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Unveiling the Morphological Acquisition and Development of Arabic Nominal Derivation in Early Childhood

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ABSTRACT

This study investigates the developmental trajectory and order of acquisition of Arabic-derived nominal forms—specifically agentive, instrumental, and locative nouns—among 54 Saudi Arabic-speaking children aged 4 to 10 years. Using a sentence completion task, children were prompted to derive novel noun forms from triliteral Form I Arabic verbs. Results revealed a clear developmental sequence in the acquisition of derivational morphology, with agentive nouns acquired first, followed by instrumental, and then locative nouns. Notably, the agentive pattern **CaCCaC** and the instrumental **CaCCaCah** were the most frequently produced, suggesting these serve as default templates for nominal derivation among young speakers. These patterns appear more accessible due to their high frequency, transparency, and productivity in spoken Arabic. Statistical analyses further confirmed that age significantly influenced performance, with older children demonstrating greater mastery and pattern distinction. The study highlights the cognitive and linguistic strategies employed by children in parsing Arabic's root-and-pattern system and extending it to novel forms. Findings contribute to the understanding of morphological acquisition in Semitic languages and fill a gap in Arabic first language research, which has traditionally focused on inflectional rather than derivational morphology. This work provides theoretical insight, emphasizing the importance of exposure to frequent and semantically transparent patterns in early language development.

Keywords: Saudi Arabic; Child Language Development; Derivational Morphology; Acquisition; Derived Nouns

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1. Introduction

First language (L1) acquisition is the process through which children develop linguistic competence by building cognitive abilities and navigating multiple linguistic pathways[1]. Humans possess an innate capacity for language acquisition, although individual differences in cognitive and physical abilities may influence the rate of development. Children typically begin acquiring words between 12 and 20 months of age and gradually analyze the lexical and morphological properties of language[2]. As they progress, they begin marking morphological distinctions such as number, gender, and tense on nouns and verbs. However, the acquisition of these properties varies across languages, influenced by language typology, paradigm regularity, and semantic complexity[3].

Research on L1 acquisition has extensively examined children's morphological development, emphasizing its complexity and gradual progression[4]. Studies have suggested that words in the mental lexicon are not stored in isolation but are interconnected within a multidimensional network[5]. The acquisition of morphological rules plays a crucial role in lexical growth and language processing, as it helps children recognize patterns and derive new words[6–8]. Additionally, morphological awareness aids learners in understanding unfamiliar derivatives and establishing connections between word structure and meaning[9–11]. As Clark[2] has emphasized, the ability to analyze word forms and meanings is fundamental to the acquisition of both inflectional and derivational morphology, shaping overall language competence.

Inflectional and derivational morphology are essential linguistic processes that contribute to word formation across natural languages. Inflectional morphology modifies lexemes by adding grammatical markers such as number, case, tense, and aspect, while derivational morphology creates new lexemes by altering their syntactic or semantic categories, such as deriving education or educatable from educate.

Children acquire derivational morphology by identifying root structures and affixes, analyzing their meanings, and applying them to construct new words[4]. The acquisition of derivational morphology is closely linked to lexical development, as it involves changes in meaning and word class[12]. Mastering these derivational processes is essential for achieving lexical complexity[13]. Research has indicated that young learners initially rely on zero-derivation and begin producing novel forms around age 4[14]. Children demonstrate a strong sensitivity to derivational regularity, consistently recognizing and applying patterns they encounter in their linguistic environment[15]. The earliest derivational markers typically include agentive, instrumental, and diminutive endings[15]. Additionally, children demonstrate pattern preferences, favoring productive and frequent forms. For instance, English-speaking children typically grasp the agentive function of the *-er* suffix before recognizing its instrumental use, a pattern observed in other languages with similar morphological structures[14, 15]. Consequently, English-speaking children tend to overgeneralize the *-er* suffix for agentive nouns, even when adult language favors *-ist* or *-ian*[16]. These findings suggest that children develop generalized principles to analyze and construct word forms.

Children's ability to form new words through derivation highlights their linguistic productivity[15]. They acquire word forms, meanings, and usage through natural language development processes, often constructing words using familiar patterns from their speech community, and, when needed, creating novel words that extend beyond conventional usage[4, 15]. This ability poses significant challenges, especially in languages with complex derivational systems[12]. To expand their vocabulary, children must develop both a robust lexicon of established words and a systematic understanding of word-formation rules[12].

However, younger children have limited vocabularies and rely on generalization, refining their repertoire only over time. Accordingly, we observed that Saudi Arabic-speaking children (aged 3–4 years) demonstrate recognition of various derivational patterns, such as the agentive noun laaʕeb 'player' and the locative noun malʕab 'playground', both derived from /l ʕ b/ 'play'. Errors in their noun derivation often result in pattern generalization, where a single form, such as *CaCCaC*, is applied to multiple noun types. These observations, along with studies by Badry[17] and Alhamadani[18], highlight the need to explore developmental patterns in Arabic nominal derivation, including the sequence in which derivational patterns emerge in child language acquisition.

This study is significant because it addresses a critical gap in Arabic L1 acquisition research, particularly in derivational morphology. While morphosemantic development has been widely explored, most prior studies on Arabic have focused on inflectional morphology rather than deriva-

tional processes. Given that Arabic is a highly derivational language, understanding how children develop their derivational lexicon is essential. Additionally, existing research has primarily examined verbal morphology, despite the extensive role of nominal derivatives in Arabic. By focusing on the acquisition of derived nouns, this study provides new empirical evidence on how Arabic-speaking children internalize and apply derivational rules, filling a crucial theoretical and empirical gap in the field.

Accordingly, this study investigates how Saudi Arabic-speaking children differentiate between form and meaning in word derivation and abstract morphological rules to construct novel nominal derivatives. Specifically, it examines the strategies children employ to acquire and apply derivational morphology within Arabic, a complex Semitic language with a root-and-pattern system. By analyzing how young speakers navigate these structures, the study provides insights into the developmental trajectory of derivational morphology in Arabic-speaking children. This study is guided by the following research questions:

1. How do Saudi Arabic-speaking children acquire agentive, instrumental, and locative derivational markers?
2. Do certain derivational patterns emerge earlier than others? If so, which nominal derivational pattern is acquired first for each noun type, and what factors influence its acquisition?

Based on previous research on the development of derivational morphology, this study proposes the following hypotheses:

1. Age influences the acquisition of derivational forms, with the expected chronological order of derived noun acquisition being agentive > instrumental > locative.
2. More frequent derivatives are acquired earlier than less frequent ones[15, 19, 20]. Consequently, the agentive pattern *CaCCaC* and the instrumental pattern *CaCCaCah* are expected to emerge before other agentive and instrumental patterns[17].

This paper is structured into six sections. Section 1 introduces the study's significance, objectives, and research questions. Section 2 reviews relevant literature on morphological acquisition. Section 3 outlines the methodology, detailing participants, data collection, and analysis. Section 4 presents the study's findings, followed by Section 5, which discusses these findings in relation to the research questions and objectives. Finally, Section 6 provides a concise summary, highlights implications, addresses limitations, and suggests directions for future research.

2. Literature Review

2.1. Derivation in Arabic (The Root-and-Pattern System)

Derivation serves as a fundamental process in lexical expansion, enabling the formation of new words by altering their lexical category or semantic meaning[21, 22]. This transformation often occurs through morphological modifications, such as the addition of affixes. For instance, in English, the suffix *-er* converts a verb into a noun (read → reader), while *-ify* changes a noun or adjective into a verb (beauty → beautify). These shifts illustrate how derivation can influence both grammatical structure and meaning.

According to Watson[23], the relationship between a root and its derived lexeme can manifest in different ways, including category shifts (e.g., verbs becoming nouns) or semantic alterations, such as the transformation of a transitive verb into a causative form or a positive term into its negative counterpart. One of the most significant processes within derivation is nominalization, which refers to the formation of nouns from verbs or adjectives[24]. This process plays a key role in expanding linguistic expression, encompassing noun types such as agentive, locative, and reason nouns[25]. Watson[23] classified nouns derived from verbs into agentive, locative, instrumental, and professional categories, highlighting the structured nature of word formation in morphological systems.

Unlike Indo-European languages, which typically form words through the concatenation of stems and affixes, Semitic languages such as Arabic utilize a rich, complex, and productive derivational system based on a root-and-pattern structure. Instead of relying on linear affixation, this system manipulates roots within specific templatic patterns to generate words[26]. In this system, a root (typically three consonants) provides semantic meaning, while the pattern determines the word's grammatical function[27]. For example, the Arabic root *k-t-b* 'writing' can take different patterns to create words like kaateb 'writer' and maktab 'office'. This templatic structure allows a limited number of patterns to generate multiple words[2, 17]. However, while many words

share a root, their meanings are not always transparent. For example, the root *ð-k-r* forms ðakar 'male' and ða:kerah ('memory'), reflecting semantic divergence[28].

2.1.1. Categories of Derived Nouns in Arabic

Arabic nouns are classified into three main categories: static nouns, which are not derived from other words; gerunds, which serve as a source for derivation; and derived nouns, which originate from existing words[29]. Specifically, within derived nouns, the process of derivation plays a fundamental role in expanding the lexicon. According to classical Arabic grammarians, derivation is further categorized into three types: greatest derivation, great derivation, and simple derivation[30].

Greatest derivation involves root substitution (*ibdal*) and metathesis (*qalb*), both of which are largely unproductive. Similarly, great derivation refers to compounding (*naħt*), in which two words merge to form a single lexical item. However, while these methods contribute to Arabic morphology, they are not as frequently used as simple derivation.

Consequently, simple derivation (ʔʃtiqaq ʔsʏar), which is the focus of this study, is the most productive form of derivation. It is widely employed across all Arabic dialects to create new words from existing Arabic roots and to adapt foreign words into the Arabic lexicon, aligning them with Arabic derivational models[17]. For instance, the modern noun mamʃa 'a place for walking exercise' is derived from the Arabic root m-ʃ-a 'walk'. Likewise, loanwords such as jekansil and jeʃaiek have been adapted from the English verbs 'cancel' and 'check,' respectively, demonstrating the flexibility and adaptability of Arabic derivational morphology. Moreover, in this process, the derived word retains a semantic relationship with its root while preserving the same consonantal order[17].

Derived nouns in Arabic are categorized into six types: agentive, instrumental, locative, passive, resembling, and comparative. This study specifically examines agentive, instrumental, and locative nouns, which are formed from Form I verbs, the foundational structure in Arabic morphology[31]. Investigating how children acquire these noun patterns provides valuable insights into their morphological development.

2.1.2. Agentive, Instrumental, and Locative Derived Nouns in Arabic

Agentive nouns refer to the doer of an action and can be derived from triliteral (Form I) or nontriliteral verbs. These nouns follow specific morphological patterns, including *CaaCeC* (e.g., kaateb 'writer' from katab 'he wrote'), *muCaCCeC* (e.g., mudarres 'teacher' from darras 'he taught'), and *CaCCaC*, which is used for hyperbolic participles denoting exaggerated professions (e.g., ħallæq 'barber')[32].

Instrumental nouns denote tools or devices used to carry out an action. These nouns typically follow the *miCCaaC*, *miCCaC(ah),* and *CaCCaCah* patterns[31]. Examples include *miftaaħ* 'key' from *fataħ* 'to open', *miknasah* 'broom' from *kanas* 'to sweep', and *saxanah* 'heater' from *saxan* 'to heat'. However, Alshdaifat[31] states that while various instrumental patterns can be selected for noun formation, certain forms remain invalid. For instance, the verb *ɣasala* 'to wash' can generate the valid instrumental nouns *ɣassalah* 'washing machine' and *miɣsalah* 'hand washer', whereas *miɣsaal* is considered an invalid formation.

Locative nouns indicate places where actions take place and are derived from triliteral verbs. Their formation depends on the imperfective verb form, following patterns such as *maCCaC(ah)* and *maCCiC*. For example, *malʕab* 'playground' is derived from *jalʕab*, and *madʒlis* 'sitting room' comes from *jadʒlis*. However, some verbs cannot generate instrumental or locative nouns due to semantic incompatibility. For instance, the verb *ħab* 'to love' cannot produce an instrumental noun because its meaning is abstract and does not align with the concrete nature of instrumental derivation[31].

2.1.3. Contrast between MSA and Colloquial Arabic in Word Derivation

Although Modern Standard Arabic (MSA) and colloquial Arabic share this root-and-pattern framework, they differ in derivational morphology. One distinction is pattern diversity, which poses challenges for children who first acquire their Arabic dialect before learning MSA upon entering school. Compared to colloquial Arabic, MSA encompasses a wider range of derivational patterns, making the transition between the two forms more complex.

Colloquial Arabic makes extensive use of certain patterns, such as *CaCCaC*, which are comparatively less common in MSA. This difference in productivity contributes to variations in word formation across spoken and written Arabic. For instance, while the instrumental pattern *CaCuul* is commonly used in MSA, it is rarely found in colloquial Arabic, except for a few uncommon terms borrowed from

MSA, such as satˤuur 'cleaver'. Conversely, colloquial Arabic tends to rely on a smaller set of patterns but uses them more productively than MSA. For instance, while MSA uses kaaðeb to refer to 'a lying person', colloquial Arabic intensifies the pattern, using kaððab. Similarly, ba:ʔeʕ 'seller' in MSA appears as bajjaʕ in colloquial Arabic, demonstrating its preference for highly productive patterns such as *CaC-CaC*.

Another major distinction is innovative derivation in colloquial Arabic, which frequently generates new words using productive patterns. For example, the words fawwal 'bean seller' and sabbak 'plumber' have emerged through colloquial derivation, illustrating its flexibility and adaptability. Since children first acquire colloquial Arabic before learning MSA, these morphological differences influence language acquisition.

2.2. Cross-Linguistic Development of Derivational Acquisition

Cross-linguistic longitudinal and experimental studies on children's morphological acquisition have revealed distinct developmental patterns. While inflectional morphology is typically acquired early, derivational morphology emerges later[33, 34]. Additionally, the order of compounding and derivation varies across languages; in English, compounding occurs first[33], whereas in French and Portuguese, derivation precedes compounding[34]. The following paragraphs provide a summary of cross-linguistic research on L1 derivational morphology acquisition from studies on English, German, Russian, and Hebrew.

Research on English derivational morphology acquisition has consistently shown that children acquire inflectional morphology first, followed by compounding, and, finally, derivation[14, 33, 35]. This pattern suggests that derivational morphology is more cognitively demanding and requires greater lexical exposure for full mastery.

One of the earliest and most influential studies, Berko[33], demonstrated that young English-speaking children struggle with derivational formation. In a nonsense-word task, only 11% of children aged 4–7 years correctly applied the agentive *-er* suffix, often preferring compounding (zib-man) or using suppletive forms (e.g., acrobat instead of zibber). This observation suggests that while children may recognize productive inflectional morphemes, they initially struggle with derivational processes due to their greater morphosemantic complexity.

Clark and Hecht[14] confirmed that *-er* is the most productive derivational suffix in English and that children begin using it for agentive nouns as early as age 3, achieving consistent usage by age 4. They identified three principles guiding derivational acquisition: (1) semantic transparency (form and meaning are directly linked and hence easier for children to acquire); (2) productivity (learners often rely on the most productive suffixes, leading to overgeneralization in the early stages of acquisition); and (3) conventionality (with greater exposure, self-invented words are gradually replaced by conventional lexical forms), with older children applying *-er* more systematically for both agentive and instrumental meanings. Importantly, their study found that agentive nouns are acquired before instrumental nouns, as agents can perform multiple actions, whereas instruments have fixed, specialized functions (e.g., a person can both dig and cut, but a spade only digs).

Nagy, Diakidoy and Anderson[35] tested fourth graders, seventh graders, and high school students on their knowledge of 10 derivational suffixes and observed significant improvements between fourth and seventh grade. However, even high school students continued to show difficulty with some derivational formations, indicating that derivational morphology develops gradually and requires extensive lexical exposure rather than relying solely on morphological awareness. This finding aligns with those from Berman[36] and Laudanna, Badecker and Caramazza[37], who emphasized that derivational processing continues well into adolescence and early adulthood, reflecting the complex interplay among morphology, semantics, and cognitive development.

Sommer-Lolei et al.[38] investigated the development of derivational morphology in three Austrian German-speaking children, revealing that suffixation was the most frequently used derivational process. Among derivational nouns, *-er* was the most productive suffix during preschool years, while *-ung* became increasingly important for forming action, result, and instrumental nouns from verbs, particularly from age 5 years onwards. However, other derivational patterns, such as *-heit* and *Ge-...-e*, which are used for abstract and collective nouns, remained rare until at least age 6. The study also found that by this age, children primarily produced and understood derivations with transparent and concrete semantic

meanings, with the first noun derivations appearing as early as age 2. Interestingly, unlike English-speaking children, German-speaking children acquired instrumental nouns before agentive nouns, which Sommer-Lolei et al. [38] attributed to children's tendency to name objects (e.g., toys and tools) before naming agents or people. The researchers further argued that simplicity, rather than input frequency, played a crucial role in determining the age and order of emergence of derivational morphology, challenging the idea that frequency alone can reliably predict acquisition patterns.

Kazakovskaya [39] studied nominal derivation development in Russian-speaking children, analyzing conversations from one bilingual and one monolingual child. The findings showed that derivation preceded compounding, with suffixation occurring before prefixation. The developmental order began with diminutives before age 2, followed by instrument and object nouns (ages 2–3), and locative and agentive nouns (ages 3–4), although agents were infrequent. This finding contrasts with Kazakovskaya and Voeikova [40], which found that agents emerged earlier, after diminutives but before instruments (ages 1;8–2;0). Additionally, diminutives were the most frequent derivatives, reflecting their prominence in Russian morphology. Both the monolingual and the bilingual child followed the same derivational order, suggesting that morphosemantic development is linked more to cognitive growth than to purely linguistic factors [39].

Clark and Berman [12] examined Hebrew-speaking children's acquisition of derivational morphology, focusing on semantic transparency, productivity, conventionality, and formal simplicity. A sentence completion task with 60 children (ages 3–11) revealed that agentive nouns were produced more accurately from age 4, whereas instrumental nouns were not mastered until age 11. Children preferred suffixes over prefixes, using *-an* (e.g., *rakdan* 'dancer') more for agents (31%) than instruments (18%). While they recognized inflectional uses of infixes and prefixes, they did not associate them with derivation. Compounding emerged later in Hebrew (age 5, peaking at 7) than in English (ages 2–3), with Hebrew-speaking children favoring instruments and English-speaking children favoring agents.

In sum, these studies examined how children acquire derivational systems in their native languages. While studies have revealed cross-linguistic similarities, such as the general order of derivational and inflectional morphology acquisition, they have also highlighted differences in timing. For instance, Russian-speaking children acquire derivational morphology before age 2 and master it by age 4, whereas English and Hebrew speakers begin at age 4 and continue learning into adolescence. Across languages, children prefer suffixation over other affixation types, yet they differ in the order of derived noun acquisition—English, Russian, and Hebrew-speaking children acquire agents first, whereas German speakers learn instruments before agents. Despite extensive research on nominal derivational morphology, further studies are needed in the Arabic context to fill existing gaps.

In addition to first language acquisition studies across various linguistic contexts, recent educational research has emphasized the role of digital tools in supporting language and morphological development, particularly for marginalized groups. For instance, Drolia et al. [41] conducted a systematic review of mobile learning applications designed specifically for refugee populations. Their findings highlight how mobile apps can facilitate linguistic development by integrating culturally relevant content, scaffolding features, and emotionally supportive narratives. Such tools were particularly effective in addressing both the educational and psychological needs of young learners in complex socio-cultural settings. While their study focused on refugee education, the principles of scaffolding, semantic transparency, and learner engagement through mobile-assisted language learning are directly applicable to understanding how children acquire and internalize derivational morphology in diverse linguistic environments, including Arabic. These insights reinforce the importance of context-sensitive learning environments, especially in the acquisition of morphologically rich languages.

2.3. Development of Derivational Acquisition in Arabic

Despite the importance of derivational morphology in Arabic [17], research has primarily focused on inflectional morphology [42–45]. Studies have indicated that Arabic-speaking children initially use unmarked singular nouns, followed by numerals with singular nouns, and later numerals with plural forms [42, 46]. The plural inflection appears before the dual, with regular plurals (feminine and masculine) being acquired earlier than broken plurals [46]. Additionally, native Arabic-speaking children master feminine plurals by

age 3, learn broken plurals gradually, and acquire masculine plurals by age 6 [47]. The feminine plural is considered the default form, with productivity and frequency influencing acquisition more than predictability and transparency [44]. Dual nouns remain the most challenging inflected forms to acquire [42].

However, research on Arabic derivational morphology acquisition remains limited. Badry [17] examined 40 Moroccan Arabic-speaking children (ages 3;5–9;9) to analyze their use of agentive and instrumental nouns through story retelling and sentence completion tasks. Badry [17] identified four developmental stages in how Arabic-speaking children acquire derivational morphology:

1. Whole-Form MemorizationInitially, words are learned as fixed units without analyzing their structure. While children recognize certain derived nouns, they do not yet understand the morphological connections between them.
2. Pattern RecognitionAs linguistic awareness develops, children begin identifying consistent morphological patterns, realizing that structures such as *CaCCaC* often denote agency across different roots.
3. Root Identification (Vertical Derivation)At this stage, children differentiate between roots and patterns, recognizing shared roots across related words. For instance, the root *l-ʕ-b* 'play' is common in laaʕeb 'player', ləʕbah 'toy', and malʕab 'playground'. This awareness helps them expand their vocabulary systematically.
4. Surface-Level Associations (Horizontal Derivation: (linking different patterns from the same root)In the final stage, children flexibly apply their understanding of derivation, generating new words while maintaining root-pattern consistency. Exposure to written language further enhances this skill.

The findings indicated that children relied on one pattern per nominal concept—*CeCCaC* for agents and its feminine counterpart *CeCCaCa* for instruments, despite Moroccan Arabic having multiple patterns. Younger children (ages 3–4) struggled significantly, failing to respond in 55% of agentive noun tasks and 60% of instrumental noun tasks. They often produced incorrect patterns by adding semivowels or consonants, suggesting partial awareness of verb–noun relationships. In contrast, children between ages 5–6 demonstrated greater awareness of derivational rules, and by ages 7–9, they produced fewer errors, indicating improved understanding of roots and patterns. Older children also used a broader range of derived patterns, showing increased lexical complexity and morphological analysis skills. Badry [17] noted that Arabic-speaking children first identified word patterns before roots, distinguishing their approach from children learning other languages. Moreover, Badry [17] conceptualized agentive and instrumental patterns as a superordinate category of action-related nouns, making them similarly challenging to acquire. However, the study did not investigate which patterns were preferred and most productive among Moroccan Arabic adults.

Alhamadani [18] investigated the developmental stages of derivational acquisition in a random sample of 320 Jordanian Arabic-speaking children aged 4–11 years. He employed nonsense words in structured interviews. The study revealed progressive development in both comprehension and production of derivation. Young children favored *CaCCaC* (55% of responses) for agentive nouns, whereas older children preferred *CaaCeC* (79% of responses). For instrumental nouns, younger children preferred *miCCaCah* (47% of responses), whereas older children shifted to *CaCCaCah* (44% of responses). In contrast, locative patterns were acquired later, with younger children using *miCCaCah* (3%) and older children favoring *maCCaC* (38%). These findings indicate that early preferences for certain patterns result in overgeneralization, which diminishes as children refine their morphological knowledge. However, even at age 11, only the agentive pattern was fully mastered, indicating that Arabic derivational acquisition occurs relatively late. Alhamadani [18] further argued that children's comprehension of derivational rules precedes their production—i.e., children internalize rules before actively using them. Alhamadani's findings contradict previous studies, such as Clark [2], which have suggested that children prefer prefixes over suffixes in early acquisition (e.g., *miCCaCah* before *CaCCaCah*).

Along similar lines, Taha and Saiegh-Haddad [48] examined awareness of root-and-pattern morphology among 143 Arabic-speaking children from the 2nd, 4th, and 6th grades. The study involved two tasks: one assessing root-based word relatedness (e.g., ʕaamel 'worker' and maʕmal 'workshop') and another evaluating word-pattern-based relatedness (e.g., madrasah 'school' and mazraʕah 'farm'). The

results revealed that root awareness develops earlier than word-pattern awareness, contradicting Badry [17]. While root recognition relies on semantic connections, understanding word patterns requires identifying morphosyntactic functions, making it more complex. These findings align with research in English [14], reinforcing the notion that root-based processing emerges earlier across languages.

Shalhoub-Awwad and Kamis-Jubran [49] investigated the acquisition of derivational word patterns and roots in the nominal system of Palestinian Arabic-speaking children (aged 3–6 years) by analyzing 2-hour recordings of spontaneous conversations. The most frequent noun category was nonlinear (deverbal) nouns (e.g., *maksu:r* 'broken' *maCCu:C* derived from the root /k.s.r/) (49.5%), followed by primitive nouns (e.g., /ʔab/ 'father') (43.1%), while linear nouns (e.g., /dahabi/ 'golden', formed with the primitive noun /dahab/ and the morpheme /i:/) (0.3%) were nearly absent before school age. Moreover, children acquired agentive patterns (*CaaCiC*, *muCaCCiC*) earlier (17.8%), followed by locative *maCCaC* (5%) and instrumental patterns *maCCa:C*, *maCCaCa*, and *miCCaCi* (2.3%). Notably, instrumental nouns showed significant growth only after age 4, with no acquisition observed in children aged 3–4. Shalhoub-Awwad and Kamis-Jubran [49] acknowledged the study's limited corpus and suggested that the absence of early agentive and locative patterns might reflect the initial stages of nominal derivational acquisition. These findings align with other research [12, 14, 15], supporting the idea that agentive nouns are learned before other noun types. Similar to Arabic [18], Russian [50], and Croatian [51], instrumental nouns tend to be acquired before or simultaneously with locatives.

3. Methodology

This section outlines the methodology for data collection and analysis used in this study, detailing the research design and the approaches employed to examine the acquisition order of Arabic nominal derivational morphology among Saudi Arabic-speaking children. It begins with a description of the participants and sampling methods, followed by an explanation of the instruments and data collection procedures, and concludes with the quantitative analysis of the corpus data.

3.1. Participants

Stratified sampling was employed to ensure accurate representation of the study population. A total of 54 Saudi Arabic-speaking children aged 4–10 years were divided into subgroups based on age and dialect. The age range was determined based on previous research on Semitic morphology acquisition [18], with Berko [33] highlighting that children as young as 4 can apply morphological rules effectively. The participants were evenly distributed across three grade levels—kindergarten, Grade 2, and Grade 4 (n = 18 per group)—to investigate distinct strategies in Arabic lexicon acquisition [12, 18]. Written consent was obtained from parents/guardians, who were informed of their child's right to withdraw from the study at any time. Ethical approval was obtained from the Institutional Review Board at Qassim University (Approval No. QU-IRB-23-39-05).

All participants were native speakers of Qassimi Arabic (QA) from the Qassim region in Saudi Arabia. Despite minor dialectal variations, research has indicated that Arabic dialects exhibit minimal morphological differences from MSA [52, 53]. Therefore, the sample is considered representative of Saudi Arabic-speaking children in their acquisition of derivational morphology. To maintain linguistic consistency, the sample included only participants who were raised by Saudi Arabic-speaking parents/caregivers to limit external language influences. Furthermore, children with linguistic impairments were excluded to ensure that normal linguistic development was assessed. Gender was not considered a variable in this study.

3.2. Material

A sentence completion task was employed for data collection, a common method in morphological developmental research [17, 18, 42]. This task assesses children's ability to manipulate morphology and provides insight into their linguistic development [54]. The material aimed to elicit agentive, instrumental, and locative nouns using ten triliteral verbs—two familiar verbs ensured semantic understanding, while eight nonsense verbs tested whether children could apply derivational rules and recognize that multiple derived nouns can emerge from the same root [12]. According to Clark [55], children's ability to create novel words demonstrates their understanding of derivation. Moreover, the use of nonsense

roots—unfamiliar to parents or other adults—helps determine if children can productively engage with the derivational system, analyze word patterns, and compensate for lexical gaps, even if they misclassify nominal patterns in the process.

The root list was adapted from Alhamadani's[18] Jordanian Arabic study, with all verbs belonging to Form I, the primary verb form in Arabic. These verbs followed the *CaCaC* pattern in the perfective form and *jaCCəC* in the imperfective form. To ensure linguistic consistency, only triliteral and regular roots—excluding glides—were selected, as outlined by Badry[17] in **Table 1**.

Table 1. List of verb roots.

No.	Roots (In the Perfective Pattern)	Verbs (In the Imperfective Pattern)
1	*n-ʒd-r**	*janʒdər*
2	*x-b-z**	*jaxbəz*
3	*ħ-d-b*	*jaħdəb*
4	*ʃ-g-l*	*jaʃgəl*
5	*d-l-b*	*jadləb*
6	*ħ-s-k*	*jaħsək*
7	*tˁ-m-s*	*jatˁməs*
8	*ħ-ʒd-f*	*jaħʒdəf*
9	*k-ʃ-r*	*jakʃər*
10	*ʃ-t-l*	*jaʃtəl*

Note: *Bold roots are real.

The task sentences included agentive, instrumental, and locative patterns derived from the same root as the given verbs. The goal was to examine how Saudi Arabic-speaking children transition from verbs to nouns across word-class boundaries. Participants completed 30 sentences—10 for each derivational pattern—by generating appropriate noun forms based on the provided verbs. **Table** 2 outlines the data collection process for participants in the agentive, instrumental, and locative tasks.

This elicitation task was designed to generate data comparable to previous studies on derivational acquisition in various languages, including English, Hebrew, Moroccan-Arabic, and Jordanian-Arabic[12, 14, 17, 18]. The study aimed to track the developmental process of Saudi Arabic-speaking children in acquiring adult-like derivation, as Clark[55] noted that children prioritize productive patterns in adult speech. To establish a baseline, 10 Saudi Arabic-speaking adults completed the same task to determine the nominal derivational patterns to which children are exposed and their frequency in Saudi Arabic dialects. The adult participants provided six derivational patterns. Two were agentive, in which the *CaCCaC* pattern was dominant, accounting for 92% of responses, whereas the *CaaCeC* pattern was used in only 8% of cases (e.g., dallab and daaleb). Two were instrumental, with the *miCCaCah* pattern being slightly more common (51%) than *CaCCaCah* (49%), as seen in midlabah and dallabah. Finally, two were for locative nouns, with the *maCCaC* pattern being predominant (88%) and the *maCCaCah* pattern appearing in only 12% of cases, as in madlab and madlabah. These results confirmed the expected forms and validated the study design prior to testing the children.

3.3. Procedures and Data Analysis

The researchers used elicitation tasks to assess the child participants, guiding them individually in completing sentences with agentive, instrumental, and locative patterns. Testing took place in a quiet, distraction-free classroom and lasted 10–20 minutes per child. Framed as a challenge, the task required children to provide missing information while researchers remained silent to avoid influencing responses. Correct and incorrect answers were recorded on scoring sheets[17, 18], and identical sentence prompts were used across age groups to analyze developmental patterns. Responses were first documented in Arabic orthography, transcribed using the Arabic nominal derivational system, and classified based on adult responses from the same dialect. Two Saudi Arabic experts reviewed the classification for accuracy. We report interrater reliability using Cohen's kappa, which was calculated at 0.84, indicating strong agreement

Table 2. Elicitation examples.

Elicitation Sentences	Input Forms
The sentence used to elicit agentive forms was	*eʃaxs elli (verb), nesammeeh….* 'a person who (verb), we call him …'
The sentence used to elicit instrumental forms was	*elʔalah elli (verb), nesammeeha…* 'we call the machine that (verb) things …'
The sentence used to elicit locative forms was	*elmakan elli (verb), nesammeeh….* 'we call the place that we (verb) things in…'

between the two language experts involved in coding the data.

The data were organized in an Excel spreadsheet by noun type and participant age, then processed and analyzed via R. Descriptive statistics (e.g., mean, standard deviation) and inferential statistics were applied to test research hypotheses. ANOVA was used to examine differences in derived noun usage across age groups and determine variations in population means based on noun forms [56].

4. Results

This study examined the developmental patterns, acquisition rate, and order of Arabic-derived nouns among Saudi Arabic-speaking children by analyzing the output of 54 participants. The study investigated variations in the acquisition of agentive, instrumental, and locative nouns, focusing on their sequential development and initial derivational patterns, with results presented through descriptive analysis, ANOVA, and post hoc analyses.

4.1. Age-Based Comparison of Derived Noun Acquisition

Descriptive analysis was conducted to assess the acquisition of derived nouns across three age groups: Group 1 (G1; ages 4;0–5;8), Group 2 (G2; ages 7;2–8;10), and Group 3 (G3; ages 9;3–10;7). Following this, ANOVA was performed to test the first hypothesis (H1), which posits that age influences the acquisition of derivational forms and that the chronological order of noun acquisition follows the sequence agentive > instrumental > locative. The total number of correct responses per child was recorded, reflecting the correct application of nominal derivational patterns for each noun type.

The dataset consists of 1,620 responses from 54 children, each providing 30 answers (10 per noun type). The analysis of correct responses (Count) revealed a mean of 5.83, indicating the average number of correct answers per derived noun, with a standard deviation of 3.48, reflecting performance variability. Some children provided no correct responses (minimum = 0), whereas others achieved full accuracy (maximum = 10). The median score of 6.00 suggests that half of the participants scored six or fewer correct answers, while the other half exceeded this number. **Table 3** presents an overview of the general descriptive statistics for all types of derived nouns across all participants.

Table 3 illustrates that children performed best on agentive nouns, with a high average score (M = 8.44, SD = 1.94) and low variability, indicating consistent accuracy. Even lower-performing children achieved moderate success (minimum = 3), while some reached the highest possible score (maximum = 10), with a median of 9 correct answers. In contrast, performance on instrumental nouns was lower (M = 5.81, SD = 2.97), showing more variability. Some children provided no correct responses (minimum = 0), while others achieved the maximum (10), with a median of 6. Locative nouns had the lowest accuracy (M = 3.24, SD = 3.22), reflecting overall poor performance and high variability. Again, responses ranged from 0–10, with a median of 3, meaning that half of the children answered three or fewer items correctly.

Next, cross-tabulation was employed to determine the average number of correct answers (out of 10) for each derived noun type across age groups. **Table 4** illustrates how different age groups acquire derivational forms and the sequential pattern of derived noun acquisition.

To further illustrate developmental trajectories across derivational types, **Figure 1** presents the average correct responses by noun type and age group.

Table 3. Overall descriptive statistics for derived noun types across all participants.

Type of Derived Noun	Percentages	Mean	SD	Minimum	Median	Maximum
Agentive	84.4%	8.44	1.94	3	9	10
Instrumental	58%	5.81	2.97	0	6	10
Locative	32.4%	3.24	3.22	0	3	10

Table 4. Cross-tabulation of correct responses by derived noun type and age group.

	Kindergarteners	Percentages	2nd Grade	Percentages	4th Grade	Percentages	Adults	Percentages
Agentive	7.22	72%	8.33	83%	9.78	97.8%	10	100%
Instrumental	3.06	30.6%	6.28	62.8%	8.11	81%	10	100%
Locative	0.39	3.9%	3.00	30%	6.33	63%	10	100%

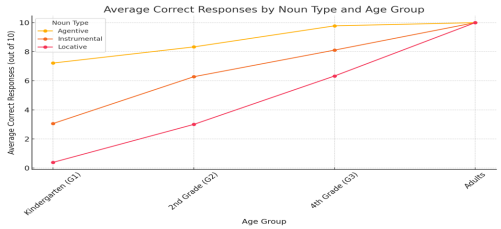

Figure 1. Average correct responses by noun type and age group.

The results were analyzed by age group based on the average number of correct answers out of 10. Kindergarteners (G1; ages 4;0–5;8) demonstrated strong acquisition of agentive nouns (M = 7.22) but struggled with instrumental (M = 3.06) and locative (M = 0.39) nouns. Second graders (G2; ages 7;2–8;10) showed even stronger acquisition of agentive nouns (M = 8.33) and moderate proficiency in instrumental nouns (M = 6.28) but continued to struggle with locative nouns (M = 3.00). Fourth graders (G3; ages 9;3–10;7) exhibited the highest acquisition rates, with strong performance in agentive (M = 9.78) and instrumental (M = 8.11) nouns and moderate improvement in locative nouns (M = 6.33).

Overall, noun acquisition improved with age, with older participants performing better across all categories. Agentive nouns had consistently high accuracy in all groups, but older children outperformed younger ones. Instrumental nouns showed the most significant improvement with age (G1 M = 3.06; G2 M = 6.28; G3 M = 8.11), while locative nouns exhibited gradual progress (G1 M = 0.39; G2 M = 3.00), with the highest accuracy seen in G3 (M = 6.33), indicating more complete acquisition.

The first hypothesis (H1) suggests that age influences the acquisition of derivational forms, following the order agentive > instrumental > locative. To test this hypothesis, an ANOVA analysis was conducted, as it is suitable for examining differences in a quantitative outcome (number of correct responses) across qualitative groups (age groups). First, however, assumption checks were performed. While the data met criteria for variable type, independence, and outliers, the Shapiro–Wilk test indicated a violation of normality (W = 0.95748, $p < 0.001$). Levene's test also showed unequal variances (F = 5.3977, p = 0.005). To address these issues, both ANOVA and the more robust Welch ANOVA were conducted.

The results revealed significant differences in derivational form acquisition among the age groups. Descriptive analysis indicated a progressive increase in the acquisition of derivational forms across age groups. Kindergarteners had a mean acquisition score of 3.56 (SD = 3.37). In Grade 2, the mean score rose to 5.87 (SD = 3.07). Grade 4 students demonstrated further improvement, achieving a mean score of 8.07 (SD = 2.36). Adults exhibited the highest acquisition levels, with a mean score of 10 (SD = 1.2).

Both ANOVA and Welch ANOVA revealed significant variations among the groups ($p < 0.001$). Further analysis using the Tukey honestly significant difference (HSD) test with Bonferroni corrections confirmed statistically significant differences. Tukey and Bonferroni post hoc tests were selected due to their robustness in managing unequal group sizes and their effectiveness in controlling for Type I error in multiple comparisons, thereby ensuring the validity of the results. Grade 2 students outperformed those in kindergarten, with a mean difference of 2.32 ($p < 0.001$). Similarly, Grade 4 students showed superior performance compared to both kindergarten (mean difference = 4.52, $p < 0.001$) and Grade 2 (mean difference = 2.20, $p < 0.001$). These results reinforce the hypothesis that age is a crucial factor in the acquisition of derivational forms, with older children demonstrating greater

proficiency.

4.2. Results of Agentive Patterns *CaCCaC* vs. *CaaCeC*

Common derivatives are expected to be acquired earlier than less common ones. Hypothesis 2 (H2) proposes that *CaCCaC* and *CaCCaCah* are learned before *CaaCeC*, *miCCaCah,* and *maCCaC(ah).* This section examines whether the results support this aspect of H2. **Table 5** provides an overview of the descriptive statistics for the agentive patterns *CaCCaC* and *CaaCeC* across all age groups of children.

Table 5. Descriptive analysis of the agentive patterns *CaCCaC* and *CaaCeC* across all age groups.

	Min	Mean	Max	SD	Median
CaCCaC	1	8	10	2.28	9
CaaCeC	0	0.29	4	0.82	0

The *CaCCaC* pattern (M = 8) was far more common in participant responses than *CaaCeC* (M = 0.2963). This result suggests that children predominantly use *CaCCaC* (e.g., xabbaz) over *CaaCeC* (e.g., xaabez *'baker'*). Some children consistently applied *CaCCaC* in all responses; in contrast, *CaaCeC* was used only four times, with some children never using it (minimum = 0). This differentiation suggests that *CaCCaC*, being a more frequent form in spoken language, is acquired earlier. **Table 6** presents descriptive statistics for both patterns by age group.

Table 6. Descriptive statistics for *CaCCaC* and *CaaCeC* by age group.

	CaCCaC					***CaaCeC***				
Age	**Min**	**Mean**	**Max**	**SD**	**Mdn**	**Min**	**Mean**	**Max**	**SD**	**Mdn**
G1	1	6.61	10	2.33	6.5	0	0.11	2	0.47	0
G2	2	7.78	10	2.21	8	0	0.56	4	1.10	0
G3	7	9.61	10	0.85	10	0	0.22	3	0.73	0

Based on this table, *CaCCaC* shows a clear developmental trend, with minimum counts increasing from G1 to G3 and mean values rising (G1 M = 6.61; G2 M = 7.78; G3 M = 9.61). Some children in each group used *CaCCaC* in all responses, reflecting its frequent usage. In contrast, *CaaCeC* was used less frequently, with some children in all groups never using it. Lower maximum and mean values suggest greater difficulty in acquiring this form. These findings support the hypothesis that common derivatives (*CaCCaC*) are acquired earlier than less frequent ones (*CaaCeC*), highlighting a developmental progression in agentive pattern acquisition.

The correlation between age and *CaCCaC* was moderately positive and statistically significant (55%; $p < 0.05$), meaning that older children demonstrated greater acquisition of this pattern. In contrast, the correlation between age and *CaaCeC* was nonsignificant (6%; $p = 0.69$), suggesting minimal age-related differences in its acquisition.

ANOVA testing confirmed that *CaCCaC* is acquired earlier than *CaaCeC*. One-way ANOVA showed significant differences in *CaCCaC* scores across age groups ($F = 11.187$, $p < 0.001$), with Welch's ANOVA further supporting this ($F = 16.35$, $p < 0.001$). These results suggest developmental differences in linguistic abilities.

Post hoc Tukey HSD tests revealed that G3 had significantly higher scores than G1 ($p < 0.001$) and G2 ($p = 0.01$), indicating a clear developmental progression. However, no significant difference was found between G1 and G2 ($p = 0.17$), which suggests gradual mastery over time. These findings highlight that older children (G3) show significantly greater proficiency in acquiring *CaCCaC*, reinforcing the developmental trajectory of language acquisition.

For *CaaCeC*, ANOVA results were nonsignificant ($p = 0.2387$ for equal variances, $p = 0.30$ for unequal variances), and Tukey tests confirmed no significant differences among age groups. This result suggests that *CaaCeC* acquisition

remains stable across ages. These findings support the hypothesis that frequent derivatives (*CaCCaC*) are acquired earlier, while less frequent patterns (*CaaCeC*) may follow a different trajectory. The results emphasize that language acquisition varies across patterns, requiring consideration of multiple linguistic factors.

4.3. Results of Instrumental Patterns *CaCCaCah* vs. *miCCaCah*

To assess children's acquisition of instrumental patterns, tests were conducted to evaluate hypothesis H2, which posits that frequent derivatives (*CaCCaCah*) are acquired before less frequent ones (*miCCaCah*). Mean, median, and standard deviation were calculated for both patterns, with results detailed by pattern and age group in **Table 7**.

Based on this table, the acquisition of *CaCCaCah* and *miCCaCah* varied across age groups. *CaCCaCah* showed an increase from G1 to G2 but declined in G3. Its maximum scores increased linearly with age, suggesting gradual acquisition. In contrast, *miCCaCah* showed a more consistent increase, with G3 scoring a higher mean than G1 and G2, indicating greater acquisition in older children.

Correlation analysis revealed a weak, nonsignificant relationship between age and *CaCCaCah* ($r = 0.23$, $p = 0.092$). However, *miCCaCah* showed a moderate, statistically significant correlation with age ($r = 0.54$, $p < 0.01$), indicating that older children more consistently acquired this pattern over time. These findings highlight differences in how instrumental patterns develop across age groups.

ANOVA results for the instrumental pattern *CaCCaCah* showed significant differences across age groups ($F = 5.15$, $p = 0.009$; Welch's $F = 8.43$, $p = 0.001$), indicating developmental disparities in linguistic acquisition. Post hoc Tukey HSD tests revealed that G2 scored significantly higher than G1 ($p = 0.0066$), but no significant differences were found between G1 and G3 ($p = 0.176$) or G2 and G3 ($p = 0.354$). These findings suggest nonlinear development.

For *miCCaCah*, ANOVA confirmed significant differences ($F = 12.87$, $p < 0.001$). Post hoc tests showed that G3 had significantly higher scores than both G1 ($p < 0.001$) and G2 ($p < 0.001$), whereas G1 and G2 showed no significant differences ($p = 0.726$). This differentiation suggests that older children (G3) exhibit greater proficiency in *miCCaCah* acquisition. The findings support the hypothesis that the more common pattern *CaCCaCah* is acquired earlier than the less frequent *miCCaCah*.

4.4. Results of Locative Patterns *MaCCaC* vs. *maCCaCah*

This section presents the findings on locative patterns across all age groups and their alignment with Hypothesis H2. Table 8 summarizes the descriptive statistics for the *maCCaC* and *maCCaCah* patterns across children's age groups.

As shown in **Table 8**, the results demonstrate the acquisition of locative patterns *maCCaC* and *maCCaCah* across age groups (G1, G2, and G3) based on participant responses (out of 10). The *maCCaC* pattern exhibited a steady increase in mean scores across groups, with G3 achieving the highest mean. A minimum score of 2 in G3 suggests that all children in this group had some familiarity with the pattern. In contrast, *maCCaCah* had much lower mean scores, with only G3 showing any usage ($M = 0.83$), and some children across all groups did not use it at all. These findings suggest a gradual acquisition, with *maCCaC* developing more consistently than *maCCaCah*.

Correlation analysis showed a strong positive relationship between age and *maCCaC* acquisition ($r = 0.73$, $p < 0.01$), indicating greater proficiency with age. In contrast, *maCCaCah* showed a weaker but still significant correlation ($r = 0.31$, $p = 0.022$). These findings underscore the age-related differences in locative pattern acquisition, with *maCCaC* being acquired more consistently. **Figure 2** visually represents these acquisition trends.

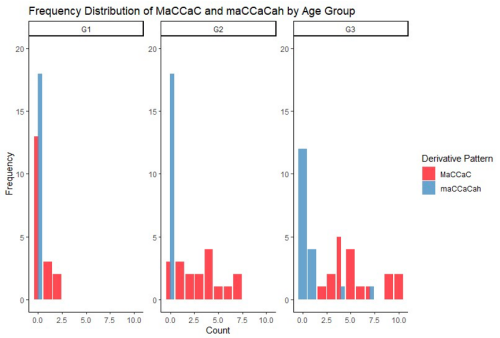

Figure 2. Frequency distribution of maCCaC and maCCaCah by age group.

ANOVA results for the locative pattern *maCCaC* showed significant differences across age groups (G1, G2, and G3), indicating developmental disparities in linguistic

Table 7. Descriptive statistics for instrumental patterns *CaCCaCah* vs. *miCCaCah* by age group.

	CaCCaCah					***miCCaCah***				
Age	**Min**	**Mean**	**Max**	**SD**	**Mdn**	**Min**	**Mean**	**Max**	**SD**	**Mdn**
G1	0	2.67	7	2.33	2	0	0	0	0	0
G2	2	5.61	8	1.91	6	0	0.61	6	1.46	0
G3	0	4.33	10	3.1	5	0	3.78	10	3.89	3.5

Table 8. Descriptive statistics for locative patterns *MaCCaC* vs. *maCCaCah* by age group.

	maCCaC					***maCCaCah***				
Age	**Min**	**Mean**	**Max**	**SD**	**Mdn**	**Min**	**Mean**	**Max**	**SD**	**Mdn**
G1	0	0.39	2	0.69	0	0	0	0	0	0
G2	0	3.00	7	2.30	3	0	0	0	0	0
G3	2	5.50	10	2.48	5	0	0.83	7	1.82	0

abilities. Post hoc Tukey HSD tests confirmed significant differences ($p < 0.01$) between all age group pairs, further supporting the developmental progression of *maCCaC* acquisition.

For *maCCaCah*, ANOVA results showed moderate significance ($p = 0.03$), suggesting some variation in acquisition across ages. However, Tukey post hoc tests found no significant pairwise differences, although some p-values approached significance (0.055), thus warranting further research.

Comparing both patterns, *maCCaC* exhibited highly significant developmental progression ($p < 0.001$), aligning with the hypothesis that more common patterns are acquired earlier. In contrast, *maCCaCah* showed only marginal significance, suggesting a less consistent developmental trajectory.

In sum, findings support a hierarchical acquisition of derived nouns: agentives first, followed by instrumentals, and locatives last. Saudi Arabic-speaking children acquire agentives before age 4, instrumentals around age 4, and locatives around age 7, mastering agentives by age 11, although instrumentals and locatives remain incomplete. High-frequency patterns, such as *CaCCaC* (agentive) and *CaCCaCah* (instrumental), are acquired more easily due to their productivity.

5. Discussion

This study investigates the development of nominal derivational structures, proposing two hypotheses. First, age influences the acquisition of derivational forms, with agentive nouns acquired first, followed by instrumental and locative forms. Second, the agentive pattern *CaCCaC* (e.g., xabbaz *'baker'*) and the instrumental *CaCCaCah* (e.g., xabbazah 'a tool used for baking') are the most frequent and productive patterns among Saudi Arabic speakers, making them easier to acquire than locative maCCaC[ah] (maxbaz *'place for baking')* and other agentive *CaaCeC* (e.g., xaabez 'baker') and instrumental miCCaCah (mixbazah) patterns.

The results confirmed partial support for these hypotheses. ANOVA and post hoc analyses revealed significant differences across three age groups—kindergarten (G1), Grade 2 (G2), and Grade 4 (G3). G1 first acquired agentive nouns, followed by instrumental and locative forms, while G3 demonstrated progressive improvement across all patterns. The results establish a clear acquisition sequence of derived nouns among Saudi Arabic-speaking children: Agentive nouns were acquired before age 4, instrumental nouns around age 4, and locative nouns by age 7. Complete mastery of agentives occurred by age 11, while instrumental and locative nouns continued developing beyond this age. These results are consistent with cross-linguistic research, including studies on English [14], French [15], German [38], Hebrew [12], and Jordanian Arabic [18]. However, in contrast to the present findings, Badry [17] reported no significant differences in the acquisition order of instrumental and agentive nouns among Moroccan Arabic-speaking children. The early acquisition of agentive nouns can be attributed to their transparency compared to other derived structures, as supported by previous research. Children develop an early awareness of agentive meaning, which denotes an individual performing a specific action. Moreover, a single agent can initiate multiple distinct actions, while the tools associated with these actions may vary, resulting in different lexical forms [12, 14]. The delayed

mastery of derivational morphology, particularly in Arabic and other Semitic languages, is attributed to its complexity compared to inflectional morphology. These results effectively address the first research question of this study.

Statistical analyses confirmed that the *CaCCaC* agentive pattern was the most frequent and productive, followed by the *CaCCaCah* instrumental form, with *CaaCeC*, *miCCaCah*, and *maCCaC(ah)* appearing less frequently. These results align with Badry's[17] findings that *CaCCaC* and *CaCCaCah* are the earliest acquired nominal patterns in Moroccan Arabic, although the present study indicates that *CaCCaC* precedes *CaCCaCah*. In contrast, Alhamadani[18] found that Jordanian Arabic-speaking children initially preferred *CaCCaC* (agentive), *miCCaCah* (instrumental), and *miCCaCah* (locative), with a developmental shift toward *CaaCeC*, *CaCCaCah*, and *maCCaC* in older groups. However, the current study suggests that the most productive patterns remained stable across all age groups, demonstrating consistent development in acquisition and application.

These variations may stem from dialectal differences, as Moroccan Arabic belongs to the Occidental North African dialects, Jordanian Arabic to the Mashreq (Orient) dialects, and Saudi Arabic to the Arabian Peninsula dialects. The acquisition of certain patterns depends on their frequency and productivity, with *CaCCaC* being more productive than *CaaCeC*, leading children to first acquire the most common forms used by adults in their linguistic environment[15, 19, 20].

These results align with Clark and Berman's[12] assertion that constructing novel derivatives poses a significant challenge in first language acquisition. Additionally, this study supports Mattes et al.'s[57] claim that typological differences influence the early development of derivational patterns, demonstrating that Arabic-speaking children master derivation over compounding from an early age. However, while Mattes et al.[57] suggested that instrumental nouns precede agentive nouns, the present study found the opposite, likely due to the high frequency and lexicalization of agentive nouns in Arabic. The early acquisition of agentives may also stem from children's greater engagement with human agents compared to objects or machines.

Children's preference for the *CaCCaC* agentive pattern can be attributed to its high semantic transparency, productivity, and conventionality. This pattern clearly expresses agency through a direct form-meaning relationship and is widely used by adults in the same linguistic environment, reinforcing its productivity. Arabic's strong derivational nature[28, 58, 59] reduces reliance on compounding, further supporting the conventionality principle.

Additionally, this study provides evidence that Saudi Arabic-speaking children acquire vertical derivation (identifying roots before patterns) before horizontal derivation. Errors in production, such as substituting instrumental forms with agentives or forming compounds like ʔālat al- ('machine of…'), indicate that children first recognize and generalize root structures before mastering pattern distinctions. This supports previous research asserting that root acquisition precedes pattern acquisition[48, 60]. Moreover, the findings align with Clark and Hecht's[14] argument that when a form has multiple meanings, children tend to learn one meaning first before acquiring others.

Overall, this study explored two key questions concerning (1) how Saudi Arabic speaking children acquire agentive instrumental and locative derivational markers and (2) whether certain derivational patterns emerge earlier than others and, if so, what factors influence their acquisition. The findings revealed a structured sequence: agentive > instrumental > locative. Supporting the vertical derivation hypothesis, children first recognize roots before applying patterns. Regarding the second question, frequent and productive patterns (*CaCCaC* for agentives, *CaCCaCah* for instrumental) were acquired earlier than less common ones (*CaaCeC*, *miCCaCah*, *maCCaC(ah)*), driven by semantic transparency, productivity, and frequency. Errors in production showed initial pattern overgeneralization before refinement, and dialectal variations influenced acquisition. This study reinforces the role of frequency, transparency, and conventionality in derivational acquisition and aligns with cross-linguistic research, confirming that children acquire frequent patterns earlier and refine less common ones over time in a structured, gradual process.

6. Conclusions

This study concludes that Saudi Arabic-speaking children acquired nominal derivational forms progressively, following the sequence agentive > instrumental > locative. Agentives emerge before age 4, instrumentals around age 4, and locatives by age 7, with full mastery of agentives by age

11, while instrumental and locative forms remain incomplete. The *CaCCaC* (agentive) and *CaCCaCah* (instrumental) patterns, being the most common and productive, are acquired earlier. The findings confirm that Arabic derivational morphology develops gradually and late, with locative forms lagging due to their low frequency and prefixed structure, consistent with prior research. The complexity of derivational morphology, particularly in Semitic languages, contributes to its slower acquisition compared to inflectional morphology[15].

This study suggests that Saudi Arabic-speaking children develop analytical strategies in acquiring nominal derivations, as evidenced by 4-year-olds actively constructing words by combining roots and patterns, particularly in agentive forms. Agentives appear to function as a default category, with children frequently overgeneralizing them to instrumental and locative nouns. Errors in production, such as the repetition of verbs or the incorrect application of agentive patterns, indicate that agentives are the most transparent, productive, and frequent.

The data indicated that the instrumental pattern *CaCCaCah* was acquired earlier than the less common *miCCaCah*, which appeared infrequently until the oldest age group (G3), where *CaCCaCah* remained dominant. Some children misclassified instrumental forms as agentives, supporting Badry's[17] claim that young learners may perceive both categories as doers of actions. These errors suggest that children are aware of grammatical gender. For instance, the suffix -ah may be linked to ʔisem al ʔalah (instrumental noun), which is inherently feminine.

Furthermore, children's infrequent use of compound constructions for instrumental and locative nouns, such as ʔalat or makenat ('machine of') and makan al ('place of'), suggests that innovative derivatives (neologisms) emerge earlier than compounds in Arabic. This preference is likely due to the higher morphosemantic transparency of derivational patterns. Additionally, the presence of incorrect responses even among the oldest participants indicates that mastery of the Arabic nominal derivational system remains incomplete at this stage of development.

This study makes a significant contribution to Arabic morphological acquisition by applying inferential analysis to child language data, extending beyond previous descriptive studies. It offers insights into derivational development with practical implications for speech-language therapy and assessments for children with language impairments. However, its focus on triliteral Form I verbs and a Qassim-based sample may limit generalizability. Future research should explore other verb forms and roots, assess comprehension alongside production, and extend the age range to examine the earliest emergence of agentives and the mastery of instrumental and locative nouns.

Author Contributions

Conceptualization, A.A. and M.A.; methodology, A.A. and M.A.; data curation, A.A. and M.A.; formal analysis, A.A. and M.A.; investigation, A.A. and M.A.; writing—original draft preparation, A.A. and M.A.; writing—review and editing, A.A. and M.A. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement

An ethical approval was obtained from the Institutional Review Board at Qassim University (Approval No. QU-IRB-23-39-05).

Informed Consent Statement

Written consent was obtained from parents/guardians, who were informed of their child's right to withdraw from the study at any time.

Data Availability Statement

Data can be provided upon reasonable request.

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Conflicts of Interest

The author declares no conflict of interest.

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