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# Grammatical Number in Arabic-English Bilingual Children

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**Abstract**
This study examined the developmental trajectories of Arabic grammatical number in Arabic-English bilingual children. The samples consisted of 80 individuals (40 monolingual children residing in Jordan and 40 bilingual children residing in the USA), aged between 5 and 9 years. Data was collected through two tasks involving picture able objects and naturally occurring communications. Although bilingual children's accuracy in plural processing demonstrated an age-related improvement, the findings reported a notable delay in plural form acquisition within the bilingual age–related trajectories. Transparency, frequency, and productivity contributed to shape the acquisition patterns of plural form among 5-7-years-old children, while predictability becomes a salient factor for the older trajectories. The study also highlighted the productivity of bilingual children to employ the feminine sound plural (FSP) as a default mechanism in generating diverse plural nouns. Prominent strategies in producing plural forms by bilingual children encompassed over-generalization of the FSP, code-switching between plural patterns, and utilization of the English plural morpheme [–s] and English quantifiers. The study, therefore, concludes that children predominantly adopt a single route mechanism during the processing of the inflectional system. Finally, the study offers noteworthy pedagogical implications pertinent to the instruction of Arabic-English bilingual children.



***Keywords:*** bilingualism; grammatical number; heritage speaker; language acquisition; plural

## 1. Introduction

The study of grammatical number is very crucial for linguists, as cross-linguistically, number is not simply a basic singular-plural distinction. This 'feature' carries additional value concerning the regular correspondences between forms and meanings, which vary across languages. For example, while English has singular and plural numbers, Arabic has singular, dual and plural, and Lihir has singular, dual, trial (three),

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paucal (four/ a small number), and plural (Corbett, 2000). In Arabic, the plural is used to refer to more than two real world-entities, while the dual is used for referring to exactly two (Mashaqba et al., 2020a). Logically, the plural in English does not convey the same meaning as in Arabic or Lihir. Hence, the study of number puts insights into the representation of the mental lexicon and the mechanisms of natural language processing (Corbett, 2000).

Of great significance, number poses challenges regarding the ongoing debate on the concatenative versus nonconcatenative distinction in morphology. As we will observe later on, number marking in English is typically concatenative; whereas in Arabic, it follows two parallel modes: concatenative (sound) and nonconcatenative (broken/irregular). Thus, the morphology of number in Arabic imposes a real challenge because of the complex structure of plural patterns that do not follow a clearly defined process in relation to their corresponding singulars (for details on the challenges of pluralization in Arabic, see Mashaqba et al., 2023b; Mashaqba et al., 2023c). In addition, structurally, number may be marked on various sentence elements (nouns, adjectives, verbs, etc.) which can present another obstacle for children, language learners, and individuals with mental/language impairments to establish grammatical agreement among different elements of the structure, e.g., noun phrase, noun clause, etc. (Mashaqba et al., 2023a; Mashaqba et al., 2020b).

Cross-linguistically, pluralization involves various morphological patternings, including morphological several processes (e.g., affixes, reduplication, or suppletion), quantifiers (e.g., numerals), and particles (e.g. classifiers), as in the following data:

| Language | Singular | Plural | Reference |
|---|---|---|---|
| Arabic | *kitaab* 'book' | *kutub* 'books' | (Mashaqba et al., 2020b) |
| English | *hænd* 'hand'*fʊt* 'foot' | *hænd-z* 'hands'*fiːt* 'feet' | (Albirini, 2015) |
| French | *travaj* 'work' | *travo*'works' | (Kilani-Schoch, 1998) |
| Hebrew | *xaver* 'friend M.*ʃana* 'year F.' | *xave-im* 'friends (m.)' *ʃan-ot* 'years' | (Dromi et al., 1993) |
| German | *ˈdiː ˈmaɥs*'mouse' | *ˈdiː ˈmaɥs –e* 'mouses' | (Sedlak et al., 1998) |
| Japanese | *neko*'cat' | *neko gəʊ-hiki* 'five cats' | (Sudo, 2016) |
| Mandarin Chinese | *waɪìɛmāəʊ* 'one cat' | *ɛsāɛn zhī ɛmāəʊ* 'three cats' | (Sudo, 2016) |
| Turkish | *keɪöpek* 'dog' | *keɪöpek-ler* 'dogs' | (Stephany, 1998) |

The study of the development of grammatical number in bilingual children is an intriguing topic that sheds light on the nature, development, and mechanisms of number assignment in the languages of heritage communities.† It also provides evidence for the productive patterns in the languages used and illuminates the linguistic and paralinguistic factors that account for number assignment, such as predictability, transparency, productivity, frequency, phonological similarity, and the sematic associations between a certain number and meaning (Albirini, 2015; Mashaqba et al., 2023b). Although there has been a considerable amount of attention given to the study of acquisition of grammatical number in Arabic by typically developing children (Abdalla et al., 2013; Albirini, 2015; Mashaqba et al., 2020b), research in language development among children of heritage-speaking communities, particularly in Arabic, is sparse. Therefore, this study would help to come closer to an understanding of the universal organization of the grammatical category of number (Corbett, 2000).

Previous research has shown that monolingual children perform better on standardized language tests and make fewer inflectional errors than bilinguals (Blom et al., 2021; Paradis et al., 2011). In the early stages of language acquisition, bilingual children consistently exhibit a delay in the acquisition of certain morphological aspects, especially the irregular forms, even after reaching the age of six when compared to their English monolingual counterparts (see Paradis et al., 2016) for Chinese-English children and Paradis et al. (2011) for French-English bilingual children). The current study aims to address this gap by exploring the development of the grammatical number in Arabic-English bilinguals of Arabic heritage in the USA, in comparison to monolingual Arabic-speaking children. The study seeks to determine the degree of overlap between the children's use of plural patterns in both languages. The study also explores the factors that affect the acquisition of the Arabic number system among bilinguals, and the mechanisms they use to pluralized nouns and the most common types of errors reported. The results of the present study can help teachers and curriculum coordinators develop strategies, curriculum subject materials, and teaching methods that enhance morphological acquisition at an earlier stage of language development. The findings of this study will also contribute to the cross-linguistic understanding of the development of grammatical number in both monolinguals and bilinguals.

† Heritage language refers to a minority language, typically used for communication by certain ethnic groups, particularly children of immigrants, in a country where the majority language differs from the parents' native language (Benmamoun et al., 2013). Delay in heritage language development would be ascribed to the existence of another dominant language used mainly in that environment, causing the speakers to grow up with a language that is entirely different where they master and become proficient. Thus, their linguistic output is distinct and transferable in linguistic aspects from their L2 to their heritage language (Montrul, 2008).

The remainder of the paper is organized as follows. Section 2 gives background information on number systems in English and Arabic, followed by a brief description of bilingualism and bilingual strategies for language processing. The section also overviews the main models of processing and acquiring inflectional morphology, and presents the research questions and hypotheses. In Section 3, we describe the methodology used to elicit the data. Sections 4 and 5 present and discuss the results. Finally, in Section 6, we conclude the paper by discussing some implications of our findings for Arabic number assignment and L2 acquisition of Arabic.

## 2. Theoretical Background

### *2.1 An Overview of Number System in English and Arabic*

English has one of the simplest plural morphology systems, consisting of regular and irregular forms. The regular form consists of three allomorphs, with the addition of the plural suffix [-s] to the stem. In contrast, the grammatical number in Arabic is divided into four grammatical systems: singular, dual, plural, and collective. The singular noun in Arabic, which is typically the unmarked number, denotes single items and human animates (e.g., *ṭabiib* 'doctor M.'), nonhuman animates (e.g., *kalb* - 'dog'), and inanimate objects (e.g., *kitaab* 'book'). The dual is used to denote two items or a pair. The stem of the noun remains unchanged when the dual is formed. In Jordanian Arabic, the dual is marked by the suffix [-een] for the masculine (e.g., *ṭabiibeen* 'two doctors, M.'), and [–teen] for feminine (e.g., *ṭabiibt-een* 'two doctors, F.').

The plural in Arabic denotes any amount greater than two and is applied to typical nouns and adjectives. Pluralization in Arabic utilizes concatenative and non-concatenative modes of inflection. The concatenative mode has into two sound forms: FSP and MSP. FSP applies to female humans, and animals, some inanimate nouns, and most loanwords, and is marked by adding the suffix [-aat] to singular nouns and adjectives (e.g., *muhandis* 'engineer' > *muhandis-aat* 'engineers, F.', *ṭaawla* 'table' > *ṭaawl-aat* 'tables' (Albirini, 2015; Mashaqba & Huneety, 2017). MSP applies only to [+animate] deverbal nouns and adjectives with *masculine* referents and is marked by suffixing the plural marker [-iin] to singular masculine nouns and adjectives (e.g., *muhandis* 'engineer' > *muhandis-iin* 'engineers, M.'). The non-concatenative mode of pluralization, also known as the 'broken plural', encompasses 31 irregular patterns involving a variety of morphophonological processes, such as internal vowel change, consonant affixation, consonant gemination, or long vowel insertion, as in *kalb* 'dog' > *klaab* 'dogs', *raakib* 'rider' > *rukkaab* 'riders', (ii) *maktab* 'office' > *makaatib* 'offices', *baab* 'door' > *ʔabwaab/ bwaab* 'doors' (Mashaqba et al., 2020b). A collective noun refers to uncountable entities or living things like animals, flowers, fruits and vegetables, as in *samak* 'fish' (Holes, 2004). This type is not considered in the present study.

In terms of acquisition, plural forms typically begin to emerge between the age of 1.9–2.3, with both regular and irregular forms fully mastered by the age of 5 (Brown, 1973). The Arabic plural system is relatively complex, and although there is no agreement among studies on the age of number acquisition in Arabic, most research suggests that the FSP is acquired first, typically between the ages of 3-5, and may be overgeneralized over other patterns because its status as the default pattern. The broken plural (BP) is typically acquired by the age of 5, followed by the MSP, which is the least frequently used (Albirini, 2015; Mashaqba et al., 2020a; Ravid & Farah, 1999).

### *2.2 Bilingualism and Bilingual Strategies for Language Processing*

Bilinguals are individuals who can fluently use a language in addition to their native language (Wallner, 2016). Worthy to note that proficiency in both languages is uncommon as one language typically dominates over the other, depending on the individual's exposure to each language and the situation in which the language is used (Peña et al., 2018). The dominant language is determined by the frequent exposure to the language used by the majority of the community, regardless of the child's home language (Gathercole, 2006; Hertel et al., 2021).

Bilinguals employ various strategies to master the languages they use, such as code-switching, transfer between languages, repair strategy, and failure of retrieval. Code-switching, the most common strategy, is a natural behavior among bilinguals' pragmatic competence, and they engage in code-switching due to their ability to analyze the sociolinguistic factors resulting from their mastery of two language systems with different social environments (Meisel, 2003). Another strategy is the failure of retrieval, also known as the tip-of-the-tongue state (TOTs) (Brown, 1991).TOTs are temporary retrieval failures where a person is certain of the word but cannot recall its form. In this case, the lemma (i.e., the semantic word) is activated, but the phonological word cannot be retrieved (Ecke, 2009). TOTs occur at all ages and are particularly prevalent among L2 learners (Brown, 1991).

It is normal for bilinguals to use L2 transfer strategy between a dominant and minority language, with L2 transfer effects being selective and primarily affecting certain linguistic areas, such as morphology

(Montrul, 2010). The outcomes of L2 transfer may take different forms, including borrowing, avoidance, and simplification, where the child substitutes related elements from the dominant language for the intended heritage ones (Corder, 1983). In the case of Arabic, children tend to regularize irregularities and replace words with easier alternatives, especially if similar options are available in L2. Thus, heritage speakers mostly rely on concatenative patterns, like the FSP, instead of the nonconcatenative ones, like BP, not only because they are simpler, but also because they resemble patterns found in L2 (Omar, 2017).

In addition, the repair strategy is employed when a person has a difficulty recalling the correct form, leading them to substitute it with alternative forms. Cross-linguistically, children often use the overgeneralization repair strategy, which can impede their acquisition of morphological aspects. In Arabic, children tend to generalize most words using the FSP over the other plural modes (Albirini, 2015). Similarly, German children tend to overgeneralize *-(e)n* plural and *–e* plurals at age of 3 (Walter, 1975).

### *2.3 Models of Processing and Acquiring Inflectional Morphology*

Inflectional morphology is semantically predictable, rule-bound, prescribed and generally applicable (Bybee, 1985), making it marked early on in children's language development (Brown, 1973). Four factors contribute to pluralization: predictability, transparency, productivity, and frequency. Productivity refers to the ability of a morpheme to extend to word classes, foreign words, and neologisms (Albirini, 2015; Mashaqba et al., 2020a). Predictability refers to the detectability of the output form based on certain linguistic features of the base form (Albirini, 2015). Transparency is determined by the degree of change in stem and has three levels: stem with no change, stem with slight change, and stem with substantial change. Frequency has two types of measurement: word form frequency and morphemic frequency. The former is simply measured by counting the total number of tokens of a word in the language corpus, while the latter is measured by counting the number of times a certain affix appears and is added to the stem (Alrashed, 2021), which will be addressed in this study. Productivity and frequency tend to shape the acquisition of plural in young children, who often use the FSP as the most productive form. Alternatively, predictability has a greater impact on older children, who depend on frequency distribution when using regular forms (Albirini, 2015; Parshina et al., 2022).

Within cognitive linguistics literature, two main models are used to describe the acquisition of inflectional morphology: the dual-route model and the single-route model. The dual-route posits that there are two distinct processing systems involved in the production of regular and irregular inflections. Regular inflections are formed through a morphemic concatenation rule, while irregular forms are rote-learned and stored in the mental lexicon in the associative network, meaning they are retrieved from memory upon lexical access (Clahsen, 1999). The single-route, also known as the connectionist model, suggests that the acquisition of both regular and irregular inflections is governed by a single learning mechanism (Plunkett & Marchman, 1993). This mechanism can be achieved either through massive storage of forms (Bybee, 1985) or by equal processing of all forms (Rumelhart & McClelland, 2014). The model predicts that children learn to compute the most likely inflected form for any input from external factors, such as direct-speech and memory units. In this mechanism, the frequency and type of exposure streamline the process of recalling and applying inflected forms, leading to improved production of correct forms over time. The model also provides ways to handle both regular and irregular inflectional morphology. The retrieval of both types is determined by the frequency and class frequency of the word, with high frequency of certain forms leading to over-generalization to less frequent forms (Mashaqba et al., 2023b; Plunkett & Marchman, 1996).

Both the dual-route and single-route models offer plausible explanations for the U-shaped curve phenomenon, underlying the acquisition of noun plurals and word forms. Most of the literature in this area focuses on L1 acquisition because the existing research on U-shape learning in bilingualism is sparse. The most commonly cited example that illustrates the U-shaped learning is the acquisition of the past tense in English. Traditionally, three distinguished stages outline the U-shape learning curve. In the first stage, children begin to produce both regular and irregular forms correctly. In the second stage, they develop a sense of regularity and tend to produce irregular forms as regular forms (*go - goed*). In the third stage, over-regularization gradually decreases until errors are eliminated altogether (Albirini, 2015). According to the dual-route model, during the first stage of development, children produce partially default forms of past tense because their lack of knowledge of the inflection system. In the second stage, they learn the regular rule and begin applying it to almost all verbs, resulting in a gradual reduction in overgeneralization as they are exposed to a wider range of examples. In the third stage, children start to distinguish between regular forms produced through the rule and irregular forms through memorization.

On the other hand, the U-shape learning process is initiated by the change in child's vocabulary repertoire size. Initially, children have a small vocabulary size, and the network is large enough to accommodate separate cases. However, as the vocabulary expands, the need for regularization becomes increasingly important. During later learning stages, the network tips the balance to support regulation, but it requires

time to properly apply it with the cases of exceptions. As predicted by the single-route model, which emphasizes memory-based processes, this leads to the U-shaped learning phenomenon (Taatgen & Anderson, 2002). Therefore, the model considers the frequency of both regular and irregular forms, as both are stored in the mental lexicon. Many studies have identified the stages of the U-shape curve as pre-morphology, proto-morphology, and morphology proper (Dressler, 1997). During the pre-morphology stage, children produce correct forms based on rote-learned forms, where frequency affects productivity. In the proto-morphology stage, children over-generalize forms. In this regard, many studies on Arabic have found that the concatenative suffix *-aat* is the most commonly over-generalized form used by children (Mashaqba et al., 2020b; Ravid & Farah, 1999). Finally, in the morphology proper stage, children begin to learn the proper forms and rules and produce correct forms (Albirini, 2015).

After replicating numerous cross-linguistic research on vocabulary size, we observed significant linguistic variation and an increase in vocabulary with age. Previous studies have reported variation in vocabulary size across languages such as Danish, Hebrew, Korean, Italy, Turkish and British. For example, Hamilton et al. (2000), found that British children had smaller vocabulary size than American children at the same age. Rescorla et al. (2017) reported a trend for Greek, Korean, and Italian children to have smaller vocabulary size than English children between the ages of 18-32 months. However, to our knowledge, no studies on vocabulary size in Arabic children using population samples have been published. Subsequently, we did not formulate any specific hypothesis concerning variations in the vocabulary size of Arabic-English bilingual children, as previous studies have provided incomplete results on this issue. To this end, this research targets the development of plural patterns by bilingual children to answer the following research questions:

1. How does the production of dual and plural forms differ between Arabic monolingual and Arabic-English bilingual children?
2. How does the level of plural and dual forms vary among different age-related trajectories? To what extent is age a factor in this variation?
3. What are the common errors that bilingual children make in acquiring the Arabic grammatical number system, and what the factors influence their acquisition of this system?

Drawing from previous studies, several hypotheses have been proposed: **H1** suggests that proficiency in plural formation develops with age, with less expertise expected among younger children. **H2** hypothesizes that the FSP is the most prevalent plural form across all trajectories, followed by the BP and MSP. Finally, **H3** posits that bilingual children have the minimal use of the dual form.

## 3. Methods and Procedure

### *3.1 Participants*

To address the inclusion of minor Arabic populations within a larger English-speaking population in the US, we employed a convenient exponential snowball sampling method for data collection. Out of 52 families contacted through acquaintances, 46 consented to participate. Bilingual families eligible for recruitment needed to reside in the US, possess bilingual language skills, demonstrate a fair level of proficiency in both Arabic and English, and have nationalities from the Levantine countries. The selected bilingual children were permanent US residents, orally proficient in English (as established through initial interviews), and attended English-medium public schools. In terms of English literacy, there exists a range from *intermediate* to *proficient*, signifying a generally commendable grasp of reading and writing skills in English among the group. However, the variance in Arabic literacy levels spans from *basic* to *intermediate*, and notably, no participant is classified as *proficient*. Enrollments in nursery or preschool occurred at diverse ages, primarily falling between 3 and 4 years old. The language predominantly spoken at home exhibits diversity, with participants noting English, Arabic, or a blend of both languages.‡

To be eligible, monolingual children were required to demonstrate basic-proficiency level in reading and writing Modern Standard Arabic and attended government schools where the language of instruction and the language spoken at home was Arabic.§ Using the aforementioned recruitment procedures, forty monolingual children (20 males and 20 females) and forty bilingual children (20 males and 20 females) between the ages of 5 to 9 years were recruited to participate in the study. These age-related trajectories were selected based on the established age range in the literature review for investigating number acquisition. The children were subsequently divided into four age-related trajectories, each consisting of four males and four females, with 12-month intervals.

‡ (For an all-encompassing view of the participants' demographic details, including participant ID, gender, age, home country visitation, nursery/preschool enrollment age, primary language spoken at home, English literacy level, and Arabic literacy level, refer to Table 1 provided in Appendix A)
§ Refer to Table 2 provided in Appendix A for more details.

### *3.2 Procedure*

Prior to data collection, a combination of informal and formal interviews and questionnaires was administered by the researchers. During this stage, several informal meetings were conducted with families and participants to observe their daily interactions within a typical household environment. The purpose of the questionnaire was to collect detailed data necessary for the research, providing insights into the receptive and expressive language skills of bilingual children, as well as aiding error analysis in the subsequent phase of the study. The questionnaire consisted of four sections, comprising 48 questions of varying difficulty levels. It assessed the dominant language(s) used by parents and their children in daily settings, the children's linguistic abilities, and any language shift based on their duration of residence in the US.

Before proceeding with the screening process, a pre-testing recording was conducted, wherein respondents were asked to name an item they were holding, in order to assess their level of understanding in Arabic. Subsequently, participants were shown two items and then more than two items to test their ability to produce dual and plural numbers. Children who demonstrated comprehension of the questions and accurately produced any plural or dual forms were selected for the study. Those who were unable to do so were excluded from the study, resulting in the exclusion of six participants.

The procedure of data collection methodology included two separate tasks: one focused on pictureable objects and the other involved naturally occurring communications. The dual-task approach was adopted based on theoretical and methodological considerations. The objective was to thoroughly examine the acquisition of grammatical number in bilingual Arabic-English-speaking children. This was achieved by assessing their ability to effectively use grammatical number in both expressive and receptive contexts. This combined approach was rooted in the belief that performance on both tasks could offer complementary insights into the language development process.

In the picture-naming task, thirty-eight singular nouns were carefully selected to assess comprehension and production of dual and plural forms. It is important to note that there is currently no standardized tool/framework in Arabic literature for testing the vocabulary size of Arabic-speaking children, which is an important area for future research. For this study, the nouns were chosen based on their representation within the children's community and their frequency levels in the language, demonstrated using Aralex, an open access online lexical database for MSA.[**] This database contains information on the token frequencies of word patterns (from a contemporary text corpus of 40 million words), making it a useful tool for studying the cognitive processing of Arabic by selecting stimuli based on precise frequency counts (Boudelaa & Marslen-Wilson, 2010).

Each child underwent a single testing session, with a break after the first 20 words to ensure sustained concentration. Picture cards were utilized during the session, with each card depicting one item of the targeted linguistic category for singular, two of the same item for dual, and three or more of the same item for plural. Spoken language was also used to assess the children's understanding of the depicted words, with clarification provided if needed. In addition, participants were asked to pluralize four nonsense words to assess short-term memory and determine their default form for pluralization of unknown words. This test aided in addressing issues related to word frequency and fossilizations. All responses were manually recorded to ensure participant privacy[††]

### *3.3 Data analysis*

Collected data was meticulously organized into codebooks and subjected to various statistical tests, including Pearson correlation coefficient, independent sample t-tests, and descriptive analysis. The Pearson correlation test explored the correlation between trajectories and the number of correct forms produced by monolingual and bilingual participants. Descriptive statistics such as mean and standard deviations were computed for both dual and plural forms among 5-9-years-old monolingual and bilingual participants. Furthermore, independent samples t-tests were performed to compare results between monolingual and bilingual participants for both dual and plural forms. Additionally, frequency calculations were conducted to identify common types of errors and strategies employed by different bilingual age-related trajectories. Data was structured into three spreadsheets using Microsoft Excel: one for all children's responses, another categorizing the responses as correct or incorrect, and a third classifying incorrect responses using the codebook.

[**] Aralex is available under a GNU-like license, enabling individuals to access it freely online or download it from www.mrc-cbu.cam.ac.uk:8081/aralex .online/login.jsp.
[††] see Appendix B & C for a complete list of words.

# 4. Results

## *4.1 Results related to plural and dual formation*

Table 1 provides a summary of bivariate analyses conducted to compare results of plural and dual forms among monolingual and bilingual participants, using independent sample t-tests. The mean dual score for monolinguals was 37.98 with a standard deviation of .156, which was significantly higher than the mean score for bilinguals (23.76±17.392) (t = 7.280, p=.000). Similarly, mean for plural score for monolinguals was 30.54 with a standard deviation of 6.470, which was significantly higher than mean score for bilinguals (15.63±11.399) (t =5.235, p = 0.000). The difference between monolinguals and bilinguals in plural scores was 8.147 points (95% CI, 10.829 to 18.976).

**Table1:** *Means, standard deviations, t- values and significant levels for monolinguals and bilinguals*

| | **Monolinguals Equal variance not assumed** | | | | | **Bilinguals Equal variance not assumed** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | M | SD | t | df | p | M | SD | t | df | p |
| Total score/ dual | 37.98 | .156 | 7.280 | 63.347 | .000 | 23.76 | 17.392 | 7.280 | 63.347 | .000 |
| Total score/ plural | 30.54 | 6.470 | 5.235 | 40.006 | .000 | 15.63 | 11.399 | 5.235 | 40.006 | .000 |

Table 2 presents the results of a Pearson correlation coefficient analysis examining the relationship between trajectories and the number of correct forms produced by monolingual and bilingual participants. The analysis revealed a positive correlation between age and the production of dual form (r [df] [82-2] = [r = 80], p=.426), as well as a positive correlation between age and the production of plural forms (r [df] [82-2] =[r=80], p= .626). Additionally, the results indicated a negative correlation between language status (bilingual or monolingual) and the total score, with scores increasing as age increased.

**Table 2:** *Pearson's correlation scores*

| | **Trajectory** | **Bilingual or monolingual** |
|---|---|---|
| *Total score dual* Pearson correlation Sig. (2_ tailed) N | .426 >0.01** 82 | -.505 >0.01** 82 |
| *Total score plural* Pearson correlation Sig. (2_ tailed) N | .626 >0.01** 82 | -.631 >0.01** 82 |

**. Correlation is significant at the 0.01 level (2-tailed).

Table 3 displays the scores for correct dual forms produced by bilinguals in the 5-6 years and 7-8 years trajectories. For the 5-6 years trajectory, scores ranged from 0 to38, with a mean of 9.50 and the standard derivation of 17.591. In the 7-8 years trajectory, the scores ranges from 0 to 38, with a mean of 31.80 and a standard deviation of 11. 487. Notably, there was a significant increase in the score of correct dual forms in the upper end of the range, with scores ranging from 32 to 38, and a mean of 36.93 and SD=1.639.

**Table 3.** *Means and standard deviations for dual forms among bilingual children*

| **Trajectory** | **Min** | **Max** | **Mean** | **SD** |
|---|---|---|---|---|
| 5-6 years | 0 | 38 | 9.50 | 17.591 |
| 6-7 years | 0 | 31 | 7.00 | 13.611 |
| 7-8 years | 0 | 38 | 31.80 | 11.487 |
| 8-9 years | 32 | 38 | 36.93 | 1.639 |

Table 4 displays the results of the formation of plural forms across different bilingual trajectories. For the 5-6 years age group, the mean score was 3.63 (SD=5.423), with scores ranging from 0 to15 out of a total of 38 forms. In contrast, the older groups of 7-8 years and 8-9 years recorded high scores, with means of 16.40 (SD=6.653) and 28.00 (SD=3.530), respectively.

**Table 4:** *Means and standard deviations for plural forms among bilingual children*

| **Trajectory** | **Min** | **Max** | **Mean** | **SD** |
|---|---|---|---|---|
| 5-6 years | 0 | 15 | 3.63 | 5.423 |
| 6-7 years | 0 | 16 | 6.22 | 6.457 |
| 7-8 years | 1 | 26 | 16.40 | 6.653 |
| 8-9 years | 21 | 32 | 28.00 | 3.530 |

## *4.2 Error Analysis*

This section delves deeper into the repair strategies and frequencies employed by bilingual children in response to incorrect forms. The analysis is based on a total of 1558 responses. Table 5 presents the age-

related trajectories and the repair strategies utilized. The highest frequency of errors was observed in the 5-6 years and 6-7 years old. The most common repair strategy used by most children was the addition of the suffix *–aat*, which accounted for 21.11%of the total repair strategies employed. Additionally, many children utilized English plural morpheme [-s] or quantifiers, ranging from 3.53% to 7.83% across different trajectories. The highest frequency of BP production was observed in the 7-8 years and 8-9 years trajectories, with a percentage of 1.9%. Conversely, the least commonly used plural morpheme was *–iin*, which accounted for only1.47% of all repair strategies utilized across all trajectories.

**Table 5:** *Repair strategies with % out of 1558*

| Trajectory | 5-6 | % | 6-7 | % | 7-8 | % | 8-19 | % | Total | % |
|---|---|---|---|---|---|---|---|---|---|---|
| correct form | 29 | 1.86 | 56 | 3.59 | 166 | 10.65 | 392 | 25.16 | 643 | 41.27 |
| stem+ aat | 64 | 4.10 | 83 | 5.32 | 118 | 7.57 | 64 | 4.10 | 329 | 21.11 |
| stem+ iin | 0 | 0 | 2 | 0.12 | 8 | 0.51 | 13 | 0.83 | 23 | 1.47 |
| stem+ s | 55 | 3.53 | 122 | 7.83 | 26 | 1.66 | 15 | 0.96 | 218 | 13.99 |
| number + stem | 55 | 3.53 | 0 | 0 | 10 | 0.64 | 1 | 0.06 | 66 | 4.23 |
| number+ stem +s | 1 | 0.06 | 1 | 0.06 | 5 | 0.32 | 0 | 0 | 7 | 0.44 |
| quantifier+ stem | 60 | 3.85 | 62 | 3.97 | 2 | 0.12 | 1 | 0.06 | 125 | 8.02 |
| quantifier+ stem + s | 1 | 0.06 | 7 | 0.44 | 4 | 0.25 | 0 | 0 | 12 | 0.77 |
| novel words | 1 | 0.06 | 1 | 0.06 | 5 | 0.32 | 4 | 0.25 | 11 | 0.70 |
| failure of retrieval | 37 | 2.37 | 1 | 0.06 | 2 | 0.12 | 11 | 0.70 | 51 | 3.27 |
| incorrect BP | 1 | 0.06 | 2 | 0.12 | 31 | 1.98 | 31 | 1.98 | 65 | 4.17 |
| quantifier + stem + aat | 0 | 0 | 2 | 0.12 | 0 | 0 | 0 | 0 | 2 | 0.12 |
| Number + stem+ aat | 0 | 0 | 3 | 0.19 | 3 | 0.19 | 0 | 0 | 6 | 0.38 |

### *4.3 Nonsense Words Analysis*

Bilingual children were given four nonsense words to pluralize, two following the sound plural and two following BP patterns. Table 6 presents the frequencies and types of strategies utilized by all children produced with these nonsense words. The analysis revealed that children in the 5-6 years and 6-7 years trajectories heavily relied on the Arabic FSP *-aat* and the plural English –s with nonsense words simulating BP patterns. This suggests an overgeneralization of both strategies in both trajectories. However, children in 7-8 years and 8-9 years trajectory demonstrated a greater reliance on BP patterns, although overgeneralization of -aat was still present in the responses of the participants.

**Table 6:** *Frequencies and strategies for nonsense words out of 160 tokens*

| | **Nonsense words simulating BP** | | | **Nonsense words simulating Sound plural** | | |
|---|---|---|---|---|---|---|
| trajectory | *tafdal* | *balan* | Total % (word1 % + word 2% ) ÷2) | ʃabi:la | *gula* | Total % ((word1 % + word 2%) ÷2) |
| 5-6 years | -aat 71.4% -s 28.6% | -aat85.7% -s14.3% | 78.55% 21.45% | -aat71.4% -s28.6% | -aat 85.7% -s 14.3% | 78.55% 21.45% |
| 6-7 years | -aat 60% -s 30% BP10% | -aat 60% -s40% | 60% 35% 5% | -aat90% -s 10% | -aat 90% -s 10% | 90% 10% 0% |
| 7-8 years | -aat 60% BP40% | -aat 30% BP 70% | 45% 55% | -aat 100% | -aat100% | 100% 0% |
| 8-9 years | -aat 14.3% BP85.7% | -aat7.4% BP92.6% | 10.85% 89.15% | -aat 50% BP50% | -aat 50% -BP 50% | 50% 50% |

## 5. Discussion

Upon examining the production of dual and plural forms by both Arabic monolingual and Arabic-English bilingual children, we find that monolinguals produced more correct forms than bilinguals in both dual and plurals forms (Table 1). This finding aligns with Paradis et al. (2016) who demonstrated a significant and consistent delay over time in the English verb morphology proficiency of Chinese-English bilinguals in comparison to monolinguals, despite spending over 6 years studying English at school. This study also showed how dependency in scores may be related to the length of exposure to morphology, indicating that children need frequently practice with morphological patterns in their daily lives in order to master lexical forms.

The findings of the study indicated a strong correlation between age and the production of dual and plural forms. Specifically, the frequency and productivity of dual form were found to be low among children aged 5-7 years, whereas they were high among the trajectories of 7-8 and 8-9 years. This suggests that it takes a longer time for children to increase the productivity and frequency of using dual patterns. These results align with Flores and Barbosa's (2014) argument that bilinguals acquire language at the same level as

monolinguals, but with a delay. They also support the findings of Mashaqbeh (2009), Ravid and Farah (2009), and Albirini (2015), which indicate that age impacts the acquisition of number, as productivity and frequency of dual and plural morphemes gradually increase over time.

The study found that bilingual children tended to make consistent errors in the production of plural morphemes, particularly through the use of overgeneralization. This was evident when bilingual children added the FSP pattern -aat to singular forms when producing regular and irregular plurals, including BP and MSP. The overgeneralization strategy was used 7.5% by the 7-8-year-old trajectories, as shown in Table 6. These results are consistent with Daana (2009), who found that adults heavily relied on this strategy in 59% of cases, and with Ravid and Farah (1999), who showed that children produced plural forms for words ending with the vowel /a/ by using the FSP suffix -*aat*.

One possible reason for the high frequency of overgeneralization using –*aat* may be attributed to the fact that FSP has no semantic restrictions and can be used for animate, inanimate, and loan words (Ravid & Farah, 1999, 2009). Another reason is that it can yield acceptable words when used by children (Daana, 2009). The high percentage of overgeneralization may also be due to productivity and frequency of the FSP, suggesting that it is the default in Arabic varieties (Albirini, 2015; Holes, 2004; Saiegh-Haddad et al., 2012). Therefore, it can be argued that the frequency and productivity of the default –*aat* played a major role in the preferred plural mechanisms of young trajectories.

Furthermore, the intriguing observation that bilingual children often rely on the FSP as a default system offers valuable insights into their morphological acquisition process. Delving deeper into how this strategy is shaped by their exposure to both Arabic and English could significantly enhance the robustness of our study's findings. Exploring the extent to which linguistic input in both languages influences the prevalence of this default strategy would shed light on the interplay between the bilingual environment and morphological development. Moreover, understanding whether the preference for this default strategy evolves over time as bilingual children gain more exposure to both languages could offer a nuanced perspective on their morphological learning trajectory. Unraveling the intricacies of how this strategy is influenced by bilingual exposure has the potential to refine our comprehension of bilingual morphological acquisition. Importantly, by pinpointing the factors that contribute to the use of this default strategy, we could uncover effective language instruction strategies that cater to bilingual children's unique learning needs. These insights hold practical implications for educators and language development programs, equipping them with targeted approaches to foster morphological proficiency in bilingual children (see section 6).

Moreover, bilingual children tend to utilize code-switching and transfer strategies, and this was observed when bilingual children borrowed the English plural suffix -s, quantifiers, and numbers and added them to Arabic singular forms to produce plural (Table 6). The results show that children preferred to add the English plural suffix -s due to the influence of code-switching on bilingual children. When children face difficulty in remembering a word, they tend to use the closest and easiest form they know from either of the two languages. The transparency of this form plays a role in the production of this type of error in the early stages of acquisition. Code-switching occurs due to language accessibility, such as the failure to retrieve the correct form (Heredia & Altarriba, 2001). While code-switching is associated with sociolinguistic factors, such as the ability to select language according to certain settings, (Meisel, 2006), it diminishes as bilingual children get older because their awareness and pragmatic competence develop, thereby minimizing the use of this strategy (Suek, 2017).

Moreover, children tend to link quantifiers to words followed by the -s suffix, which is attributed to the fact that quantifiers are widely used in English to express numbers and quantities (Ravid & Farah, 1999). The use of a certain number followed by a singular word was also observed (see Table 6). This is due to the frequent usage of numbers with words in English. Similarly, Ravid and Hayek (2003) reported early emergence of numeral and even quantifier before the stem. In this context, bilinguals tend to apply this pattern as a form of simplification and borrowing resulting from the influence of the English as L2. This is consistent with the findings of Albirini and Benmamoun (2014), who suggested that transfer strategy plays a key role and cannot be separated from other factors such as incomplete acquisition or attrition, and that the influences of the L2 lead bilinguals to use this strategy more often.

Another strategy observed in bilingual children is failure of retrieval, which depends on the availability of examples. This was obvious when bilinguals used the same word stems without changing (see table 6 for analytical results of using zero strategy).This finding is in line with Ravid and Farah (1999), who noted that some young children did not respond or kept the word the same. Similarly, Ravid and Hayek (2003) analyzed incorrect responses and found that children tended to repeat the word or keep it the same, as it is easier for them to keep the word unchanged when they are not sure. According to Laaha and Dressler (2012), the lack of change to the stem implies a higher frequency and greater transparency of the word.

These results are consistent with previous research by Abdalla et al. (2013), Ravid and Farah (1999), and (Albirini, 2015), which suggest that the development of BP is slow and occurs later in both monolinguals and bilinguals. However, our study revealed that our participants showed better production of BP than MSP,

which is also consistent with Ravid and Farah (1999).Interestingly, there were few responses to MSP, as most children failed to trigger the MSP as a unit stored in their associated memory. Although MSP is regular, it is less productive (and acquired later) than BP (Ravid & Hayek, 2003), possibly due to the fact that MSP is restricted to human masculine nouns, making it hard to produce. Overall, the types of errors produced by the age-related trajectories showed that transparency plays a role in pluralization among the young trajectories (5-6 years old) in which the addition of -s plural to words is transparent and frequent. This is an unexpected result, and it contradicts with Albirini's (2015) argument that morphemes produced by young groups are less transparent than those produced by older trajectories in monolinguals. The least productive plural form is the MSP among all trajectories, while BP is the least transparent and more predictable in the older trajectories (7-8 and 8-9 years old).

On this view, the debate in the current study is to identify the mechanisms that children use in the acquisition of word inflection. Our findings for the 5-7-year-old trajectories as largely in line with the predictions of the single route mechanism, which emphasizes the active role of rule-based system in word processing. This observation is evident from the heavy reliance on overgeneralization of the *-aat* suffix, which accounted for 21.11% of responses. Moreover, the correct responses produced by 5–6-year-old children were less frequent than those produced by 8–12-year-old children. The younger children (5-6) tend to avoid BP forms compared to the older trajectories, with a percentage of only 1%. These results suggest that children at the ages of 5-6 rely on the single route mechanism. In contrast, the results for 8-9-year-old children support the dual-route processing model, which posits that both rule-based and memory retrieval mechanisms are active in word processing.

Regarding the nonsense words, our research has shown that bilingual children engage in an active process of pluralization through analogy, relying on the closest word that resembles the nonsense word. This finding also supports the proposal that frequency plays an important role in children's linguistic development (see Albirini, 2015 for similar results on monolingual JA-speaking children). Bilingual children are more likely to form BPs of nonsense words when there are phonological similarities between the nonsense word and the native word. For example, children in the younger trajectory (5-6 years old) pluralized the nonsense word *tafdal* as *tafdal-aat* or *tafdal-s* through overgeneralization, as shown in Table 6. However, older children (7-9 years old) with a larger vocabulary size and better verbal working memory used phonological similarities for the nonsense word *tafdal*, to retrieve the correct form from memory rather than relying on rule. Thus, we found participants making the *tafaadil* instead. For other nonsense words following sound plural, children used the rule-based retrieval. Therefore, this trajectory followed the dual- route in both typical and nonsense words. As children gain more exposure to language, their lexicon expands, and they can use both retrieval modes in different situations. These findings show that children's plural Arabic morphological development follows the U-shape trajectory, with three stages of development: pre-morphology, proto-morphology, and morphology proper, as observed in both monolingual and bilingual children (Albirini, 2015). This result conforms to findings of previous research showing that bilinguals acquire the irregular forms of the Hebrew plural noun system in a similar way and exhibit similar patterns of developmental errors through overgeneralization (Schwartz et al., 2009; Strobach & Schönpflug, 2011).

To recap, the observed delay in the acquisition of plural forms among bilingual children compared to monolinguals could potentially be attributed to a combination of linguistic and cognitive factors. Bilingual children are exposed to and must manage two linguistic systems, which might lead to a slower pace of mastery in each language's intricate morphological features. The bilingual environment could introduce additional complexity due to the potential for cross-linguistic influence and interference, making it harder for bilingual children to establish clear morphological rules for each language. Moreover, bilingual children often allocate cognitive resources to language selection and inhibition, which might divert attention and processing capacity from acquiring complex morphological structures. Additionally, the differing frequency and transparency of plural forms in the two languages might contribute to the observed delay. The default and productive nature of certain plural patterns in one language could potentially overshadow the acquisition of less predictable forms in the other language. Furthermore, the age of onset of bilingual exposure, as well as the amount and quality of input in each language, could play a role. Monolingual children might receive more consistent and intensive exposure to singular and plural forms within a single linguistic context. In contrast, bilingual children's exposure to each language might be more variable, potentially affecting the consolidation of morphological rules. Overall, these combined linguistic, cognitive, and exposure-related factors likely contribute to the delay in the acquisition of plural forms among bilingual children compared to their monolingual counterparts.

Moving forward, it is important for longitudinal studies to investigate the social factors that affect the pluralization process in bilingual children. Further research also should explore other complex morphological aspects of bilingual language development, including inflection (such as subject-verb agreement, gender, and voice) and derivation (such as diminutive formation, verb conjugations, verbal derivatives, etc.).

## 6. Concluding Remarks and Implications

The study indicates that monolingual children perform better than bilingual children in forming dual and plural forms, with younger bilingual children relying heavily on the strategy of overgeneralization of the default FSP and code-switching, influenced by transparency and frequency. Transparency, productivity, and frequency were found to be influential factors in the formation of plural forms in younger trajectories, while predictability plays a role in older trajectories. As children get older and more exposed to the language, their lexicon and vocabulary size expands, enabling them to use both retrieval models in different situations. The study findings have significant implications for pedagogy, as they can inform the development of curricula that promote the most effective strategies for teaching Arabic heritage-speaking communities and non-native Arabic speakers. Additionally, the study's data, along with data from similar studies, could be useful to construct a computational database for generating plural forms automatically and other morphological structures.

The study suggests several pedagogical implications for teaching Arabic-English bilingual children. Firstly, teachers need to be aware of the potential delays in the acquisition of plural forms among bilingual children and provide additional support and reinforcement to help these students master plural processing. Secondly, transparency, frequency, productivity, and predictability are essential factors in shaping the acquisition of plural forms among different developmental trajectories. Teachers can use this information to design activities and exercises that focus on these factors to enhance students' learning and understanding of the inflectional system. Thirdly, bilingual children tend to rely heavily on the feminine sound plural as a default system to form different plural nouns. Teachers should provide explicit instruction and practice on using other plural forms to help students develop a more diverse and accurate plural processing system. Finally, the study highlights the different strategies used by bilingual children to produce the plural form, including over-generalization of the feminine sound plural, code-switching between plural patterns, or using the English plural morpheme [-s] and English quantifiers. Teachers can incorporate these strategies into their teaching approach to help students develop a more nuanced and flexible understanding of the inflectional system.

While the current study has provided valuable insights into the acquisition of plural forms among bilingual children, it is essential to acknowledge its limitations and identify potential avenues for future research. One potential confounding variable lies in the socio-linguistic background and language proficiency levels of the bilingual participants, which could influence their morphological development. Additionally, the study's cross-sectional design limits the ability to track individual children's developmental trajectories over time. Further investigations employing longitudinal approaches would offer a more comprehensive understanding of the morphological progression within bilingual language development. Future studies could also delve deeper into the interplay of other linguistic aspects, such as gender agreement or verb conjugations, in both Arabic and English, to provide a more holistic view of morphological acquisition in bilingual children. Exploring the impact of language input balance and the role of context on morphological acquisition could shed light on the specific environmental factors that shape bilingual children's linguistic development. Furthermore, investigating the transfer of morphological skills between the two languages and assessing how these skills contribute to broader cognitive and linguistic abilities could yield valuable insights. By addressing these limitations and delving into these suggested directions, future research has the potential to build upon the current findings and contribute to a more comprehensive understanding of bilingual morphological development.

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*Informed Consent Statement*

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*Data Availability Statement*

The data supporting the findings of this study can be optioned from the corresponding author upon request.

*Conflicts of Interest*

The authors declare no conflict of interest.

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**Appendix A:**

**Table 1:** *Demographic information and literacy levels of bilingual participants*

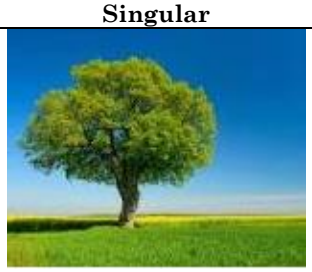
| Participant ID/Code | Gender | Age | Home country visits | Age of nursery /preschool enrollment | Primary language spoken at home | English Literacy level | Arabic Literacy level |
|---|---|---|---|---|---|---|---|
| **B1** | M | 5;2 | once | 4 | both | Intermediate | Basic |
| **B2** | F | 5;3 | once | 4 | English | Intermediate | Limited |
| **B3** | F | 5;3 | never | 3 | English | Intermediate | Limited |
| **B4** | M | 5;5 | once | 3 | both | Intermediate | Basic |
| **B5** | M | 5;8 | once | 4 | Arabic | Intermediate | Limited |
| **B6** | M | 5;4 | once | 3 | both | Intermediate | Basic |
| **B7** | F | 5;9 | once | 4 | Arabic | Intermediate | Basic |
| **B8** | F | 5;9 | Twice | 4 | both | Intermediate | Basic |
| **B9** | M | 6;2 | Twice | 4 | both | Proficient | Basic |
| **B10** | F | 6;9 | Twice | 4 | English | Proficient | Basic |
| **B11** | M | 6;6 | Twice | 4 | English | Proficient | Basic |
| **B12** | F | 6;3 | Twice | 3 | English | Intermediate | Limited |
| **B13** | M | 6;5 | once | 3 | both | Proficient | Limited |
| **B14** | M | 6;5 | 3 times | 3 | Both | Proficient | Basic |
| **B15** | F | 6;8 | Twice | 4 | English | Intermediate | Basic |
| **B16** | F | 6;4 | once | 4 | both | Intermediate | Limited |
| **B17** | F | 7;3 | once | 3 | English | Proficient | Basic |
| **B18** | F | 7;6 | Twice | 3 | both | Proficient | Intermediate |
| **B19** | M | 7;9 | once | 3 | both | Proficient | Intermediate |
| **B20** | M | 7;7 | never | 3 | both | Intermediate | Intermediate |
| **B21** | F | 7;2 | Twice | 3 | English | Proficient | Basic |
| **B22** | F | 7;8 | Twice | 4 | both | Proficient | Limited |
| **B23** | M | 7;5 | Never | 4 | English | Intermediate | Basic |
| **B24** | M | 7;3 | Twice | 4 | both | Intermediate | Basic |
| **B25** | M | 8;6 | 3 times | 3 | | Proficient | Intermediate |
| **B26** | M | 8;3 | never | 4 | English | Proficient | Basic |
| **B27** | F | 8;8 | never | 4 | both | Intermediate | Limited |
| **B28** | M | 8;5 | Twice | 3 | both | Proficient | Limited |
| **B29** | M | 8;7 | 3 times | 3 | both | Intermediate | Proficient |
| **B30** | F | 8;8 | twice | 4 | both | Proficient | Proficient |
| **B31** | F | 8;3 | never | 4 | both | Intermediate | Intermediate |
| **B32** | F | 8;9 | never | 4 | English | Proficient | Limited |
| **B33** | M | 9;4 | never | 4 | English | Proficient | Basic |
| **B34** | F | 9;2 | Twice | 4 | both | Proficient | Proficient |
| **B35** | M | 9;5 | Twice | 3 | English | Intermediate | Limited |
| **B36** | F | 9;7 | 3 times | 3 | both | Proficient | Proficient |
| **B37** | F | 9;8 | Twice | 4 | both | Proficient | Intermediate |
| **B38** | M | 9;4 | 3 times | 3 | both | Proficient | Proficient |
| **B39** | M | 9;1 | 3 times | 3 | both | Proficient | Intermediate |
| **B40** | F | 9;8 | once | 3 | both | Proficient | Proficient |

**Table 2:** *Demographic information and literacy levels of monolingual participants*

| Participant ID/Code | Gender | Age | Visits outside Jordan | Age of nursery /preschool enrollment | Primary language spoken at home | Arabic Literacy level | English Literacy level |
|---|---|---|---|---|---|---|---|
| **M1** | M | 5;4 | - | 3 | Arabic | Intermediate | Limited |
| **M2** | F | 5;2 | - | 4 | Arabic | Proficient | Limited |
| **M3** | M | 5;5 | - | 4 | Arabic | Intermediate | Limited |
| **M4** | F | 5;6 | - | 3 | Arabic | Proficient | Limited |
| **M5** | M | 5;2 | - | 3 | Arabic | Intermediate | Limited |
| **M6** | M | 5;8 | - | 3 | Arabic | Proficient | Limited |
| **M7** | F | 5;3 | - | 4 | Arabic | Intermediate | Limited |
| **M8** | F | 5;9 | - | 3 | Arabic | Intermediate | Limited |
| **M9** | M | 6;1 | - | 4 | Arabic | Proficient | Limited |
| **M10** | M | 6;6 | - | 3 | Arabic | Proficient | Limited |
| **M11** | F | 6;9 | - | 4 | Arabic | Proficient | Limited |
| **M12** | F | 6;5 | - | 3 | Arabic | Intermediate | Limited |
| **M13** | M | 6;3 | - | 3 | Arabic | Proficient | Limited |
| **M14** | M | 6;8 | - | 3 | Arabic | Proficient | Limited |
| **M15** | F | 6;5 | - | 4 | Arabic | Proficient | Limited |
| **M16** | F | 6;4 | - | 4 | Arabic | Intermediate | Limited |
| **M17** | F | 7;2 | - | 3 | Arabic | Proficient | Basic |
| **M18** | M | 7;6 | - | 4 | Arabic | Proficient | Basic |
| **M19** | F | 7;7 | - | 3 | Arabic | Intermediate | Basic |
| **M20** | M | 7;9 | - | 4 | Arabic | Proficient | Basic |
| **M21** | F | 7;6 | - | 3 | Arabic | Proficient | Basic |
| **M22** | M | 7;5 | - | 4 | Arabic | Proficient | Basic |
| **M23** | F | 7;8 | - | 4 | Arabic | Proficient | Basic |
| **M24** | M | 7;4 | - | 4 | Arabic | Proficient | Basic |
| **M25** | F | 8;3 | - | 3 | Arabic | Intermediate | Basic |
| **M26** | M | 8;6 | - | 4 | Arabic | Intermediate | Basic |
| **M27** | M | 8;5 | - | 4 | Arabic | Proficient | Basic |
| **M28** | F | 8;9 | - | 3 | Arabic | Proficient | Basic |
| **M29** | M | 8;3 | - | 3 | Arabic | Proficient | Basic |
| **M30** | M | 8;9 | - | 4 | Arabic | Proficient | Basic |
| **M31** | F | 8;4 | - | 4 | Arabic | Proficient | Basic |
| **M32** | F | 8;8 | - | 4 | Arabic | Proficient | Basic |
| **M33** | M | 9;2 | - | 4 | Arabic | Proficient | Basic |
| **M34** | F | 9;5 | - | 4 | Arabic | Proficient | Basic |
| **M35** | M | 9;5 | - | 4 | Arabic | Proficient | Basic |
| **M36** | F | 9;8 | - | 4 | Arabic | Proficient | Basic |
| **M37** | F | 9;7 | - | 4 | Arabic | Proficient | Basic |
| **M38** | M | 9;5 | - | 4 | Arabic | Proficient | Basic |
| **M39** | M | 9;2 | - | 4 | Arabic | Proficient | Basic |
| **M40** | F | 9;7 | - | 4 | Arabic | Proficient | Basic |

**Appendix B:**

**Sample pictures:**

| Singular | Dual | Plural |
|---|---|---|
|  |  |  |
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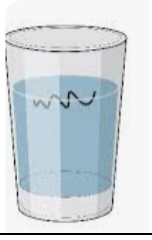
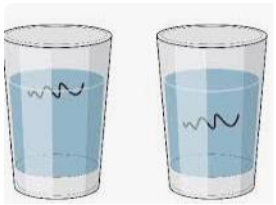
|  |  |  |