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The Learning Environment and Oral Proficiency: Exploring The Measures

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ABSTRACT: *This study incorporates a mathematical linguistic approach to explore (a) how learning environments may interfere oral proficiency, (b) what metrics can possibly discriminate the oral learning quality. To this end, Japanese learners from classroom and natural environment are selected. Four oral tests were carried out. Dependency distance is utilised for measuring syntactic diversity and the moving window of type-token ratio is used for testing lexical sophistication. The finding suggests that classroom education results in higher scores in picture description, role play and storytelling, leading to learners being good at syntactic structure, obtaining solid grammar and diverse linguistic expressions. Learning in natural environment, however, has an advantage in enrichening vocabulary and listening comprehension, leading to a quick and more lexicon-contained response to the interaction. A correlation analysis brings to light that in natural environment learning, the longer the MDD, the higher the MAMR and MAMSP. To put it another way, the more diverse the MDD, the greater the lexical sophistication.*

KEYWORDS: Japanese language acquisition, oral proficiency, learning environment, mathematic linguistics

INTRODUCTION

The term "learning environment" was initially put forward by Moos (1974), referring to the psychosocial environment. Existing studies of learning environment are particularly focused at the classroom level, for example, traditional classrooms, e-learning, distance learning, laboratory classrooms, computer classrooms, etc. "Remarkable works on this topic include: Booth's (1997) evaluation of a change in teaching methods using the college and university classroom environment inventory; Buerck et al.'s (2003) findings on non-traditional learning style; Crump's (2004) outcomes on mitigating factors in the culture of the computing learning environment; and Dorman et al.'s (2002) investigation into the associations between ten classroom environments and academic efficiency with secondary school students in Australia,

Canada and Britain. In these researches, a number of measuring methods were used, for example, the Test of Science Related Attitudes questionnaires (Fraser and Aldridge 2001); the Inventory of Classroom Environment (Fraser and Sinclair 2001); Student and Teacher Semi-Structured Interviews and a Student Survey (Crump 2004), etc. The analysis of data has also evolved, for example, mean differences and analysis of variance (Fraser and Sinclair 2001); factor analysis, correlations, t-test and stepwise multiple regressions (Rivera and Ganaden 2000); and Chi-Square Homogeneity analysis (Buerck et al. 2003).

Recently, another line of research, in light of Dependency Grammar framework, that computes and calculates written quality, has achieved success in language acquisition (Liu 2008). Dependency distance is deemed a reliable metric of measuring learning proficiency, particularly in writing. A number of areas have attempted to utilize the dependency distance metric, including Chinese English learning quality (Jiang and Liu 2015; Jiang et al. 2019); Japanese English acquisition proficiency (Komori et al. 2019; Li and Yan 2021); writing proficiency by Hungarian Japanese learners (Li 2022); and oral proficiency by Turkish Japanese learners (Li 2022). There is, however, room for further exploration in line of quantitative linguistics; in other words, it remains to be seen whether mean dependency distance (MDD) may index oral acquisition quality in different environments. This study targets Japanese learners in traditional classroom environments and, learners in a natural environment, to explore: (a) whether MDD can be used as an indicator of acquisition proficiency of learners from different learning environments; and further analyse how a learning environment may interfere with acquisition proficiency.

In this article, Section 2 outlines the methodology (including the framework, corpora, syntactic parser, and MDD calculation), Section 3 addresses results and discussions, and Section 4 presents the conclusion.

DATA AND METHODS

Data

Data were drawn from the International Cross-Sectional Corpus of Japanese as a Second Language. Oral data of Chinese Japanese learners in a classroom environment and natural environment were extracted. Note that both classroom-educated learners and natural environment-educated learners are all located in Japan and are all adults (university students, housewives, salarymen working in Japanese company). This means that all participants had

already passed the critical period[1] for language acquisition. Four speaking tasks were carried out. Each oral text includes 49 samples, as detailed in (1).

Oral task

(a) Storytelling: the learner narrates a story based on the illustrations of columns 4 and 5.
(b) Interaction: a natural conversation between learner and researcher is carried out for about 30 minutes.
(c) Role play: the learner is asked to play a given role, according to a scene that is set up in advance.
(d) Description: the learner is asked to describe an illustration.

Details of materials are provided in Table 1.

Table 1. Study data

Natural environment				
Genre	**Storytelling**	**Interaction**	**Role play**	**Description**
words	19257	149989	39494	34202
Classroom environment				
Genre	**Storytelling**	**Interaction**	**Role play**	**Description**
words	13417	161553	20482	34741

Analysis

The central goal of this study is to explore how learning environment might interfere the learning quality. To this end, syntactic diversity and lexical sophistication of Japanese leaners-oral data is examined.

Measuring oral proficiency at syntactic level

Dependency distance is a concept under the framework Dependency Grammar (Tesnière 1959; Yngve 1960; Hudson 2007; Liu 2009b). It refers to the distance between the governor and the dependent, where the governor is the core linguistic element in a sentence, such as verb and predicate; the dependent are subject, object, oblique, adverb, post/prepositional phrase, etc. this study follows Liu, Hudson, and Feng's (2009) measuring method of the dependency distance, i.e., |governor − dependent|. The mean dependency distance of the whole sentence would be

[1] A new study carried out by Hartshorne et al. (2018) at MIT suggests that the length of critical period is up to the age of 17 or 18.

$$MDD = \frac{1}{n}\sum_{i=1}^{n} |DD_i|$$

Measuring oral proficiency at lexical level

In light of previous work that the moving window can obtain a better average type-token ratio (Cech and Kubat 2018; Covington and McFall 2010; Yan and Liu 2021; Li, Liu, and Li 2022), this study obtains the moving window of TTR in terms of word form via the following formula:

$$MATTR\ (W)_{word\ form} = \frac{\sum_{I=1}^{N-W+1} F_i}{\mathrm{W}\ (\mathrm{N}-\mathrm{W}+1)}$$

and obtain the moving window of TTR in terms of the lemma via the formula:

$$MATTR\ (W)_{lema} = \frac{\sum_{I=1}^{N-W+1} F_i}{\mathrm{W}\ (\mathrm{N}-\mathrm{W}+1)}$$

The lexical sophistication is obtained via $\frac{\sum_{I=1}^{N-W+1} F_i}{\mathrm{W}\ (\mathrm{N}-\mathrm{W}+1)} - \frac{\sum_{I=1}^{N-W+1} F_i}{\mathrm{W}\ (\mathrm{N}-\mathrm{W}+1)}$. Essentially, the higher the MAMR, the greater the lexical sophistication.

RESULTS AND DISCUSSION

Drawing on the methodology highlighted above, this section proceeds to analysis. Section 3.1 presents the MDD of four oral tasks, seeing if MDD may discriminate the oral proficiency. Section 3.2 looks into whether learning environment may interfere oral acquisition.

Oral proficiency measured by MDD

Table 2 provides the MDD of storytelling, interaction, role play and description.

Table 2. MDD of oral data by learners in a classroom and natural environment

Learning environment	Storytelling MDD	Interaction MDD	Role play MDD	Description MDD
Japanese learners of classroom environment	4.0798	3.3446	4.1544	3.3299
Japanese learners of natural environment	4.0068	3.3432	3.2559	2.9935

In an oral context, Japanese learners in a classroom environment perform better than natural environment-educated adults in terms of storytelling, role play and description. Perhaps this is due to the fact that classroom education values the training of role play, storytelling, and picture description. Regarding interaction, an equal quality is seen in the performance by classroom-based learners and natural environment-based learners. This is owing to the fact that both groups have opportunities to communicate since the participants live in Japan. The difference is that classroom learners usually communicate in a campus setting while natural environment-based learners' communication takes place in everyday public settings such as a supermarket, company, etc. Focusing on lexical sophistication, Table 3 provides the MAMR and MAMSP values of oral data by learners of classroom and natural environment. It seems that in terms of interaction, storytelling and role play, learners in the natural environment perform significantly better than learners in a classroom environment. However, in terms of picture description, learners in a classroom environment show a better result than those in a natural environment, owing to the fact that classroom education places more emphasis on training in picture description.

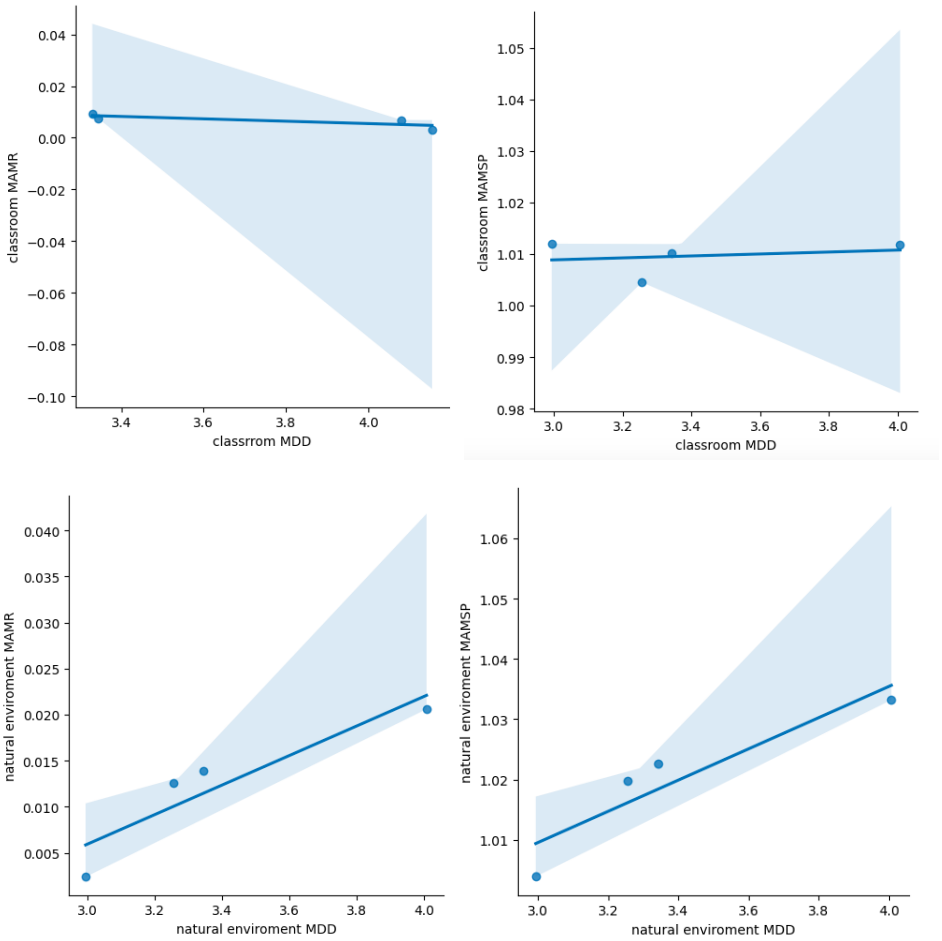
Table 3. MAMR and MAMSP of oral data by learners of classroom and natural environment

Oral task	**Japanese learners of classroom environment**		**Japanese learners of natural environment**	
	MAMR	MAMSP	MAMR	MAMSP
Storytelling MDD	0.0069	1.0118	0.0206	1.0332
Interaction MDD	0.0075	1.0102	0.0139	1.0227
Role play MDD	0.0032	1.0045	0.0126	1.0198
Description MDD	0.0094	1.0120	0.0024	1.0039

Pulling the strands of syntactic diversity and lexical sophistication together, we might assume that classroom education places more value on grammar and expressions training, as confirmed by the higher results in picture description, role play and storytelling, amongst learners showing a good handle on syntactic structure, mastering solid grammar and linguistic expressions. Learning in the natural environment, however, has an advantage in enrichening vocabulary and listening, leading to a quick and more lexicon-contained response to the interaction.

Associations between oral proficiency and different learning environments

A further analysis between syntactic diversity and lexical sophistication is carried out. Figure 1 presents the correlation of MDD and MAMR; MDD and MAMSP.



Corelation analysis demonstrated that the natural environment MDD has a positive correlation to MAMR and MAMSP; in other words, the longer the MDD, the higher the MAMR and MAMSP –the more diverse the MDD, the greater the lexical sophistication.

CONCLUSION AND FUTURE RESEARCH

This study incorporates a mathematic linguistic approach to examine the associations between learning environment and acquisition quality. The target of the research is Chinese learners studying Japanese. Four oral tests were carried out: storytelling, interaction, role play, and description. Oral proficiency is measured at a syntactic and lexical level, with mean dependency distance for measuring syntactic diversity and, moving-average morphological richness and moving-average mean size of paradigm for measuring lexical sophistication.

Classroom learning presents a better performance among learners than the natural environment in terms of storytelling, role play and description. This finding suggests the

importance of classroom education, which secure a systemic training in role play, storytelling, picture description. Classroom learners and natural environment learners equally perform at interaction. Lexical sophistication presents a different picture. learners in the natural environment performs significantly better than learners in the classroom environment in terms of interaction, storytelling and roleplay, while classroom learning show a better result than natural environment-learning in terms of picture description, given that classroom education places more emphasis on training in description. These outcomes from lexical and syntactic examination lead us to deduce there is a link between language environment and oral proficiency. Both learning environments have advantages and disadvantages: the classroom environment helps to build a solid foundation of grammar and organising syntactic structure. The natural environment helps to obtain a richer vocabulary and a relatively quicker response. A further study of the correlation between syntactic diversity and lexical sophistication demonstrates that in natural environment-learning, the longer the MDD, the higher the MAMR and MAMSP; in other words., the more diverse the MDD, the greater the lexical sophistication.

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