Individual differences in preschoolers’ ability to generalize unaccusative intransitive constructions in novel verb experiments: Evidence from their familiar verb usage in naturalistic play contexts

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1. Introduction

Several researchers have drawn upon a construction framework to examine early child language (see Clark, 2003, Clark & Kelly, 2006; Tomasello, 2003). Within this framework, language is viewed in terms of recurrent patterns of meaning, rather than in terms of discrete and additive meaning units such as words (Budwig, Narasimhan, & Srivastava, 2006; Goldberg, 1995; Slobin, 1985). For instance, the SVO transitive construction with a form of “agent + verb + object” (e.g., The boy rolled the ball) is associated with the meaning of direct causation, which is not simply determined by adding the meaning of the arguments to the meaning of the verb. Slobin (1985) and Goldberg (1995), among others, contend that constructions are collections of meaning that designate basic patterns of experience. The construction framework fit nicely with the views of usage-based approach to language development (Budwig, 2004; Tomasello, 2003). According to this approach, children learn language in the form of sentence level constructions, not as separate words or abstract rules. Usage-based theorists emphasize that children experience language as part of social interactions and language structures emerge from language use.

One endpoint of language development is the possession of abstract patterns that capture the grammatical configurations of linguistic experience. Because much of adult grammar, especially the more abstract parts, is centered around verbs and their arguments (Fillmore, 1988; Goldberg, 1995), early verb constructions play an important role in children’s development towards adult-like grammatical competence. Researchers (see Tomasello, 2003, for a review) have conducted either naturalistic observation or novel verb experiments to examine children’s early construction development (see Smith, 2006 and Smith & Budwig, 2005 for an exception). The studies on naturalistic language usage (e.g., Cameron-Faulkner, Lieven, & Tomasello, 2003; Lieven, Pine, & Baldwin, 1997; Tomasello, 1992) show that around age 2, children begin using item-based constructions. This means that they use certain kinds of syntactic structures with some verbs, other kinds with other verbs, and sometimes with little or no overlap between them. For example, a child may only use the verb “open” in transitive constructions such as “I opened the door” and “he opened the box” but not in an intransitive construction such as “the door opened,” whereas for another verb such as “drop,” the child may only use it in intransitive constructions such as “it dropped,” or “the ball dropped.” It is not until around age 3 that children can use a verb in more than one construction type. Experimental studies (Abbot-Smith, Lieven, & Tomasello, 2004; Childers & Tomasello, 2001) also show that 2-year-olds tend to be conservative and use new verbs only in the constructions in which they have heard them used before. After the age of 3, children begin to possess abstract schemas that enable them to be productive and use a verb in a sentence frame in which they have not heard it modeled. These findings suggest that the transition from item-based constructions to adult-like abstract verb constructions happens around the age of 3.

However, great individual differences exist in children’s performance with newly-learned verbs. Among children whose ages ranged from 2;6 to 3;6, Ono and Budwig (2006) found that age was not a significant predictor of their ability to generalize the unaccusative intransitive construction schema to newly-learned verbs when embedded within ongoing natural interactions between caregivers and their children. Some children as young as 2;6 already show the ability to creatively use a newly-learned verb in an unmodeled unaccusative intransitive (e.g., “the powder
Various findings on the effect of age on children’s generalization ability imply two plausible explanations with reference to the construction schema examined and the methodology adopted. One explanation is that perhaps there are different developmental trajectories for the acquisition of various construction schemas, as proposed by Ono and Budwig (2006). The age effect seems to be clearer with the transitive schema than with passive or unaccusative intransitive schemas, into which children have more difficulties assimilating newly-learned verbs (Brooks & Tomasello, 1999). This indicates that, with unaccusative intransitive constructions, the transition from item-based to abstract construction happens later compared to transitive constructions. Support for this argument can be found in neurolinguistic studies, which suggest that processing unaccusative intransitive utterances places more cognitive demands than the canonical transitive constructions because of the switching of an animate actor/agent with the inanimate object/patient in the subject position. This so-called “derived order” is processed by a specific brain part, Broca’s area (Bastiaanse & Van Zonneveld, 2005). On the other hand, paucity of unaccusative intransitive constructions in child-directed speech (c.f. Cameron-Faulkner et al., 2003) may also contribute to a possibly different trajectory for acquisition of this construction schema.

The other plausible explanation is that because the design in Ono and Budwig’s (2006) study resembled children’s everyday social interactions, it successfully increased the level of engagement on the part of children and elicited their full linguistic capacity, especially for the younger children under age 3. This resulted in no age differences in generalization ability being found. Ono and Budwig’s research design was in accordance with the “naturalistically informed novel verb training” procedure proposed by Budwig and her colleagues (for details, see Budwig, et al., 2006; Smith & Budwig, 2005). According to this procedure, the experiment is designed to use novel verb training embedded within naturalistic observations so as to be able to better tap children’s constructional abilities as well as to explicate the process by which children move from item-based productions to verb-general constructions. Based on naturalistic observations, it has been suggested that the transition from concrete to abstract is a flexible and piecemeal process. Between the limited scope, the lexically specific strategy, and the adult-like usage, there exists an intermediate of phase “interim solutions” in which children pattern language into childlike abstract form-function linkages to meet their own communicative needs and express their specific perspectives. For instance, children use a transitive construction primarily to represent scenes involving self as agent acting on an object, whereas the unaccusative intransitive constructions are used for talking about scenes with a negative result or with goal blocking, as in “it (the box) doesn’t open” (Budwig, 1995, 2001; Budwig, Stein, & O’Brien, 2001). Ono and Budwig (2006) incorporated the considerations on interim solutions in their methodology (e.g., designing goal-blocking scenes). Furthermore, informed by naturalistic observations, they also made modifications to the novel verb paradigm to simulate everyday social interactions when young children learn new verbs.

To date, few studies have explored individual differences in generalization ability. However, Smith’s (2006) study has inspired us about how to approach this issue. Aimed at exploring the relation between toddlers’ experimental usage of novel verb with their naturalistic talk, Smith’s (2006) study has compared individual children’s verb diversity in transitive and intransitive frames produced in naturalistic talk with verb diversity in utterances containing novel verbs, providing the first comparative analysis of performance with natural and experimental verb constructions by the same child. The findings suggest a relationship between a child’s propensity to generalize a transitive trained novel verb to an intransitive construction and that same child’s level of verb diversity in naturally produced intransitive constructions. This study informs us that exploring various aspects of children’s familiar verb usage could provide important insights, revealing the possible underpinnings of individual variations in children’s generalization ability.
Our ongoing work (Ono & Budwig, 2006; Smith, 2006) embeds novel verb training within ongoing interactions between caregivers and their children. Ono and Budwig’s (2006) finding that age was not a predictor in generalization ability leads to the question: What accounts for individual differences in children’s ability to generalize transitively trained novel verbs to unaccusative intransitive constructions? Because our methodology also involves collecting naturalistic data on each dyad, we can examine the role of child natural language use to performance on novel verb tasks. In this follow-up study, three aspects of the same children’s concurrent familiar verb usage—verb types, verb constructions and subject diversity—are examined. In particular, the study addresses the following questions:

1. Does the frequency of verb types that children produce in naturalistic play contexts predict whether they can generalize novel verbs in an experimental setting?
2. Is there a relationship between children’s ability to generalize novel verbs in an experimental setting and the types of verb constructions that they use in naturalistic contexts?
3. Is the diversity of subject arguments that children produce in naturalistic play a salient predictor of children’s generalization ability?

2. Method

2.1. Participants

Eighteen monolingual English-speaking children with a mean age of 3;0 (range 2;6-3;6) and their mothers participated in this study. There were 8 boys and 10 girls. The participants were recruited through day care centers and informal play groups in a mid-size city in New England.

2.2. Material

A measure of receptive vocabulary, the Peabody Picture Vocabulary Test (third edition, PPVT-III, Dunn & Dunn, 1997) was administered to children. The PPVT correlates highly with full-scale verbal intelligence measures such as the Wechsler Preschool and Primary Scale of Intelligence (revised, WPPSI-R) (Carvajal, Parks, Logan, & Page, 1992) and the verbal subscale of the Stanford-Binet IV (Hodapp, 1993).

Mother and child dyads were observed in naturalistic play, including with blocks and playdough. The participants also played four novel verb games using the novel verbs dax, ping, gav, and lem. To dax involved the action of making dots on pre-colored shapes with a “magic wand” (a marker that changes ink color) with the change in the color of that shape. To ping referred to the action of moving a magnet underneath a plastic container with small metal objects to cause the objects in the container to move around. To gav involved pouring colored baking soda into a glass of vinegar to cause a fizzing reaction. To lem referred to squeezing an aspirator so that the air coming out the aspirator moved light objects, such as feather and cotton ball across a game board to a finish line.

2.3. Procedure

The participants took part in two 45-minute sessions over a one-week period. In each session, mother and child dyads first were observed in naturalistic play for approximately 20 minutes and subsequently each dyad engaged in 4 novel verb games that simulated everyday verb learning. The PPVT-III was administered at the end of the first session. The experimenter states a word and children select the picture that best illustrates it out of four choices. The test continues until children miss 8 out of a set of 12 words.
At the beginning of the first experimental session, the researcher introduced a sock puppet as a curious monster and children were told to be ready to tell the puppet what was going on while they played games. The guidelines for the adult input followed prior studies (e.g. Abbot-Smith et al., 2004; Brooks & Tomasello, 1999) with variation in tense morpheme and the use of pronoun/noun phrase in subject and object position. During the games, the novel verbs were modeled in SVO transitive constructions (e.g., “Look, I am going to dax the circle.”) and in questions (e.g., “Can you dax it?”) by the researcher and the mother. The mothers were given a total of four index cards—one card for each verb—and they were asked to use the novel verbs to make a request and to describe what the child was doing. For example, they read: “Now it’s [child’s name]’s turn. Can you PING these? You are PINGING them. [Child’s name] can PING the nails.” After they read the card, they were left to use the novel verbs at their own discretion while engaging with their children. The order of the four novel verb games was counterbalanced among participants.

In a given session, each novel verb was enacted eight times, and the researcher ensured to provide a minimum of 18 models per verb. Two of the eight enactments were accompanied by elicitation attempts. During the fifth and eighth enactments, the puppet asked the child a set of questions. The first question was always a neutral question, such as “What’s going on?” Then, a patient-focused question such as “What’s happening to the nails?” was asked to bring the child’s attention to the object. These two questions gave children the opportunity to use unmodeled constructions. And finally, an agent-focused question such as “What are you doing?” was asked so that children had a chance to use the modeled SVO transitive constructions, such as “I’m PING the nails.”

2.4. Coding

All uses of novel verbs in the experimental setting by the adults and the children were transcribed and coded for construction type, including SV unaccusative intransitive (e.g., the powder gavs), SV ergative intransitive (e.g., I’m gaving), SVO transitive (e.g., I’m gaving the powder), questions (e.g., can you gav the powder?), fragment (e.g., gaving) and other (e.g., this one is to gav).

Mother and child talk during naturalistic play was transcribed into CHAT format (see MacWhinney & Snow, 1990). Transcripts were used to isolate children’s utterances containing lexical verbs (utterances containing the main verb “to be” or any other forms of it was excluded).

Children’s utterances in the naturalistic play containing lexical verbs were coded for verb types and verb constructions. Each verb type represents one specific lexical verb used. For example, if a child used the verbs build, come, cook, cut, do, eat, this resulted in 6 verb types.

According to the complexity level, three categories were set for the verb constructions children used in the naturalistic play: reduced constructions, basic constructions, and elaborate constructions. Each type includes several subcategories. Reduced constructions include verb fragments and imperatives. Basic constructions include simple transitives and simple intransitives. Elaborate constructions include subject-predicate other, complex and questions. The operational definition of these subcategories followed the work of Cameron-Faulkner et al. (2003). Example of each subcategory is shown in the parentheses.

1. Reduced constructions
   - Verb fragment—Incomplete utterances without subject (did it.)
   - Imperatives—Objectless requests for action (push it harder.)
2. Basic constructions
   - Simple transitives—Utterances with a subject, a transitive verb and an object (I built a tower.)
   - Simple intransitives—Utterances with a subject and an intransitive verb (I win.)
3. Elaborate constructions
Subject-predicate other—subject-predicate utterances except simple transitives and simple intransitives, such as ditransitives, resultatives and locatives (they swim in the ocean.)

- Complex—utterances with two lexical verbs (I know you have a castle.)
- Questions—utterances transcribed with a question mark and having question syntax in the main clause (what else are you gonna use?)

Children’s subject-predicate constructions in the naturalistic play were further analyzed for the levels of subject diversity. This includes four steps.

**Step 1:** all subject-predicate constructions used by children in the natural play context were isolated and coded for argument frames and subject forms. The present study focuses on the argument frames with pronominal subjects, due to the fact that they occupy a very high percentage (92.8%) of all the argument frames (with nominal and pronominal subjects) that the children have used (see also Valian, 1991). Therefore, the three major argument frames include: Pronoun_Verb_Pronoun transitive frame (e.g., we did it), Pronoun_Verb_Noun transitive frame (e.g., I made a ball) and Pronoun_Verb intransitive frame (e.g., it doesn’t fit). For these three major types of argument frames, subject forms were further coded. Each form represents one specific pronoun, such as I, we, you, it and so on used as sentence subject.

**Step 2:** the median number of subject forms used in each type of argument frame by all children was calculated.

**Step 3:** low, mid and high levels of subject diversity were created: low level—less than median usage; mid level—equal to median usage; high level—above median usage.

**Step 4:** for each argument frame, each child was assigned into the 3 levels of subject diversity based on their subject repertoire.

3. Results

Analysis of the children’s and adults’ novel verb usage revealed that eight out of 18 children (44%) produced at least one novel verb in an un-modeled unaccusative intransitive construction. These children are credited as “generalizing children,” whereas some other children cannot go beyond the models provided and thus are characterized as “non-generalizing children.” The focus of this study is on the data from the naturalistic observation of mother-child play of these two groups of children: generalizing children \((n=8)\) ranging in age from 30.0 to 41.9 months, with a mean of 36.3 months; and non-generalizing children \((n=10)\) ranging in age from 30.1 to 41.7 months, with a mean of 34.6 months.\(^1\)

Figure 1 presents a comparison between generalizing and non-generalizing children with respect to their verb types in naturalistic contexts. No significant difference was found in the frequency of verb types between the two groups of children. As Figure 1 shows, on average non-generalizing children produced 35.6 verb types, whereas generalizing children produced 38.0 verb types. Non-generalizing children and generalizing children produced almost the same frequency of verb types in their naturalistic play interactions with their mothers.

\(^1\) We examined whether generalizing children might have larger vocabularies than non-generalizing children, though our analyses of the relation between children’s generalization ability and their receptive vocabulary ability provided no support for this claim (see Ono & Budwig, 2006). In fact, our analysis of the children reported here revealed that non-generalizing children had a higher mean standard score on the PPVT, which was 111.3 (SD=10.3), while the mean standard score for generalizing children was 102.4 (SD=9.7), suggesting that non-generalizing children in this sample had slightly higher PPVT scores.
Figure 2 presents a comparison between generalizing and non-generalizing children in terms of their verb construction usage in naturalistic contexts. This analysis aims to explore whether a relationship exists between children’s ability to generalize novel verbs in an experimental setting and their verb construction usage in naturalistic contexts. As shown in the Figure 2, non-generalizing and generalizing children produced almost the same percentage of basic constructions (around 36%); however, non-generalizing children produced more reduced constructions and generalizing children produced more elaborate constructions. An average of 29% of verb constructions produced by non-generalizing children were reduced constructions, as opposed to reduced constructions accounting for only 23% of verb constructions produced by generalizing children. In contrast, generalizing children produced 6% more elaborate constructions than non-generalizing children (41% vs. 35%). This difference has not arrived at the significance level, although it seems that a trend is emerging that there exists a relation between children’s ability to generalize novel verbs in an experimental setting and the complexity of verb constructions in naturalistic play.
Another very interesting relation is the relation between children’s ability to generalize novel verbs in experimental contexts and the diversity of subject forms used in the three most popular argument frames in naturalistic play. The results are presented in Figure 3. Half or over half of non-generalizing children (50% to 60%) clustered in the low diversity level in the three major argument frames respectively. In contrast, the majority of generalizing children (over 60% to about 90%) clustered in the mid or high diversity level, especially in the high diversity level. For the purpose of statistical analysis, the low level was compared with combined “mid and high” level in 2 x 2 chi-square analyses. Fisher’s exact test shows that for Pronoun_Verb intransitive frame, there was a marginal significant relationship between children’s generalizing ability and their diversity levels of subjects ($p = .066$). For the two transitive frames, the relation shows up although the results do not reach significance. Overall, children who generalized novel verbs in an experimental setting had a higher range of diversity in the subject forms used in the three main argument frames produced in natural play contexts. Non-generalizing children could be characterized as having a low diversity level in subject profiles in naturalistic play.

**Figure 3  Subject diversity in three major argument frames**

**Pronoun_Verb_Pronoun transitive frame**

<table>
<thead>
<tr>
<th>Percentage of children</th>
<th>Low (3 pronouns or less)</th>
<th>Mid (4)</th>
<th>High (5 or more)</th>
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**Pronoun_Verb_Noun transitive frame**

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<th>Percentage of children</th>
<th>Low (4 pronouns or less)</th>
<th>Mid (5)</th>
<th>High (6 or more)</th>
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**Pronoun_Verb intransitive frame**

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<tr>
<th>Percentage of children</th>
<th>Low (5 pronouns or less)</th>
<th>Mid (6-7)</th>
<th>High (8 or more)</th>
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**Non-generalizing children**

**Generalizing children**
4. Discussion

The importance of integrating naturalistic observations with novel verb experiments to study children’s generalization ability has not been appreciated until recently. In line with Smith’s (2006) study, the present study provides evidence that naturalistic data offer valuable information to account for experimental results. Specially, findings from the integrated analyses of the current study and the study by Ono and Budwig (2006) indicate that: generalizing children differ from non-generalizing children not in age or in the size of their verb vocabulary, but rather in the complexity and in the range of subject profiles at the construction level in their everyday interactions. The current findings suggest that children are more likely to assimilate a novel verb in an unaccusative intransitive construction schema, when in naturalistic linguistic interactions they are able to use more elaborate constructions and to employ a more diverse range of pronouns as sentence subjects.

The current results indicate that the size of verb vocabularies children produce in naturalistic play contexts does not contribute to their generalization ability displayed in the novel verb experiments. This seems surprising at the first glance given Tomasello’s verb island hypothesis, which suggests that verbs are the main centers of organization of early linguistic items and that children are better able to assimilate a novel verb to construction schemas when they are older and have more vocabulary (Tomasello, 2000, 2003). According to the verb island hypothesis, we might expect that a relation exists between the size of children’s verb vocabulary and their productivity with novel verbs. This, however, does not turn out to be the case. It should be acknowledged that it is possible that the overall verb vocabulary size of generalizing children was greater than that of non-generalizing children, but the play contexts constrained the possibility for them to fully exhibit all the verbs that they were able to produce. Thus, if we had extended our observations to other aspects of children’s daily life, we might have found that generalizing children did have greater size of verb vocabulary. However, this would seem unlikely given the evidence taken from the consideration of their PPVT performance (see footnote 1). The results of children’s PPVT scores indicate that in fact, generalizing children didn’t have higher mean standard score on PPVT than non-generalizing children, which lends further support to our finding that children’s generalization ability cannot be reliably predicted by the size of their verb vocabulary. The current finding suggests that knowing lexical knowledge of verbs is necessary but not by itself sufficient to the acquisition of sentence-level syntactic constructions, which requires cognitive processing such as making analogies and schematizing (Gentner & Markman, 1997; Tomasello, 2003). Therefore we can infer that it is not the case that children with larger verb vocabulary size are surely at a significant advantage in creating abstract constructions. The current finding about no discernible relation existing between verb types and children’s generalization ability is consistent with Goldberg’s (1995) viewpoint that sentence-level constructions are form-meaning correspondences that exist independently of particular verbs and must be learned in their own right. Whether and in what way construction learning relates to verb learning is a crucial question for future research, and more detailed comparative analyses on verb classes may be informative.

To capture the differences between generalizing and non-generalizing children in their use of verb constructions, we adopted a novel global analysis on the complexity of construction types. We did this by conceiving of constructions containing lexical verbs as forming a hierarchy, from reduced constructions to basic constructions to elaborated constructions, with each constellation containing specific sentential constituents (see the coding). The major finding is that non-generalizing children produced more reduced constructions, most of which are “subjectless,” whereas generalizing children produced more elaborate constructions that have extra constituents such as locative words, auxiliary, or sentential complements for designating additional perspectives beyond the canonical subject-predicate relations. It should be noted that in terms of elaborate constructions, we cannot infer from the results that the underlying linguistic representations of children who can generalize the unaccusative intransitive constructions are more abstract or more
complex than those who cannot generalize. Without information about the productivity of those elaborate constructions, we simply do not know the abstractness of the underlying linguistic representations involved (see Tomasello, 2003). It is possible that although generalizing children use more elaborate constructions, they still use them in a restricted item-specific manner; that is, perhaps those constructions are tied tightly to a small number of lexically specific frames. However, the current finding nevertheless indicates the close links between children’s use of elaborate verb constructions in everyday interactions and their ability to generalize unaccusative intransitive constructions, which throws light on the nature of the natural language use that helps children build up abstract linguistic categories. Future work should carefully investigate this issue.

An especially interesting finding in this study is that the diversity of pronominal subjects that children employ in their daily linguistic interactions is a reliable predictor of children’s generalization ability. This finding supports the suggestions made in prior work (Cameron-Faulkner et al., 2003; Childers & Tomasello, 2001) that pronouns play an important role in the acquisition of constructions. Childers and Tomasello’s (2001) experimental study focuses on the importance of pronouns as a stable element in the form of a consistent pronoun frames across different exemplars and in facilitating abstraction of the transitive construction schema, whereas the current finding suggests that the variability of the pronouns used as sentence subjects may help children readily assimilate a novel verb in an unaccusative intransitive construction schema. This seeming conflict (consistency vs. diversity) can be resolved when we take a careful look at what were the exact experimental tasks for the children. In Childers and Tomasello’s (2001) study, children were faced with the task of abstracting the transitive construction schema out of the exemplars. In this case, the pronoun functions as the “anchor point” of the whole set of exemplars and thus the consistency of the pronoun facilitates abstracting. In our study, children heard novel verbs used in other construction types and were prompted to creatively use the novel verbs in unmodeled unaccusative intransitive constructions. This task requires that children flexibly change their perspectives of viewing the scene and draw on their subject repertoire to express different perspectives when the discourse demands encourage them to do so. The present results indicate that the use of diverse pronouns in subject position may be an indication that children are able to take diverse perspectives in talking about a scene. Generalizing children may be bringing a broader conception of form-function patterning of constructions into the experimental task—diverse ways to describe scenes for adopting different communicative purposes. Therefore, when prompted, children with a greater repertoire in subject pronoun usage may be better able to switch perspectives. Our ongoing analyses are focused on a better understanding of the relationship between semantic aspects of pronoun use in everyday interactions and the acquisition of verb constructions.

The current findings have significant educational implications. The importance of facilitating children’s construction development not only lies in that the development of constructions is an indispensable aspect of children’s language development. It also resides in that constructions offer children a symbolic tool for understanding the world within which they live (Budwig, 2004) and thus would exert profound impact on children’s socialization process. Our results suggest that interventions that focus primarily on enlarging children’s vocabularies may not necessarily lead to their increased ability to productively use verb constructions. A recent study (Cenko, Budwig, Hu, Smith, & Goodspeed, 2006) provides converging evidence for this proposition. In this first comparative analysis on Head Start and middle class children’s development of verb constructions, Cenko et al. (2006) found that despite Head Start children having normative vocabulary development, compared to their middle class counterparts, they look less advanced in verb construction development, both in terms of the complexity level of verb constructions and in the range of argument frames. Our results also suggest that if a child cannot flexibly use a newly-learned verb across different construction types, it may not be due to a relatively small vocabulary size per se. Rather, it is likely that the child lacks enriched experiences with constructions in
everyday interactions. For instance, the child may not have sufficient exposure and/or practice with verbs used in a variety of elaborate constructions and with diverse subject arguments. Taking together, findings from these studies highlight that children’s language development may benefit from educational programs that are not solely lexically-based but include an emphasis on the need to communicate with different perspectives and practicing various constructions.

5. Acknowledgements

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6. References


