

The Role of ZPD in Estimating Learners' Future Level of Development: The Case of Reading Ability

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ABSTRACT: The present study aimed at investigating the possible impact of Zone of Proximal Development (ZPD) on the learners' performance. Forty-six Iranian university students participated in this study by taking two types of reading comprehension tests (i.e., the main idea and Wh-question type). The researchers used the Winstep program to analyze the data and estimate the learners' Rasch measure in pre, post, and mediation tests. The study indicated that the ZPD was the main reason for the observed difference between the learners' performance on pretest (Actual Level of Development or ALD) and posttest (Future Level of Development or FLD). The study also revealed that the learners with lower Rasch measure showed more sensitivity to mediation.

Keywords: dynamic assessment, reading comprehension, zone of proximal development (ZPD), Actual Level of Development (ALD), Future Level of Development (FLD)

Dynamic Assessment (DA) is not a newly-born field of study. Following the introduction of the concept, many scholars have tried to apply DA to various academic disciplines (C. Lidz, personal communication, May 29, 2011). Dynamic Assessment seems to be in its infancy in second language acquisition (SLA). Poehner (2008) states that "few studies have examined L2 performance from a DA perspective, although the growing interest in Vygotskian theory among applied linguists has led to some exploration of how DA principles might be used in L2 contexts" (p. 5).

DA has its roots in Vygotsky's theory of child's cognitive development (Poehner, 2008). According to Vygotsky (1978), cognitive development occurs at two levels: potential or assisted level (present to future), and actual and unassisted level (past to present). At the actual level, the child does the task without any help (autonomous level), but at the potential level the child needs another person's (a mediator's) assistance (Vygotsky, 1978).

Dynamic Assessment developed as a response to criticisms against conventional (static) tests, which aimed at measuring the learners' knowledge by a single observation of their performance in academic settings. To measure the learners' improvement, researchers, teachers, and assessors rely on gain scores or the difference between the pretest and posttest results in a research context, or a clinical situation (Lidz, 2003). While this method has been around for a long time, many scholars doubt the validity of the results that these tests provide (Kozulin & Grab, 2001; Poehner, 2008). In the face of these criticisms, DA has been proposed as an alternative method to replace Static Assessment (SA). According to DA, knowledge emerges as a result of the examiner and examinee's interaction (Fuchs, Compton, Fuchs, Hollenbeck, Craddock, & Hamlet, 2008; Vygotsky, 1978).

A plethora of criticisms are leveled against Static Assessment (SA). One such criticism is that SA has inadequately represented the minorities due to normative sampling (Gutiérrez -Clellen, & Peña, 2001; Kester, Peña, & Gillam, 2001). The second criticism relates to the purpose of SA. Static assessment, as many scholars believe, does not turn learners into independent knowledge constructors and problem solvers (Jonsson, Matheos, Svingby, & Attström, 2007). The problem compounds when one considers the current argument on the interactive nature of language competence (Bachman, 2007; Young, 2011). The proponents of interactional competence believe that competence emerges within a collaborative dialogue.

Zone of Proximal Development (ZPD)

The most important feature of DA is the notion of ZPD which stands for Zone of Proximal Development (Lantolf, 2002, 2006; Ohta, 2000). ZPD refers to the difference between what a person can achieve alone (unassisted) and what he can accomplish when assisted. Its scope includes more than just expert/novice interaction. People working jointly are able to co-construct contexts in which expertise emerges as a feature of group (Lantolf, 2002). To Lantolf (2006), ZPD is more appropriately conceived as the collaborative construction of opportunities. Elsewhere, Ohta (2000) refers to ZPD as the internalization of social interactive processes which happen within ZPD. ZPD functions at two opposite levels of social and psychological plane. As Birjandi, Daftarifard, and Lange (2011) state, "the initial cognitive development starts with externalization and moves to internalization through transmission of object regulation to other regulations and finally to self regulation" (p. 126). It is believed that the true picture of learners' knowledge can be achieved through the estimation of their ZPD (Lantolf, 2002, 2006; Poehner, 2008) rather than SA. Haywood and Lidz (2007) state that

standardized, normative testing is likely to yield low scores and consequent pessimistic predictions of future learning effectiveness and school achievement. It is not the major role of DA to dispute those predictions; indeed, they are disastrously likely to prove accurate if nothing is done to overcome various obstacles to learning and performance. (p. 3)

ZPD is measured variously by different scholars. In a test-teaching-retest procedure, ZPD is measured through estimating the range between unsupported and supported performance (Kester, Peña, & Gillam, 2001). To Jitendra, Rohena-Diaz and Nolet (as cited in Kester, Peña, & Gillam, 2001), ZPD should be measured through considering (1) quality and quantity of change produced by learners; (2) the amount of the examiner's effort involved in teaching; and (3) the examinees' responsiveness. Kozulin and Grab (2001) also list two methods of analyzing learners' performance in DA: (1) comparing learners' score improvement through standard deviation and effect size, and (2) comparison of learning potential score (LPS) through the following formula:

$$\text{“LPS} = \frac{(S_{\text{post}} - S_{\text{pre}})}{S_{\text{max}}} + \frac{S_{\text{post}}}{S_{\text{max}}} = \frac{2S_{\text{post}} - S_{\text{pre}}}{S_{\text{max}}}$$
 where S_{pre} and S_{post}

are pre- and post-test scores and S_{max} is a maximal obtainable score” (p. 7). While the formula is an innovative way of measuring ZPD, it has certain problems because posttest is partially part of the result. Therefore, it is not possible to compare the effects of ZPD with learners' performance on Pretest (M. Linacre, personal communication, July 20, 2010). To Baek and Kim (2003), ZPD score is the difference between non-mediated pretest and mediated posttest for each individual.

ZPD is also measured in terms of reciprocity (Lidz, 2003; Poehner, 2008). Reciprocity refers to both learners' and examiner's responsiveness to mediation and learners' request for further help when they face problems during a task. Reciprocity is important because it helps the mediator to understand the learners' sources of problem. According to Van Der Aalsvoort and Lidz (2002), reciprocity may include (a) learners' responsiveness to the examiner, (b) self regulation of attention, and (c) comprehension of activity demands and reaction to challenges.

Research on Dynamic Assessment: Mixed Claims

Comparing the learners' performance on pretest (ALD) and posttest (FLD) is an important procedure in DA studies. However, there are debates about whether pretest scores can function as an acceptable indicator of success of

failure or even a more interactive intervention (Cole & Dale, 1986). Fuchs et al. (2008) believe that pretest (ALD) performance can be considered as a competing predictor for the posttest (FLD) performance. Kozulin and Grab (2001) argue that ZPD might serve as a better predictor of learners' potential development than static score. Kozulin and Grab compared two groups of learners as they took different reading comprehension tests. While one group received dynamic mediation (DA group) on a reading comprehension test, the other group did not receive any form of mediation (Non-DA group). The researchers found that the DA group outperformed the Non-DA group on the non mediated posttest. Ableeva (2008) also argued that ZPD can be indicative of the learners' difference in the posttest.

We can conclude that the learners' performance on pretest or Actual Level of Development (ALD) cannot be predictive of their future development. However, we need to state that this conclusion may not be true for all learners (Poehner, 2008). Predicting learners' future level of development is important in educational contexts. In such contexts, the common strategy to screen, group, and categorize learners into appropriate educational programs is based on the learners' performance on a single observation. This implies that learners with similar actual level of knowledge would probably have similar future level of development. However, there are scholar who argue that the learners' ZPD is the main indicative factor of the learners' future performance or the future level of development (Haywood & Lidz, 2007; Lidz, 2003).

Purpose of the Study

Considering the above arguments, the present study tries to investigate the effect of Dynamic Assessment (DA) on the development of learners' potential ability (ZPD) in reading comprehension. The purpose of this study is to investigate whether DA qualitatively differentiates between learners with similar actual level of development (Pretest) on two distinct reading skills (i.e., understanding the main idea and referential questions). These two skills have been selected due to the fact that they are hypothetically different from each other in terms of cognitive complexity. Figure 1 shows the schematic design of this study.

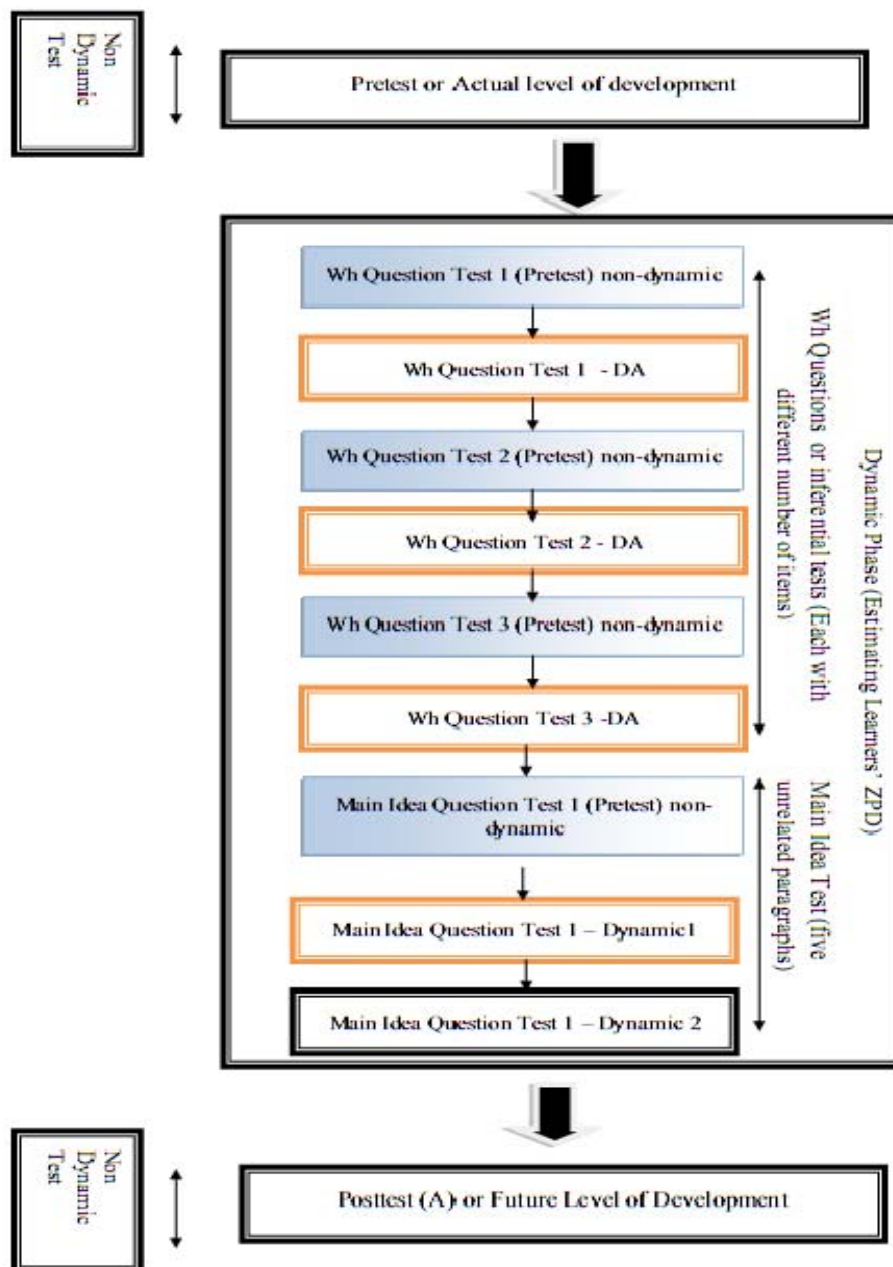


Figure 1. Schematic Design of This Study

Method

Participants

A total of 46 Iranian university students (36 Female and 10 Male) majoring in psychology at Allameh Tabatabaei University participated in this study. They formed the intact group. Their age ranged between 18 to 25 years. From among 46 participants of this study, 33 rated their English ability as elementary, three as intermediate, and one as advanced. Eight participants did not mention anything regarding their level of proficiency.

Instruments

Two instruments were used in this study. First, a non-DA pretest (ALD) and posttest (FLD) and second, four successive DA tests (See Figure 1 for the schematic design). The Pretest and posttest were the same and measured the subjects' performance on two different skill-based tests (main idea and referential questions). Each of the reading abilities (main idea and referential questions) was represented with five items (five inferential questions and five main idea questions). The second instrument was DA tests consisting of different texts that were used to measure the learners' ZPD on two distinct reading skills (main idea and referential questions) in four consecutive weeks. The *main idea* test included five paragraphs for which subjects had to write the answers (the main idea). The paragraphs were different in terms of the positions of the main idea. The referential question tests included three texts, each with different number of items (Text one, two, and three had four, four, and twelve items, respectively).

Between the non-mediated pretest (ALD) and posttest (FLD), the DA tests were used in static and mediated forms. Each static test was mediated through preselected implicit hints. This means that the subjects were given the question two or three times depending on the difficulty of the reading skill measure, each time with the more explicit hint written on the paper. Each text for referential questions was given twice because the skill was easy and many students were able to find the answer after the first given mediation; but the paragraphs for main idea questions were given twice as they were more demanding.

Strategies used for mediation in this study were (a) text analysis according to location (for both main idea and factual information tasks), (b) looking for clues in the questions (for both main idea and factual information tasks), and (c) inference through comparing the function of sentences in relation to each other (for main idea tasks).

Procedure

The researchers administered the reading comprehension tests in a regular English course for undergraduate psychology students. The first tests

included items that measured reading for main idea (4 items) and scanning (8 items). The second test also included twelve items, each addressing different types of Wh-questions. The researchers also used vocabulary charts to provide the Persian equivalents of the infrequent vocabulary items. The subjects answered all the questions by writing a short answer exclusively. These tests and vocabulary charts were also used as the posttest at the end of the course. From the students' point of view, the posttest served as a "pre-final" exam to ensure the response validity. Moreover, the posttest functioned as an indication of the subjects' future level of development.

The posttest was mediated by the addition of "hints" to the questions that included such activities as: (1) text analysis according to location (the subjects were told for instance that the location of the main idea was in the middle of the paragraph), (2) looking for clues in the questions (What does a wh-type question require you to do?), and (3) inference through comparing the function of sentences in relation to each other (Try to find the most general sentence in the paragraph). The strategies were applied according to the relationship between the answer and the question. The hints functioned as a mediation means because they were selected based on the reading mechanisms that learners go through to answer the questions (Alderson, 2000; Grabe, 1991).

The *main idea* questions were scored 0, 1, or 2, but factual question items were scored dichotomously. In both factual information and main idea tasks, redundant information was given no marks. To estimate the subjects' ZPD, the researchers followed Baek and Kim's (2003) procedure. That is they used the differences between pretest and posttest in the mediated section (See figure 1) to estimate the ZPD. For that purpose, the researchers made sure that the tests, chosen and devised as the instructional tools, produced both pretest (ALD or unassisted) and assisted scores. This procedure produced three ZPD scores and one pretest score for each subjects' performance on inferential questions and two ZPD scores, along with one pretest score for their performance on main idea questions in dynamic phase.

Data Analysis and Results

Rasch measure can be used for several purposes: screening data, analyzing data, and preparing data. Considering the descriptive nature of this study, the researchers used the Rasch model for screening and preparing the data for further comparisons. In this study, the subjects' scores (raw scores) were converted to Rasch measure. As discussed earlier, some of the DA studies (Fuchs et al., 2008; Gutiérrez-Clellen & Peña, 2001) have used the standard score instead of raw score. However, due to the advantages of the Rasch measure, the researchers used Rasch measure instead of the standard

score. The rationale for this choice was manifold: First, Rasch measure gives intervals, whereas the raw score gives rank orders (T. Bond, personal communication, July 30, 2010). Second, Rasch measure equalizes scores in number so that the scores become comparable. Third, raw scores are strongly non-linear at the extremes (Linacre, 2010). Moreover, Rasch model can be used with small samples (M. Linacre, personal communication, May 11, 2011).

For data analysis, Rasch measures for each person in the pretest (ALD) and posttest (FLD) were estimated. The researchers used Winstep Program in this analysis. Because each task was rated differently on a different scale, the following syntax was used to separate different tasks from each other:

DPF = \$\$1W3; task codes are in the first 3 columns of the item label.
 ISUBTOT = \$\$1W3
 ISGROUPS = AAAAABBBBB; items 1-5 and items 6-10 have different rating scales.

This was repeated for each phase of the study, i.e. pretest, posttest, and the mediation test. Subsequently, Differential Person Functioning (DPF) was run to obtain each person's measure on each task separately. The participants' ZPD scores were obtained for each test through the estimation of the difference between the subjects' Rasch measures on unassisted test administration and assisted test administration in the dynamic phase (DA).

Analysis One: Item and Person Reliability

Table 1 shows the mean and standard deviation for both tasks of main idea and referential questions. As is shown in this table, the means and standard deviations for both tasks in the posttest are more than those of the pretest. This indicates the subjects' improvement after the treatment sessions. The observed change in the standard deviation of the post test scores (i.e., 0.77) indicates that the participants in this study perform similarly (lower standard deviation) after intervention.

Table 1. Means and Standard Deviations of the Pretest (ALD) and Posttest (FLD) for the Tasks

Tasks	Mean (SD)	
	Pretest	Posttest
Main Idea	1.29 (1.67)	1.91 (0.61)
Referential Question	1.22 (1.06)	1.90 (0.77)

There are two criteria for reliability estimates in IRT models: person and item. The person reliability index indicates how easy or difficult a test is for

the selected sample. The reliability indices of item and person in both pretest (ALD) and posttest (FLD) are reported in Tables 2 and 3. As shown in Table 2, person reliability index has changed from 0.47 to 0.0. This demonstrates that the subjects' performance in the posttest (FLD) has improved (Linacre, 2010, personal communication).

Table 2. *The Reliability Indices of Person for Pretest (ALD) and Posttest (FLD)*

Person	43 Input		43 Measured		INFIT		OUTFIT		Reliability	
	Score	Count	Measure	Error	IMNSQ	ZSTD	OMNSQ	ZSTD		
Pretest	Mean	5.7	10	1.23	0.67	1	0	1.13	0.1	
	S.D.	2.5	0	0.96	0.20	0.44	0.9	1.06	0.9	0.47
Posttest	Mean	10.3	10	1.91	0.54	0.96	0	1	0.1	
	S. D.	2.2	0	0.53	0.11	0.36	0.9	0.61	0.9	0.0

Note: S.D. = Standard Deviation

Moreover, as is shown in Table 3, the test has a high item reliability index both in posttest ($r = 0.86$) and pretest ($r = 0.92$).

Table 3. *The Reliability Indices of Item for Pretest (ALD) and Posttest*

Item	10 Input		43 Measured		INFIT		OUTFIT		Reliability	
	Score	Count	Measure	Error	IMNSQ	ZSTD	OMNSQ	ZSTD		
Pretest	Mean	24.6	43	1.51	0.32	0.94	-0.1	1.13	0.4	
	S.D.	12	0	1.20	0.08	0.25	1.0	0.36	0.6	0.92
Posttest	Mean	44.2	43	0.95	0.31	0.99	0.1	1	0.2	
	S. D.	14.5	0	0.92	0.14	0.07	0.6	0.15	0.8	0.86

Analysis Two

As discussed above, Rasch measure for each person was obtained through Differential Person Functioning analysis (DPF) to reveal whether DA based on skill-based test mediation differentiated between subjects with similar actual level of development (Pretest) on two distinct reading skills.

DPF aims at representing how persons function in different domains or item formats. Johnson and Alsmadi (1998) believe that persons should be screened individually for differential functioning over different item groups. This analysis is usually performed to find the effect of person types

rather than specific cognition on test results (M. Linacre, personal communication, August 11, 2010). In this study, the DPF was used to estimate each person's ZPD score for each test while their performance on other tests functioned as covariate. According to Linacre (M. Linacre, personal communication, May 31, 2011)

On an arithmetic test, we can code each item label by strand: A=addition, S=subtraction, M= multiplication, D=division. Then DPF of person-x-item code gives us the ability of each person on each strand in a directly comparable way. 4 separate analyses would be influenced by the relative difficulty of the 4 strands.

This indicates that estimating DPF through Rasch measure for each learner's ZPD score can be indicative of the learner's performance in the specific task in relation to their performance on other tasks.

As was mentioned earlier, Ableeva (2008) contends that ZPD can be indicative of learners' future level of development (or their performance in the non-mediated posttest). This means that the same method of teaching might not produce similar results for those who have shown similar actual level of development on the non-mediated pretest. Therefore, in this part, we compare the performances of learners on the posttest with each other (Learners' future level of development) who obtained the same Rasch measure in the pretest. To this end, the subjects were first sorted in terms of their pretest scores on the referential (wh-question) and main idea tests (See Table 4). Then ZPD for each person was estimated through DPF procedure. As is indicated in table 4, the subjects in this study form five logit groups: (1) less than 1 (N =2), (2) between 0.5 and -1 (N = 13), (3) 1.31, (4) 2.59, and (5) beyond 3. For example, subjects with coding number of 8 and 18 had similar pre wh-Rasch measure of (-2.41) and subjects with the coding number of 30, 31, 21, and 10 had similar wh Rasch measure of (-0.96).

The fourth, fifth, and sixth columns of table 4 report the subjects' ZPD for wh-question mediated tests and columns 10 and 11 report the subjects' ZPD for the main idea question mediated tests. These ZPDs were estimated through the differences between subjects' performance on pretest (ALD) and mediated tests in DA phase of the study (note that the subjects took two types of pretest: one that is represented as non-mediated posttest (FLD) and one that is mediated through the DA phase). As is shown in Table 4, five ZPDs are reported. ZPD1, ZPD2, and ZPD3 are estimated through the differences between non-mediated and mediated tests of three successive referential (WH) tasks given to subjects ($ZPD1 = DA1 - NDA1$; $ZPD2 = DA2 - NDA2$; and $ZPD3 = DA3 - NDA3$). ZPD4 and ZPD5 are the differences between non-mediated and mediated tests of main idea tasks

given to subjects (ZPD4 = DA4- NDA4; ZPD5 = DA5-ZPD4). Main idea tasks were mediated twice each time with more explicit hints, as mentioned earlier.

Table 4. Subjects' Rasch Measure on Pretest (ALD) and Posttest (FLD) by Tasks

WH Question Task							Main Idea Task					
Groups	Subjects' Code	Pre WH	PS WH	ZPD1	ZPD2	ZPD3	groups	Subjects' Code	Pre Main	PS Main	ZPD4	ZPD5
1	8.00	-2.41	.89	.0	-.22	.69	1	4.00	.45	1.30	.16	-.55
	18.00	-2.41	2.09	absent		.79		36.00	.45	2.27		-2.23
	30.00	-.96	-.15	-.66	-.11	-.33		6.00	1.07	2.27	.62	-1.13
2	31.00	-.96	.60	.65	-1.25	-1.07	2	15.00	1.07	1.77	.43	-.35
	21.00	-.96	1.85	.58	1.84	-.36		13.00	1.07	1.30	-.85	.32
	10.00	-.96	2.09	absent	-1.51	.95		26.00	1.07	1.75	.66	.40
	42.00	.22	1.01	-.52	1.11	.16		22.00	1.07	3.32	-.88	.43
	17.00	.22	1.01	.15	-.17	absent		23.00	1.07	3.32	-.88	1.92
	25.00	.22	1.26	.39	1.42	2.46		10.00	1.50	2.31	1.76	-1.06
3	32.00	.22	1.57	.87	.10	.41	32.00	1.50	3.04	.63	-1.02	
	14.00	.22	1.85	-.65	-.10	1.77	25.00	1.50	2.85	.20	-.82	
	34.00	.22	1.93	.55	-.15	-1.85	3	24.00	1.50	1.30	.66	-.36
	38.00	.22	2.51	.98	.02	2.27	37.00	1.50	1.30	.67	.45	
	4.00	.22	2.59	-.24	-2.39	-.32	9.00	1.50	1.77	.65	1.80	
	29.00	.22	2.59	-.55	.09	-.39	11.00	1.50	1.30	-2.38	1.93	
	40.00	1.31	.83	-.24	.10	-1.12	29.00	1.88	1.30	1.67	-2.09	
	24.00	1.31	.83	.18	.0	absent	7.00	1.88	1.77	-.30	.82	
	7.00	1.31	.89	-.51	-.06	.0	20.00	1.88	1.75	.61	1.64	
	12.00	1.31	.89	.65	.07	-.40	4	2.00	1.88	1.30	-.85	1.91
4	44.00	1.31	1.01	-.05	.05	.49	21.00	1.88	1.30	-.87	2.55	
	41.00	1.31	1.01	-.68	.0	absent	42.00	1.88	2.28	-2.37	3.32	
	1.00	1.31	1.85	1.25	-.07	1.24	28.00	2.23	2.31	-1.67	.34	
	13.00	1.31	1.85	.47	2.66	2.16	44.00	2.23	2.28	.66	.40	
	19.00	1.31	1.93	-.55	-1.51	.16	5	38.00	2.23	3.32	-.28	1.32
	9.00	1.31	1.93	.0	-1.52	-.41	1.00	2.23	1.30	-.82	2.89	
	28.00	1.31	2.09	-3.42	-.56	.54	34.00	2.57	1.77	.64	.06	
	22.00	1.31	2.51	.65	.07	.61	6	19.00	2.57	1.77	-.86	3.17
	16.00	1.31	2.59	.0	.22	.55	41.00	2.94	2.28	.84	-1.81	
	45.00	1.31	2.70	.33	absent	absent	7	16.00	2.94	1.30	-.88	2.03
6.00	1.31	2.92	.50	1.11	-1.66	5.00	2.94	2.27	-2.17	4.73		

	37.00	2.59	1.85	.0	.18	-1.32
	15.00	2.59	1.93	.17	.01	.10
	3.00	2.59	1.93	-.55	1.51	-.38
	23.00	2.59	2.51	.98	.12	-.41
	26.00	2.59	2.70	1.10	.14	-.40
	20.00	2.59	2.70	-.43	-.02	.61
5	35.00	2.59	2.70	.54	1.10	-2.69
6	11.00	4.12	1.85	-.43	.07	.61
	27.00	4.12	2.70	-.55	.04	-.38
	39.00	4.12	2.92	-.05	.05	-.30
	36.00	4.12	2.92	.0	.22	-.36
	2.00	4.13	2.59	-.05	-1.51	.42
	5.00	4.13	2.92	.0	.24	-.32

As is shown in this table, the findings are rather inconclusive. Sometimes from among those subjects with similar Rasch measure in the wh-question pretest (ALD) in non DA phase, those with higher ZPD obtain higher Rasch measure in the posttest (FLD). For example, subject 8 and 18 (both with Rasch measure of -2.41 in Non-DA phase pretest) are different in ZPD3 (0.69 and 0.79, respectively). Subject 18 gets a higher score in the posttest (FLD) and his/her ZPD is higher than that of subject 8. Also, the Rasch measure of subject 10, 21, 30, and 31 in the pretest (ALD) is - 0.96; however, their Rasch measures in the posttest are different (2.09, 1.85, - 0.15, 0.60, respectively). This indicates that some of the subjects are more responsive to mediation than others because of their higher ZPD. Another example is subject 38 with the ZPD of 32.27 who outperforms most of the subjects in the posttest in his/her group.

However, in some cases, those with higher Rasch measure in the posttest seem to be less responsive to ZPD. For example, subject 13 has the highest ZPD3 and ZPD2. This means that s/he has been the most responsive person to the mediation provided. However, her/his performance on the posttest is not the highest one, despite showing a substantial improvement (pretest = 1.31, posttest = 1.85). Surprisingly, those subjects with the highest score on the posttest (group four, five, and six) do not show very high ZPD, even though their ZPDs are almost positive. Considering the fact that some of these subjects (subjects 37, 15, 3, and 11) gained a lower score in their non-dynamic posttest (as the indication of their future level of development), we can conclude that they were not responsive to mediation due to their self confidence. Poehner (2008) holds that some subjects reject mediation due to their high level of self confidence. This might indicate that those with higher level of

knowledge (here responding to referential questions), are less responsive. They believed that their responses were correct and they did not need to pay attention to the hints that their teacher provided.

Table 4 also reports the subjects' Rasch measures on the main idea tasks (pretest, posttest, and mediated tests). Some of the subjects were absent in one of the three sessions of mediation for the main idea tasks so they were excluded. The number of the participants subjected to Rasch measure in this analysis is 30. As is shown in this table, the subjects form seven groups: (1) those with logit less than 1 (N=2); (2) those with logit between 1 and 1.50 (N = 6); (3) those with logit between 1.50 and 1.80 (N = 7); (4) those with logit between 1.80 and 2 (N = 6); those with logit 2.23 (N = 4); (5) those with logit 2.57 (N = 2); and those with logit 2.94 (N =3).

The results confirm that subjects with similar Rasch measure in the pretest (ALD) with a higher ZPD obtain a higher Rasch measure in the posttest. For example, subjects 4 and 36 have the same logit in the pretest (ALD) but in the posttest (FLD) they are different. Subject 36 with higher ZPD5, has higher Rasch measure in the posttest. This holds true for subjects with logit 1.07 (subject 23 whose ZPD5 is 1.92). The same is also true for subjects with logit 1.88 (for example subject 42) and logit 2.23 (for example subject 38).

However, the relationship between the subjects' Rasch measure and their ZPD5 or ZPD4 is mixed. Some of the subjects with higher ZPD have got lower posttest scores (subjects 9 and 11), but some have got a high posttest score with lower ZPD (subjects 10, 32, and 25). The same can be claimed for subject 41 with a Rasch measure of 2.94 in the pretest (ALD), having the highest score in his/her group but the lowest ZPD in this group (ZPD5 = -1.81).

Conclusion

This study aimed at investigating the relationship between the subjects' actual level of development and their future levels of development. The study specifically attempted to investigate whether subjects with similar actual level of development (pretest) showed similar ZPD (tests during DA) or future level of development (posttest) and whether ZPD can predict the subjects' future level of development. The results of this study also indicated that the subjects' performance improved on the posttest observation. Furthermore, the data also showed a significant decrease in the magnitude of standard deviation on the posttest (subjects' future level of development). This decrease is indicative of the fact that the mediation had a normative effect and made the sample more homogeneous.

However, some of the subjects with certain Rasch measure did not systematically reply to mediation. This may have been caused by different factors. First, this might have occurred due to various factors that have not

yet been taken into account; e.g., subjects' growth over tasks, hierarchical ordering of mediation, and responsiveness to mediation. As is shown in Table 4, subjects with similar abilities in the pretest, showed different ZPDs and unpredictable future levels of development (posttest). This is supported by Ableeva (2008) who purports that "these differences, in turn, indicated that the subjects had different unique ZPDs; that is, they were each developmentally different despite similarities in their pretest performances" (p. 80).

This research also faced certain limitations. First, the number of participants was not large enough to meet the psychometric criteria for conducting quantitative statistical procedures like regression. Another study could be done to see which measure (ZPD vs. pretest) better predicts the subjects' performance on the posttest. Because ZPD is the function of different factors (subjects, tasks, the examiner, and the interaction between them), other studies are needed to investigate the nature of ZPD in different contexts and in relation to various cognitive and psychological factors. Perhaps, a research on DA within "activity theory" would better illuminate the possible nature of the subjects' interactional competence. The focal point in activity theory is that "mind emerges as a special component of human interaction with the environment" (Lantolf & Thorne, 2006, p. 237). Therefore, the mind should be studied within the context of experiment and activity in this theory.

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