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The Impact of Analogy on L3 Reading Comprehension

Mohammad A. Salmani Nodoushan

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Hossein Karami
University of Tehran

Mohammad Ali Salmani Nodoushan
Iranian Institute for Encyclopedia Research

ABSTRACT

Little research has been conducted to investigate the effect of analogy on third language (L3, hereafter) reading comprehension though some experts believe that it has facilitating and debilitating effects on L1 and L2 respectively. This article explores the effect of analogies on reading comprehension of expository texts by students of English as a third language. Subjects were all Turkish university students of English as a Foreign Language who had Farsi as their second language. Written recall protocols taken from 350 participants were analyzed for a text with and without analogy. The results indicate that analogy had a facilitative effect regardless of proficiency level.

INTRODUCTION

In his preface to Alderson's (2000) Assessing Reading, Bachman notes: "Reading through which we can access worlds of ideas and feelings, as well as the knowledge of ages and visions of the future, is at once the most extensively researched and the most enigmatic of the so-called language skills" (p. x). The complex and enigmatic nature of this "psycholinguistic guessing game" (Goodman, 1967, p. 127) is even more evident when we are faced with reading in a foreign language. At a time that "bilingualism or multilingualism is the norm rather than the exception" (Richards & Rodgers, 2001, p. 3), with reading being one of the most important skills to be acquired, educators have tried hard and fast to develop new ways of teaching this highly mysterious construct. Despite the extensive research on reading, as Bachman (op cit) notes, most scholars would agree that relatively little is known about the process underlying reading comprehension. This dearth of knowledge is even more serious in the case of reading in a third language.

Some aspects of reading comprehension have received considerable attention during the last two or three decades. One such issue is the impact of analogy on successful reading comprehension. Some educators would readily agree that analogy can prove especially helpful. Singer (1986), for example, calls science texts "friendly" on the basis of the number of analogies used in them.

There are quite a few research studies exploring the impact of analogy on L1 reading comprehension believed to have a positive effect. In the case of L2, the results suggest just the reverse. However, no research has been done to investigate the impact of analogy on L3 reading comprehension. This article investigates this issue.

BACKGROUND

A general agreement holds among the researchers in L1 reading that analogy has a facilitative effect. In one of the earliest studies on the subject, Vosniadou and Ortany (1983) reported young children to have better recall from reading texts containing analogies although the recall varied significantly from analogy to analogy. Blood circulation/journey analogy, for example, was not as helpful as an infection/invasion analogy. Nevertheless, both analogies yielded greater recall than did no analogy at all.

In a seminal work, Perfetto, Bransford, and Franks (1983) set out to investigate whether their participants could find out the analogy between two word problems and use that analogy to solve the second problem. The subjects could not apply the previously presented information to solve the second problem. Interestingly, after failing to solve a problem the first time, a hint did not improve performance on a second problem. The subjects needed to be told of the analogy.

In a similar vein, Hays and Henk (1986) compared illustrations versus analogies as aids for their subjects learning to read by tying complicated knots. The analogies were not helpful for immediate learning but the pictures were. However, a delayed memory recall two weeks later indicated that analogies may be of much benefit in retention.

Bean, Searles, and Cowen (1990) gave their subjects a text with a lock and key analogy to explain the function of enzymes or control text describing the function of enzymes with no analogies. No significant difference was reported either in the comprehension or the participants' perceived difficulty of the texts.

So far, it seems that some analogies aid the readers while other analogies do not. Halpern, Hansen, and Riefer (1990) pointed out that the reason lies in the nature of the underlying structural relationships between the two parts of the analogy. For an analogy to be helpful, the underlying structures of each part of the analogy must be similar while the surface structures should be maximally different. The analogy between the atom and the solar system is effective because the surface structure features are very different whereas the underlying structural relationships are similar (smaller revolve around a larger one in both cases). They theorized that comprehension is improved when readers are able to go beyond differing surface structures to find similar structural relationships. A near domain analogy has similar surface and underlying structures. A far domain analogy has similar underlying structures but different surface features. Halpern et al. (1990) tested readers with three topics each with two different analogies (a far domain and a near domain). The far domain analogy facilitated recall more than the near domain analogy in all three topics.

The research on the role of analogy in L2 reading is limited. Hammadou (1990) tested high school nonnative students of French. She reported both novice and advanced students to recall more of the non-analogy than the analogy texts. The recalls of the non-analogy texts were more accurate than those of the analogy texts, which contained more mis-information. She noted that analogy had a debilitating effect on both topics. Similarly, Hammadou (2000) gave two different passages to groups of American and French students. This was one of the first attempts to compare the effect of analogy on L1 and L2 reading comprehension in the same research to ensure the comparability of the results. Participants received two passages with different analogies. Analogy did not enhance comprehension in either of the passages. Interestingly, analogy even had a debilitating effect on one of the passages.

Given the above findings, it appears the results generally suggest that analogy has a facilitating effect on L1 reading but a debilitative impact on L2 reading. As noted earlier, no research has been done to explore its effect on L3 reading comprehension. This study addresses this gap.

THE STUDY

The present study was conducted to explore the effect of analogy on L3 readers' comprehension of expository texts. Previous research had indicated variable results on the topic for L1 and L2 readers. As no research is available on the impact of analogy on L3 reading, a null hypothesis of no impact was proposed. We were especially concerned with the impact of analogy on L3 reading comprehension because even if analogy has a facilitative impact on L2 reading comprehension, such an impact may not be readily transferred into L3 reading comprehension. This is an important issue because the participants in the present study are living in a context where even the dominant language, Persian, is not their first language. The kind of training they receive in English, however, is exactly the same as those students who are native speakers of Persian. The courses are mainly focused on the comprehension of scientific English texts (Karami, 2013). The teaching materials are normally developed after taking into account the current thinking about best ways of teaching reading comprehension. Thus, if analogy has a facilitative impact on L2 reading comprehension, they may be included in the texts. This would cater to the needs of English learners who are native speakers of Persian. What about the Turkish speakers? Is it logical to surmise that analogy will have the same impact on their comprehension of the texts without any empirical support? Given the serious nature of such assumptions, we empirically examine the issue here.

Earlier reading comprehension research had indicated that proficiency is a determining factor; we agree with this, but at the same time suggest that, in addition to proficiency (and a good number of other factors), analogy is also an important factor. As such, the primary research question of the present study was: Does analogy have an impact on L3 reading comprehension of expository texts? A secondary research question was: Does this impact, if any, vary with level of proficiency?

METHOD

Participants and Procedures

To test the impact of analogy on reading comprehension, we gave a passage with and without analogy to a group of Iranian university students. The participants were 350 (189 males and 161 females) native Turkish students who had Farsi as their second language. They were learning English as a third language. The age of the participants ranged from 19 to 32. They were all majoring in English. A number of them were in the early weeks of their studies and, as is natural, they were from low proficiency levels.

The participants were categorized into four groups based on their scores on the proficiency test. The groups were created based on standard deviation units after transforming the scores into Z-scores. All those scoring less than -1 SD were categorized beginners, those scoring between -1 SD and the mean as lower intermediate, the students scoring between the mean and +1 SD as the upper intermediate, and all test takers scoring above +1 SD were grouped as advanced.

All groups received a version of the text (either the analogy or the non-analogy text). After two weeks, they received the other version. In order to avoid a practice effect, counterbalancing was adopted.

Instrumentation

The two reading texts (a text with two versions, with and without analogy) were specifically designed for research purposes by topic experts and taken from Hammadou (2000) (see Appendix). Hammadou (2000) reported that an analogy version of this passage had no facilitative effect. This passage was specifically chosen because if it proved to be helpful in this study, such finding would then suggest that the impact was not due to the specific text or analogy selected. The passage was about nuclear fission, describing the process of nuclear fission and providing an analogy version that compared it to mouse populations. A proficiency test (PET reading test) was given to all participants before the written protocol tests. The students were asked to write in English. The problem here was that they had received all their instruction in Persian and were not familiar with the written form of Turkish. Another problem was that writing in a language other than English made the scoring extremely difficult.

Scoring and Data Analysis

The scoring of the written recall protocol was based on Meyer's (1985) written recall protocol procedure. This procedure is based on idea units. These are actual content units and the rhetorical relationships they serve in the sentences. Therefore, each participant's score was determined by counting the number of exact content units and the number of accurate rhetorical relationships. A two-way analysis of variance (ANOVA) was conducted on the results to determine the relationships among the variables. The factors included proficiency (four levels) and the text type (Analogy or Non-Analogy).

Table 1: Descriptive Statistics for the Texts

Proficiency		N	Mean	Std. Deviation
Beginner	Analogy	35	31.8286	12.32177
	Non-Analogy	35	26.7905	7.93605
Lower Intermediate	Analogy	40	35.9250	13.23801
	Non-Analogy	40	21.9750	12.01623
Upper Intermediate	Analogy	36	50.3889	25.70140
	Non-Analogy	36	39.7500	22.00712
Advanced	Analogy	64	82.4219	14.25062
	Non-Analogy	64	67.3177	17.20715

RESULTS

The means and standard deviations of both versions of the text for all proficiency levels are given in Table 1. The table clearly indicates that the Analogy group has outperformed the Non-Analogy group across all proficiency levels. In order to investigate the statistical significance of the differences in mean scores of the two groups, participants' reading scores were subjected to a two-way analysis of variance having two levels of text type (analogy and non-analogy) and four levels of proficiency (Beginner, Lower Intermediate, Upper Intermediate, and Advanced). All effects were statistically significant at the $p<.001$ significance level.

The results of the two-way ANOVA are reported in Table 2. The two-way ANOVA found a main effect of text type, $F(1,345)= 46.255$, $p \leq .001$, indicating that the performance

of the groups on the Analogy and Non-Analogy texts were statistically different. There was also a main effect of proficiency level, $F(3,345)= 181.498$, $p \leq .001$. Such finding indicates that the performance of at least two proficiency groups were statistically different from each other.

In order to further investigate the differences in mean score of the participants, a post-hoc analysis was conducted using the Tukey HSD statistic. The results are reported in Table 2. It is evident from the table that the participants' performance on the Analogy text was higher than their performance on the Non-Analogy text except for the Beginning and Lower Intermediate groups. That is, the mean difference between the performances of these groups was not statistically significant.

Table 2: Multiple Comparisons Results

(I)	(J)	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Low	Low-Mid	-4.09	3.87	.716	-14.14	5.95
	High-Mid	-18.56	3.97	.000	-28.86	-8.25
	High	-50.59	3.51	.000	-59.72	-41.46
Low Mid	High-Mid	-14.46	3.84	.001	-24.44	-4.48
	High	-46.49	3.37	.000	-55.25	-37.74
High mid	High	-32.03	3.48	.000	-41.08	-22.98
Low	Low-Mid	4.81	3.68	.560	-4.74	14.37
	High-Mid	-12.95	3.78	.004	-22.76	-3.15
	High	-40.52	3.34	.000	-49.21	-31.84
Low-Mid	High-Mid	-17.77	3.65	.000	-27.26	-8.28
	High	-45.34	3.21	.000	-53.67	-37.01
High-Mid	High	-27.56	3.31	.000	-36.17	-18.95

Figure 1: Graphical Presentation of the Means

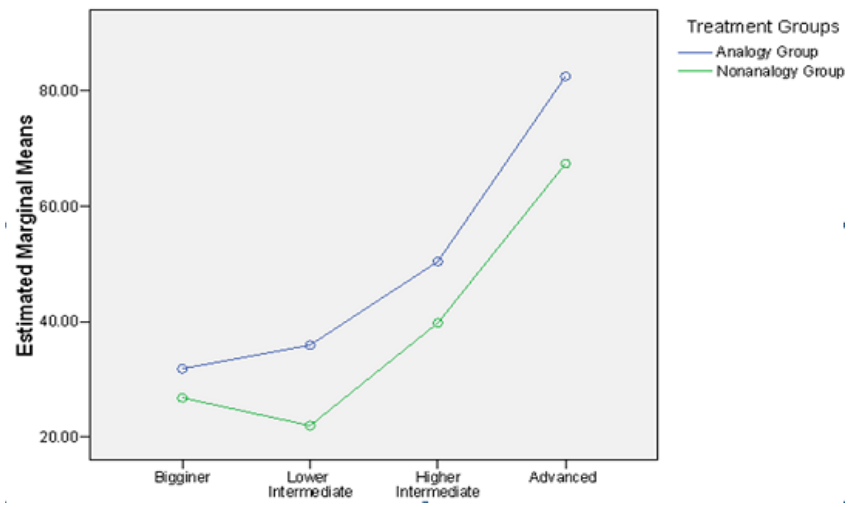

Figure 1 graphically presents the performance of the participants on the two text types. It is now more clearly observed that their performance on the 'analogy' text was higher than their performance on the 'non-analogy' passage.

DISCUSSION AND CONCLUSION

As noted previously, conflicting and inconclusive results have been reported on the impact of analogy in L1 reading comprehension. Generally, the bias is toward a positive effect. This does not hold true in L2 reading. Hammadou (1990, 2000) reported analogy to have a negative effect. She concluded that analogies in reading passages place an additional burden on readers. However, the present study did not support her results in L3 reading. Altogether, the results indicated that analogy had a facilitative effect regardless of proficiency level. Note, however, that the difference between the Beginner and Lower Intermediate groups was not significant. Accordingly, it may be argued that learners with low proficiency levels may not have the required competence to understand the analogies at all. That is, their poor language abilities may be a hindrance in the way of understanding the point of the analogies. Therefore, analogies do not facilitate their comprehension of the text. Hence, it may be further argued that learners should possess a threshold or minimum of language proficiency to be able to take advantage of the analogical texts.

Previous research has suggested a more positive effect for analogy on L1 reading than on L2 reading (Vosniadou & Ortany, 1983; Hammadou, 2000). In this study, the mean performance on the analogy passage was higher than that of the non-analogy text. However, we would not hesitate to caution that we should approach the interpretation of these results with extreme care as further research will be needed to arrive at a final conclusion.

Halpern, et al. (1990) theorized an explanation for the role analogy plays in reading comprehension. Generally, they hypothesized an analogy should have different surface features while the underlying structural relationships are maximally similar for it to be effective. That is, the analogy should be a "far domain" one. Hammadou (2000) notes such a condition seems to be present in the nuclear fission/population explosion in mice analogy. The underlying structures are similar: mice and nuclear atoms reproduce themselves, the population of both decreases as they are spread out in a large area, and so on. However, the surface features have little in common. Clearly, further research is needed before firm conclusions can be drawn. It was highlighted earlier that the research on different aspects of reading comprehension should serve in the instruction of this construct. The study provides some evidence that analogy can be a useful tool in teaching reading comprehension of L3 texts.

Implications for Teaching

Where do we go from here? The implications for teaching should be considered in the broader context of teaching reading comprehension. Analogy is not the only factor involved. Being able to read in a second or third language is a function of a complex set of variables, each of which interacts in unpredictable ways. The research on every one of these factors, including analogy, however, can be illuminative in some ways. It may be safely speculated that the research on analogy and reading has not been definitive so far. The absolute rejection or acceptance of analogy as a teaching device is not the panacea for the complexity of the issue. Analogy may prove to be useful in some contexts but not in others. In the same vein, some analogies may work but not others.

Some researchers (e.g., Hammadou, 2000) have voiced concerns about the extra burden that analogy may put on the readers. Although the statement may hold true under some specific conditions and with certain analogies, this may not generalize to all analogies or to all contexts. There are surely observed instances in which a difficulty arises but this is solved by a simple analogy. On the other hand, Hammadou's observation may be more relevant for learners with low-level language proficiencies.

Finally, we wonder whether the person who provides the analogy is a determinant factor. We are not just concerned with reading comprehension of texts; we are equally concerned with the instruction of this construct. The teacher may be a key factor, as the manner of the presentation of an analogy may count as much as the analogy itself. Little or no research has been done to explore the impact of the analogies that teachers use in classrooms on the more efficient learning of different skills involved in reading comprehension.

Further Research and Limitations of the Study

Much remains to be explored in further research. A study may be designed in which the impact of the analogy variable is explored for L1, L2, and L3 reading in the same context. This may help improve comparability of the results and render the generalizability of the interpretations plausible.

Another direction for research may be the actual interaction of teachers and students in the classroom contexts and the role analogy can play here. We emphasized earlier that we should be concerned with teaching reading comprehension as much as we are with just the final performance on reading texts.

The present study used one text with two versions (with and without analogy). However, previous studies have indicated that analogy may have varying effects depending on the nature of the analogy and the text used. Thus, the performance on just one text cannot be a true measure of the underlying reading ability.

Hossein Karami *is a lecturer at the Faculty of Foreign Languages and Literature, University of Tehran. His research interests include various aspects of language testing in general, and validity and fairness in particular.*

Email: hkarami@ut.ac.ir

Mohammad Ali Salmani Nodoushan *is Associate Professor of Applied Linguistics at the Iranian Institute for Encyclopedia Research. He has published several papers in international scholarly journals including* Teaching and Teacher Education, Speech Communication, TESL Canada Journal, *and so on. Besides his position as the editor in chief of the* International Journal of Language Studies, *Dr. Salmani Nodoushan sits on the editorial boards of a couple of international scholarly journals, including* The Journal of Asia TEFL, Asian EFL Journal, *and* The Linguistics Journal.

Email: Salmani.nodoushan@yahoo.com

REFERENCES

Alderson, J. C. (2000). *Assessing Reading*. Cambridge: Cambridge University Press.

Bean, T. W., Searles, D., & Cowen S. (1990). Text-based analogies. *Reading Psychology: An International Quarterly*, *11*, 323-33

Goodman, K. S. (1967). Reading: A psycholinguistic guessing game. *Journal of the Reading Specialist.* 6 (1), 126-135.

Hammadou, J. A. (1990). The effects of analogy on French reading comprehension. *French Review, 64*, 239-252.

Hammadou, J. A. (2000). The impact of analogy and content knowledge on reading comprehension: What helps, what hurts. *Modern Language Journal, 84*, 38-50.

Halpern, D. F., Hansen, C., & Riefer, D. (1990) Analogies as an aid to understanding and memory. *Journal of Educational Psychology, 82*, 298-305.

Hays, D .A., & Henk, W. A. (1986). Understanding and remembering complex prose augmented by analogic and pictorial illustration. *Journal of Reading Behavior, 18,* 63-78.

Karami, H. (2013). An investigation of the gender differential performance on a high stakes test in Iran. *Asia Pacific Education Review*, *14*(3), 435-444.

Perfetto, G. A., Bransford, J. D., & Franks, J. J. (1983) Constraints on access in a problem solving context. *Memory and Cognition*, *11,* 24-31.

Richards, J. C., & Rodgers, S. T. (2001). *Approaches and methods in language teaching*. Cambridge: Cambridge University Press.

Singer, H. (1986). Friendly texts: Description and criteria. In Disher, E. K., Bean, T. W., Readence, J. E., & Moore, D. W. (Eds.), *Reading in the content areas: Improving classroom instruction* (pp. 112-128). Dubuque, LA: Kendal/Hunt.

Vosinadou, S., & Ortany, A. (1983). The influence of analogy in children's acquisition of new information from text: An explanatory study. In Niles, J. A (Ed.), *Searches for meaning in reading/language processing and instruction* (pp. 71-79). Rochester, NY: National Reading Conference.

APPENDIX

Chain Reactions *(Analogy Passage)*

Chain reactions are chemical or physico-chemical reactions whose speed increases rapidly and which become explosive. The nuclear fission reaction (i.e.: that of uranium) is a chain reaction. One can compare chain reactions to the development of a population of mice.

When a mouse is fertilized, it gives birth to several mice. When a uranium atom receives a neutron, it disintegrates into several lighter atoms and emits energy and gives birth to several new neutrons. Each emitted atom will be able to strike another uranium atom, which, in turn, will disintegrate emitting several neutrons. In the same way the female mice will be able to reproduce and to give birth to several new mice.

The quantity of mice and the number of births per day increase exponentially and become very large. In the same way, the speed of the nuclear reaction, that is the number of disintegrations by unit of time, increases exponentially and becomes infinitely large: this is the explosion.

If the mice spread out over a large territory (to look for food for example), they have few chances to meet, and the population is not going to increase rapidly. For the same reason, if the sample of uranium has a mass less than a certain value, called critical mass, too many neutrons escape from the sample without having encountered any other uranium atoms. Then, the speed of the reaction remains low.

If one wants to control the mouse population, it is necessary to produce predators, cats for example, who are going, by capturing some of the mice, to reduce the population and its growth. If one increases the number of cats, one reduces the number of mice and vice versa. It is the same thing for the nuclear reaction where, if one wants to control the speed of the reaction, it is necessary to prevent a large part of the emitted neutrons from striking the uranium atoms. For that, one mixes with the uranium an absorber of neutrons, cadmium for example, which will capture a part of the neutrons. If one increases the amount of cadmium, the reaction slows down. This is the method of control used in nuclear reactions.

Chain Reactions (Mon-analogy Passage**)**

Chain reactions are chemical or physico-chemical reactions whose speed increases rapidly and which become explosive. The nuclear fission reaction, for example that of uranium, is a chain reaction.

When a uranium atom receives a neutron, it disintegrates into several lighter atoms and emits energy and gives birth to several new neutrons. Each emitted atom will be able to strike another uranium atom, which, in turn, will disintegrate emitting several neutrons.

The speed of the nuclear reaction, that is the number of disintegrations by unit of time, increases exponentially and becomes infinitely large: this is the explosion.

For there to actually be an explosion, it is necessary for the emitted neutrons to be able to strike the uranium atoms. Further, a sufficiently large number of uranium atoms is needed for that to occur, in other words, a large enough mass must be present. If the sample of uranium has a mass less than a certain value, called critical mass, too many neutrons escape from the sample without having encountered any other uranium atoms. Then, the speed of the reaction remains low.

If one wants to control the speed of the reaction, it is necessary to prevent a large part of the emitted neutrons from striking the uranium atoms. For that, one mixes with the uranium an absorber of neutrons, cadmium for example, which will capture a part of the neutrons. If one increases the amount of cadmium, the reaction slows down. This is the method of control used in nuclear reactions.