'direct' approach and 'infusion' model. Based on the skills approach, thinking skills can be taught explicitly through exercises which are not related to any specific subject matter area. Two programs which are identified within this approach are De Bono's 'cognitive research trust' (CoRT) (1985) and Feuerstein's 'Instrumental Enrichment' (IE) (Maclure, 1991). The infusion model attempts to integrate the thinking skills within the curriculum. "Examples of infusion strategies can be drawn from mathematics, the sciences, the humanities and information technology" (Maclure, 1991, p. xi). Yet, there is a third approach which favors neither the skill approach nor the infusion model. Proponents of this approach believe that thinking skills will emerge as results of using traditional approaches and state that by learning cognitive knowledge, the learners will develop their thinking.

Throughout the history of teaching thinking, there has always been tensions among researchers to use the skills approach or the infusion model and the two approaches have been criticized and questioned. The transferability of thinking skills embedded within a specific subject matter in the infusion model as well as the feasibility of integrating teaching thinking

with teaching other subjects have been questioned (Coles, 1993; Maclure, 1991). It is believed that learners should be provided with techniques and strategies of how to think not just thinking haphazardly through the courses.  However, McPeck (1981) stated that thinking cannot be considered a separate and general skill and should be taught through a subject matter. To benefit from the advantages of the two approaches and reduce the inefficiency of each approach, Baron and Sternberg (1987) has proposed a mixed model in which skills approach is used for teaching some thinning skills separately and infusion model is used for integrating some thinking skills with the courses. They believe that individuals need to learn how to think in special teaching thinking courses, and at the same time pay attention to and practice thinking skills in all courses through the curriculum.

Interest in teaching thinking is reflected in examining the effectiveness of different approaches for improving thinking skills. For example, cognitive acceleration through science education (CASE) proved to be effective in improving cognitive reasoning of male teenagers (Shayer & Adey, 1993). Teachers in the activating children thinking skills (ACTS) reported the effectiveness of the program on improving children's thinking skills and ability to maintain social relationships and connections (McGuinness et al., 1997). Moreover, it was shown that using thinking skills increased the learners' self-esteem and self-concept (Fisher, 1998). Yet, McGuiness (1999) stated that teaching thinking projects help improve learners' thinking skills and academic achievement. However, the teaching thinking programs were effective not just for participants, the teachers involved in the projects developed in terms of theoretical and practical knowledge of thinking and thinking skills (McGuinness et al., 1997; McGuinness, 2000; Munro, 1999).

Dewy and Bento (2009), applying an infusion ACTS program in an experimental study, showed that the experimental group benefited from the program and the children's cognitive reasoning, awareness of thinking skills, self-esteem, self-confidence, cooperative working, and some social skills improved considerably. Moreover, the participants of the study were able to employ the thinking skills they had learnt in transcendent tasks and situations. The experiment was also effective for teachers and developed their awareness of different thinking skills and professional beliefs about teaching thinking. Yet, IE program designed for cognitive development and teaching thinking developed by Feuerstein and his co-researchers (Feuerstein, Rand, Hoffman, & Miller, 1980) have been proved to be successful in developing children's thinking skills, problem-solving techniques, and transferring thinking skills to real life situations (Delclos, Bransford, & Carl Haywood, 1984). According to Wegerif (2006, p. 144), dialogic thinking and teaching is suitable for promoting thinking skills and
Dialogic thinking, I argue, offers a particularly useful framework for education in suggesting the direction of dialogue as an end in itself, that is, the direction of becoming more able to dwell in the contradictory, multiple, and creative space of dialogue.

According to Tomasello et al. (2004, p. 675), dialogic representations emerge from the combination of "the general ape line of understanding others as animate, goal-directed, and intentional agents" and "a species-unique motivation to share emotions, experience, and activities with other persons". They stated that it is through dialogic interactions that individuals make linguistic symbols, develop social norm, share beliefs, and develop their cognitive abilities. Dialogic interactions set the ground for the emergence of higher mental functions (Vygotsky, 1978). Fisher (2007) examined the effects of philosophical discussions on thinking skills in a dialogic teaching context. The findings showed the effectiveness of the teaching thinking program in the participants' improvement in self-esteem, academic achievements, critical thinking, creative thinking, cognitive and verbal reasoning, active engagement, careful listening

to other ideas, and posing questions fluently. It was revealed that philosophical discussion improves emotional intelligence which includes self-awareness, self-regulation, resilience, empathy, and social skills.

Furthermore, considering the Iranian EFL context, Hajhosseiny (2012) investigated the effect of two dialogic teaching methods including group discussion and Socratic dialogue on university students' critical thinking and showed that dialogic teaching methods improved the participants' understanding and some social skills such as interacting with each other, participating in group discussions, and taking responsibility. Moreover, the dialogic methods encouraged the learners to pay attention to different dimensions of critical thinking such as "analyticity, cognitive maturity, self-confidence, self-evaluation, open- mindedness and truth-seeking" as well as different elements of social interaction such as "knowing each other, friendship and intimacy, tendency to dialogue, responsibility, class dynamism, interaction with teacher, intimacy with the instructor" (p. 1358). This was a qualitative study which applied action research and used interviews for evaluating the effectiveness of the treatment.

Recently, with the increase in interest in incorporating thinking skills in classroom curriculum (De Corte, 2002; Moseley, Elliott, Gregson, & Higgins, 2005; Topping, 2002), teaching thinking has been placed at the locus of attention. Moreover, dialogic approaches for teaching thinking have been considered effective means to develop critical thinking (Hajhosseiny, 2012; Lip man, 1997; Moon, 2008; Paul& Elder, 2004). To contribute to the literature done on the field, this study attempted to examine the effectiveness of the infusion model (a model which attempts to integrate thinking skills into education curriculum) for teaching thinking skills through a dialogic approach. Although the efficiency of dialogic approach for improving critical thinking of Iranian students has been proved (Hajhosseiny, 2012), there is a dearth of studies which have addressed the implementation of the infusion model through dialogic approach for improving critical thinking.

This study holds importance in that it included the three types of thinking mentioned by Sternberg (1990) including executive processing, performance processing, and learning processes. Executive processing includes planning, monitoring, and evaluating. In performance phase, individuals are involved in action doing real thinking such as making decisions, making inferences, making deductions and induction, etc. In the learning processes, the individuals learn how to think by posing questions, listening to others' ideas, and seeking answers and comments to others' questions and opinions. Moreover, in evaluating the thinking elements, both cognitive and affective elements of thinking were taken into account since according to Coles (1993, p. 338), "If teaching thinking is to be successful, it must realize that thinking capacities are grounded in both cognitive and affective aspects of people". Therefore, this study addressed the following questions.

1. How does the infusion model of thinking implemented through dialogic teaching affect critical thinking?

## Method

### Setting and participant

The case of the study was a female PhD candidate in teaching English as a foreign language (TEFL) who had received her master degree in TEFL and her BA in English literature and language. The participant was a native speaker of Persian with the experience of studying English for 14 years at language institutes and university. The study was conducted over a semester at Shiraz University in 2015.

**Material and instrument**
Critical thinking abilities and elements
In order to evaluate the improvement of the participant with regard to thinking skills, thinking abilities and affective elements of critical thinking proposed by Paul and Nosich (1993) in a model for assessing higher order thinking were used. Moreover, the researcher elicited some cognitive elements of thinking from different thinking criteria which were mentioned in the model.

**Paul and Nosich (1993, p. 101): Critical thinking abilities**
1. Refining generalizations and avoiding over-simplifications
2. Comparing analogous situations: transferring insights into new contexts
3. Developing one's perspective: creating or exploring the implications of beliefs, arguments, or theories
4. Clarifying issues, conclusions, or beliefs
5. Clarifying and analyzing the meanings of words and phrases
6. Developing criteria for evaluation: clarifying values and standards
7. Evaluating the credibility of sources of information
8. Questioning deeply: raising and pursuing root or significant questions
9. Analyzing or evaluating arguments, interpretations, beliefs, or theories
10. Generating or assessing solutions
11. Analyzing or evaluating actions or policies
12. Reasoning dialogically: comparing perspectives, interpretations, or theories
13. Reasoning dialectically: evaluating perspectives, interpretations, or theories
14. Reading critically: constructing an accurate interpretation of, understanding the elements of thought in, and evaluating, the reasoning of a text
15. Listening critically: constructing an accurate interpretation of, understanding the elements of thought in, and evaluating, the reasoning of an oral communication
16. Writing critically: creating, developing, clarifying, and conveying, in written form, the logic of one's thinking
17. Speaking critically: creating, developing, clarifying, and conveying, in spoken form, the logic of one's thinking

**Paul and Nosich (1993, p. 103): Affective elements of thinking**
1. Thinking independently
2. Exercising fair-mindedness
3. Developing insight into egocentricity and socio-centricity
4. Developing intellectual humility and suspending judgment
5. Developing intellectual courage
6. Developing intellectual good faith and integrity
7. Developing intellectual perseverance
8. Developing confidence in reason
9. Exploring thoughts underlying feelings and feelings underlying thoughts
10. Developing intellectual curiosity

**(Paul & Nosich, 1993): Cognitive elements of thinking derived from different thinking criteria**
1. Being responsible for learning

2. Making decisions
3. Using communication skills
4. Using problem solving skills
5. Taking initiatives/having active engagement
6. Presenting one's positions clearly
7. Giving logical/justified arguments
8. Giving significant examples to support claims
9. Modifying thinking in the flow of conversation
10. Synthetizing information or ideas

## Books covered in the class
The topics discussed in the following books were used for class discussions.
1. *Approaches and methods in language teaching by* Richards and Rodgers (2014).
2. *Teaching English as a second or foreign language by* Celce-Murcia, et.al. (2014).
3. *Exploring English language teaching: Language in action by Hall (2011).*
4. *Socio-cultural theory and the teaching of second languages* by Lantolf and Poehner (2008).
5. *Socio-cultural theory and the pedagogical imperative in L2 education by* Lantolf and Poehner (2014)
6. *Learning to think and thinking to learn* by Maclure and Davies (2005).

## Class interactions
All the interactions occurred in the classroom during the semester were recorded. After the course, the arguments and interactions produced by the participant were transcribed. Then, the transcriptions were analyzed for different thinking elements.
Reflective journal
The participant wrote a reflective journal after every session of the class. In the reflective, she reported what happened during the class including the interactions that she had with the mediator and other classmates and her feelings. Overall, sixteen reflective journals were produced by the participant. The reflective journals were analyzed qualitatively for different thinking elements.

## Data collection and analysis procedures
This study was conducted in a PhD course allocated to thinking about and criticizing second and foreign language teaching methodology at Shiraz University. The objective of the course was to critically discuss and review theoretical and practical aspects of different issues in language teaching. An infusion model of thinking was used for teaching thinking through a dialogic approach. One of the students volunteered to write reflective journals after the class and was selected as the participant of the study. The course took 16 sessions, the first session of the class was allocated to introducing the course and its objectives, the materials and books which were supposed to be covered in the course, required assignments, and course evaluation procedures. For the next sessions, the students of the class were supposed to read preplanned sections of the assigned books before the class and discuss them critically in the class. The first five sessions of the class were allocated to the books by Richards and Rodgers (2014), Celce-Murcia (2014), and Hall (2011) (mentioned in the material section). During the second five session, the books by Lantolf and Poehner (2008, 2014) were covered and over the third five sessions, the students discussed some remaining chapters of the book By Lantolf and Poehner (2014) and the book on thinking by Maclure (2005).

Moreover, the students were asked to hand in four critiques on specified topics during the course. In addition to the assignments that all the students were required to do, the participant produced reflective journals after each session. Each session, the students and the course professor posed questions or introduced different topics of the assigned chapters for each session and discussed the issues with others. All the interactions occurred during the sessions were recorded for further analysis. The recorded interactions in which the participant had taken part were transcribed. The researcher analyzed the class discussions and the reflective journals produced by the participant qualitatively in order to find elements of critical thinking elicited from the model of assessing thinking proposed by Paul and Nosich (1993) to show the effects of teaching thinking through an infusion model on the participant's thinking skills.

## Results

This section is divided into two parts. The first part presents the number of thinking elements found in the participant's interactions and reflective journals. In the second part, examples of each thinking element taken from the samples produced by the participant are provided.

**Elements of thinking in the participant's interactions and reflective journals**

In this part, descriptive statistics of different elements of thinking found through a qualitative analysis from the participant' interactions produced in the class and reflective journals produced after the class is presented. The class sessions were divided into three equal five sessions in order to see how the use of thinking elements changed over the course. Elements of thinking are divided into thinking abilities, affective elements, and cognitive elements. In Table 1, frequency of critical thinking abilities found in the interactions and reflective journals is shown.

*Table 1. Number of thinking abilities found in the participant's class interactions and reflective journals*

| Critical thinking abilities | 1st five sessions | 2nd five sessions | 3rd five sessions |
|---|---|---|---|
| Refining generalizations and avoiding over-simplifications | 2 | 4 | 5 |
| Comparing analogous situations: transferring insights into new contexts | 1 | 1 | 3 |
| Developing one's perspective: creating or exploring the implications of beliefs, arguments, or theories | 1 | 2 | 4 |
| Clarifying issues, conclusions, or beliefs | 2 | 3 | 5 |
| Clarifying and analyzing the meanings of words and phrases | 2 | 5 | 5 |
| Developing criteria for evaluation: clarifying values and standards | 0 | 0 | 3 |
| Evaluating the credibility of sources of information | 0 | 1 | 2 |
| Questioning deeply: raising and pursuing root or significant questions | 4 | 9 | 10 |
| Analyzing or evaluating arguments, interpretations, beliefs, or theories | 3 | 7 | 7 |
| Generating or assessing solutions | 4 | 5 | 6 |
| Analyzing or evaluating actions or policies | 1 | 2 | 2 |

| | | | |
|---|---|---|---|
| Reasoning dialogically: comparing perspectives, interpretations, or theories | 5 | 7 | 11 |
| Reasoning dialectically: evaluating perspectives, interpretations, or theories | 2 | 5 | 10 |
| Reading critically: constructing an accurate interpretation of, understanding the elements of thought in, and evaluating, the reasoning of a text | 4 | 6 | 9 |
| Listening critically: constructing an accurate interpretation of, understanding the elements of thought in, and evaluating, the reasoning of an oral communication | 3 | 4 | 9 |
| Writing critically: creating, developing, clarifying, and conveying, in written form, the logic of one's thinking | 1 | 1 | 2 |
| Speaking critically: creating, developing, clarifying, and conveying, in spoken form, the logic of one's thinking | 6 | 9 | 12 |
| Total | 41 | 71 | 105 |

As it is obvious in the Table 1, implementing the infusion model of teaching thinking through a dialogic approach was effective in improving the thinking abilities of the participant. The total number of thinking abilities changed from 41 in the first five sessions to 71 in the second five sessions, and finally, to 105 in the third five sessions. Table 2 represents the number of affective thinking elements found the in the participant's interactions and reflective journals over the course.

*Table 2. Number of affective elements of thinking found in the participant's class interactions and reflective journals*

| Affective elements of critical thinking | 1st five sessions | 2nd five sessions | 3rd five sessions |
|---|---|---|---|
| Thinking independently | 4 | 5 | 13 |
| Exercising fair- mindedness | 3 | 3 | 8 |
| Developing insight into egocentricity and socio-centricity | 2 | 2 | 5 |
| Developing intellectual humility and suspending judgment | 3 | 6 | 8 |
| Developing intellectual courage | 3 | 4 | 5 |
| Developing intellectual good faith and integrity | 5 | 6 | 8 |
| Developing intellectual perseverance | 4 | 5 | 10 |
| Developing confidence in reason | 4 | 5 | 12 |
| Exploring thoughts underlying feelings and feelings underlying thoughts | 3 | 4 | 7 |
| Developing intellectual curiosity | 3 | 5 | 15 |
| Total | 34 | 55 | 91 |

According to Table 2, the total number of affective elements produced in the first five sessions were 34 which changed to 55 for the second five sessions and 91 for the third five

sessions. This means that the treatment was effective in increasing the number of affective elements in the participant's thinking skills.

***Table 3.*** *Number of cognitive elements of thinking found in the participant's class interactions and reflective journals*

| Cognitive elements of thinking derived from different thinking criteria | 1st five sessions | 2nd five sessions | 3rd five sessions |
|---|---|---|---|
| Being responsible for learning | 2 | 3 | 5 |
| Making decisions | 4 | 4 | 7 |
| Using communication skills | 6 | 10 | 13 |
| Using problem solving skills | 2 | 3 | 5 |
| Taking initiatives/having active engagement | 5 | 9 | 12 |
| Presenting one's positions clearly | 2 | 5 | 8 |
| Giving logical/justified arguments | 2 | 6 | 10 |
| Giving significant examples to support claims | 2 | 3 | 6 |
| Modifying thinking in the flow of conversation | 1 | 3 | 7 |
| Synthetizing information or ideas | 6 | 7 | 14 |
| Total | 31 | 58 | 87 |

As it is indicated in Table 3, the total number of cognitive elements of critical thinking found in the interactions and reflective journals by the participant increased during the course. Although the number of some elements were equal in the first and second five sessions, they notably increased in the third five sessions.
Samples of different elements of thinking produced by the participant
Thinking abilities taken form the participant's class interactions and reflective journals
►**Refining generalizations and avoiding over-simplifications:** I think teaching English to students is very complicated and using metaphors like these shows that teaching is a simple job.

►**Comparing analogous situations: transferring insights into new contexts:** By reviewing the first five principles of Ellis that were criticized with the help of the professor and other classmates, I criticized the second five principles.

►**Developing one's perspective: creating or exploring the implications of beliefs, arguments, or theories:** In my opinion, the criticism against the implicit teaching of thinking which states that learners cannot transfer the thinking skills to other contexts is not acceptable. If learners gain awareness of the thinking skills and become conscious about how to do critical thinking, they can use apply it in all contexts.

►**Clarifying issues, conclusions, or beliefs:** Overall, I think Hall has foregrounded the practical aspect of language teaching in his book rather than the theoretical ones.

►**Clarifying and analyzing the meanings of words and phrases:** I think the meaning of development in sociocultural theory is somehow different; here development is a process, there is no end point or product where we can say development is occurred.

►**Developing criteria for evaluation: clarifying values and standards:** In dynamic assessment, as you see some kind of improvement in learners you can decide that it was effective although you do not find a complete and acceptable performance.

►**Evaluating the credibility of sources of information:** Of course for valid information on critical pedagogy and critical thinking, we should refer to journals publishing papers on thinking and critical thinking.

►**Questioning deeply: raising and pursuing root or significant questions:** Is the teacher conscious of the type of mediation that she/she gives to the students? I mean explicit and implicit ones.

►**Analyzing or evaluating arguments, interpretations, beliefs, or theories:** I am not sure if I am right or not, but in my opinion, SCT theory is a more powerful and effective framework than post-method for teaching language.

►**Generating or assessing solutions:** In our context, because the classes are crowded and the teachers do not have time to pay attention to every learner, it is very important to use group works and group dynamic assessment for their improvements.

►**Analyzing or evaluating actions or policies:** I think the order in which the professor asked us to read the books and criticize them is purposeful. First we started with traditional methods, then post-method, then SCT, and finally critical thinking.

►**Reasoning dialogically: comparing perspectives, interpretations, or theories:** There are two orientations for language learning. I think for those who learn English for communicative purposes, formulaic expressions are needed, while for those who are after academic purposes, both should be instructed.

►**Reasoning dialectically: evaluating perspectives, interpretations, or theories:** the part that mentioned the idea of Feurstein which proposed retarded performers instead of retarded individual was very deep in meaning and exactly in line with SCT and its components, mediation and ZPD.

►**Reading critically: constructing an accurate interpretation of, understanding the elements of thought in, and evaluating, the reasoning of a text:** What I got from this page is that Zero grammar approach which presented by Krashen considers the learners' built-in syllabus.

►**Listening critically: constructing an accurate interpretation of, understanding the elements of thought in, and evaluating, the reasoning of an oral communication:** You are comparing Ellis's principles with Kumaravadivelu's macro strategies; however, I think that the tenets and philosophies behind them are totally different and you are not allowed to compare two different things.

►**Writing critically: creating, developing, clarifying, and conveying, in written form, the logic of one's thinking:** Four critiques were written by the participant during the course.

**►Speaking critically: creating, developing, clarifying, and conveying, in spoken form, the logic of one's thinking:** Post-method states that the teachers are supposed to theorize from their practices, but I believe that novice teachers do not have enough experience to develop theories. Affective elements of thinking taken form the participant's class interactions and reflective journals.

**►Thinking independently/exploring thoughts underlying feelings and feelings underlying thoughts:** I think, there is a problem in this figure. If we add another stage, named reflection after evaluation [Thinking independently], it would be a more comprehensive and powerful framework [feelings underlying thoughts]. Today, I had both bad and good feelings in the class, bad for not being able to think critically, and good for learning how to criticize some principles of Ellis and understanding that we can criticize the significant figures' ideas [thoughts underlying feelings].

**►Exercising fair-mindedness**: it is not true to say that reliability and validity do not exist in dynamic assessment, they do, but their definitions are redefined based on the concepts of dynamic assessment and sociocultural theory (SCT).

**►Developing insight into egocentricity and socio-centricity:**  Why do you think that the teachers are always right? What is the scale for evaluating what is right or wrong? Because we are teacher we cannot say that teachers are right all the time.

**►Developing intellectual humility and suspending judgment:** I think this principle of Ellis is closely related to Lewis idea that "language consists of grammaticalized lexis, not lexicalized grammar." Am I right? Is there any relationship between the two?

**►Developing intellectual perseverance, Developing confidence in reason:** Is there any difference between metalinguistic knowledge and verbalization...It is mentioned that learning about concepts does not deal with metalinguistic knowledge, it is related to semantic and functional knowledge. In verbalization, we deal with explanation of the concept, but we cannot use metalinguistic knowledge because in the definition of verbalization we can find that during verbalization, we talk through the concepts not about the concepts, so I think using metalinguistic knowledge in verbalization is not allowed.

**►Developing intellectual courage:** Today, I wrote the first criticism and I criticized five principles of Rod Ellis in the way I learnt during the previous session.

**►Developing intellectual good faith and integrity:** I think the critique I wrote on SCT was acceptable because I considered everything about the theory and now I am pleasant that I have learnt to write critiques.

**►Developing intellectual curiosity:** You see in SCT, everything is in a dialectical relationship but I think verbalization is not a relationship. It is an activity done by learners. What is your idea? Cognitive elements of thinking derived from thinking criteria.

**►Being responsible for learning:** To learn about writing critiques, I searched some databases and downloaded some critiques on the topic.

►**Making decisions:** There were many topics in the book by Hall, on which I can write critiques. Finally, I decided to write about computer assisted language learning because I had a background knowledge about.

►**Using communication skills:** Code switching, literal translation, use of such and thing.

►**Using problem solving skills:** considering reliability and validity in dynamic assessment, first, we need to divide the discussion into interventionist and interactionist DA because I think there is a difference between the two.

►**Taking initiatives/having active engagement:** Let me answer his question and clarify the point for him.

►**Presenting one's positions clearly:** concerning the learner autonomy, the author defines it as setting objectives, or evaluating the teaching program. However, I believe that learners at lower levels do not have the expertise and knowledge to do such things.

►**Giving logical/justified arguments:** By referring to page 124, we can understand that concepts are tools of mind not the use of concept because if the authors meant the use of concept, they would have used tool not tools because the use of concept is singular.

►**Giving significant examples to support claims:** See, for example if a teacher want to teach a list of vocabulary and he/she just write the list on the board….

►**Modifying thinking in the flow of conversation:** I thought agency is unique for SCT, but it seems that it can be used in other theories and approaches albeit with different definitions appropriate to the theory or approach.
►**Synthetizing information or ideas:** So referring to the educational policies that constrain the Iranian teachers and ask them to follow pre-specified plans and the flexibility of SCT, do you think that the Iranian teachers cannot apply this theory in their classes?

## Discussion

As mentioned in the result section, the number of critical thinking skills in terms of thinking abilities, affective elements, and cognitive elements increased over the course. The number of thinking abilities in the third five sessions was more than the abilities found in the first and second five sessions which can be justified by two facts: 1) the participant reviewed some articles on critical thinking and different thinking approaches in the third five sessions, and 2) she had already practiced critical thinking over the previous ten sessions and had received mediation from other classmates and the professor as an expert in critical thinking. Similarly, the total number of affective elements increased over the course which indicated that the infusion model of thinking had positive effects on the affective side of thinking skills. However, based on the data, the change in the number of affective elements from the second five sessions to third five sessions was more tangible and prominent than the change in the number of elements from the first five sessions to the second five sessions. One possible reason for better performance of the participant during the third five sessions can be the fact that during the second five sessions, the participant learnt about SCT, mediation, and learner development, empowerment, and

independent performance which might have affected her thinking abilities and encouraged her to develop these thinking abilities. Yet, the total number of cognitive elements of critical thinking found in the interactions and reflective journals by the participant increased during the course. The results are in line with Alexandre's (2006) view that teaching by discussions and dialogues within a dialogic approach promotes thinking and understanding, improves the activities that leaners do, and overall, leads to development in learning.

### Conclusion

Due to the importance of thinking skills in education and the recent interest in literature for examining different approaches for teaching thinking, this study examined the effects of the infusion model for teaching thinking through a case analysis. The study was conducted over as semester in a PhD course designed for reviewing and criticizing language teaching methods. A range of thinking elements and abilities proposed by Paul & Nosich (1993) was used for analyzing the data including a sample of the interactions and reflective journals produced by a PhD candidate in the class. Applying the infusion model of thinking through dialogic teaching in which the purpose was to pose questions, discuss the issues critically, answer reasonably, express ideas, and defend ideas could encourage the participant to think independently, express ideas through courage and perseverance, and consequently improve her self-confidence. In line with studies which showed that using thinking skills increased the learners' self- esteem, self-confidence, and self-concept (Dewy and Bento, 2009; Fisher, 1998; 2007), this study showed that teaching thinking skills through the infusion model integrated within a dialogic approach increased the frequency of occurrence of affective elements of thinking such as independence, confidence, and courage in reasoning. Moreover, the participant's ability to understand others' ideas and argue reasonably with others was improved (fair-mindedness). Taking part in discussions and listening to other's views could increase the participant's awareness about other viewpoints and helped her to pay attention to other people while reasoning and thinking critically. Yet, she became more conscious of giving un-biased points of view and reasoning in favor of both herself and others in the society (egocentricity and socio-centricity).

Confirming the study by Dewy and Bento (2009), which revealed the strength of the infusion model for improving cognitive, affective and social skills, this study showed that using the infusion model through a dialogic approach increased a range of thinking abilities as well as cognitive and affective elements of critical thinking. Moreover, the findings revealed the efficacy of dialogic approaches for teaching thinking and improving critical thinking and were in agreement with the results of the studies which proved that dialogic approaches were effective in promoting learning in general (Mercer & Littleton, 2007; Reznitskaya et al., 2009; Reznitskaya, 2012) and, specifically, developing thinking skills (Alexander, 2008; Fisher, 2007; Hajhosseiny, 2012; Lip man, 1997; Moon, 2008; Paul & Elder, 2004; Wegerif, 2006). Moreover, the results confirmed Vygotsky's (1978) view that dialogic interactions leads to higher mental functions. The results of this study can be informative for language teachers and those in favor of improving thinking skill and promoting deep and critical thinking. Nonetheless, the results cannot be generalized since it was a case analysis of a PhD student. Thus, the number of participants and the proficiency level of them should be taken into account. What's more, this study used a qualitative method for the evaluation of the effect of teaching thinking on the participant's thinking skills, other researchers can mix quantitative and qualitative methods to find more rigorous results.

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