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The Effect of Age of Acquisition on the Development of Lexical Attainment and Oral Proficiency in English as L2 in Adult Native Arabic Speakers

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Abstract

This study investigates the influence of the age of acquisition (AoA) on the development of lexical attainment and oral proficiency in English as a second language (L2) among adult native Arabic speakers, focusing on classroom foreign language learners within the Egyptian context. AoA, a critical variable in second language acquisition (SLA) research, is explored in relation to two key domains: lexical knowledge and oral proficiency. The study examines the role of AoA and AoA related effects, such as the order of bilingualism and the length of exposure to rich language input (LoE) as a confounding factor. Through a mixed-methods approach, the research quantitatively assesses vocabulary size using the Peabody Picture Vocabulary Test (PPVT-5) and qualitatively analyzes oral speech production based on spontaneous speech samples. The participants, 42 native Arabic speakers aged 23-28, were categorized based on their age of English L2 acquisition onset, representing early childhood and late childhood sequential bilinguals. The findings reveal significant correlations between AoA and L2 proficiency, with early bilinguals generally outperforming late bilinguals in both lexical knowledge and oral proficiency. However, the study also attempts to investigate the impact of LoE on L2 development, suggesting that extended exposure to rich language input might compensate for the disadvantages associated with late acquisition. The findings could contribute to the ongoing debate on AoA effects in SLA and offer implications for language education policies and practices, particularly in contexts involving the Arabic-English language pair.

Table of Contents

List of Abbreviations

AoA: Age of Acquisition

CAH: Cognitive Aging Hypothesis

CPH: Critical Period Hypothesis

FL: Foreign Language

GJT: Grammaticality Judgment Test

L1: First Language

L2: Second Language

LoE: Length of Exposure to Rich Input

LOR: Length of Residence

PPVT: Peabody Picture Vocabulary Test

SLA: Second Language Acquisition

VOT: Voice Onset Time

List of Tables and Figure

1. Chapter One: Introduction

1.1. Background of The Study

Bilingualism is a broad overarching term that describes a spectrum of linguistic profiles, in which an individual knows or uses two languages either productively or receptively at varying degrees, forms, frequencies, and proficiencies (Byers-Heinlein & Lew-Williams, 2013). Hence, there are no two bilinguals who are exactly the same in terms of competence and performance; Even if the socioeconomic differences were controlled for (de Bruin, 2019). A myriad of factors are at interplay mediating how a bilingual profile is shaped. Examples of those factors include the age of second language acquisition (AoA), the order of acquiring this language besides an individual's first language, the length and mode of exposure to the second language (i.e.: whether through formal instruction or in an immersive environment), the similarity between L1 and L2 from a contrastive point of view, and many others, which determine how far balanced and complete a specific bilingual phenomenon manifests (Birdsong, 2006).

Although AoA and order of bilingualism are perceived as two important factors mediating L2 proficiency, it is a difficult quest to allocate a specific weight or prioritize a factor over the other with regards to the attainment of linguistic proficiency. For example, Jedynak (2009) studied the pronunciation of post-pubertal L2 learners and compared them to native speakers; it was concluded that the length of L2 learning is more important than the onset of target language acquisition, where the late L2 acquisition of some participants of the language was not a constraint limiting achieving a native like level (Singleton, 2013). In another study by McDonald (2000) in which AoA was controlled for, two groups of early bilinguals varied in

English L2 proficiency based on a grammaticality judgment test that captured language knowledge, where L1 Spanish speakers outperformed L1 Vietnamese speakers, which suggested that the distance between L1 and L2 could probably dominate among other factors mediating L2 proficiency (Singleton, 2013). As the aforementioned studies demonstrate, the weight of a specific factor may vary from one context to another, and the role of AoA in shaping a bilingual profile among other factors is yet to be further understood.

1.2. Theoretical Background

A theory most supporting to the important role of AoA in L2 proficiency, yet highly debatable, is the critical period hypothesis (CPH), where it is assumed that there is a specific time bound window for successful or complete language acquisition, posing a maturational constraint for developing near native proficiency in a targeted L2 language (Azieb, 2021). In the same vein, it is also hypothesized that there is a critical period for each linguistic area, phonology being the most vulnerable (Singleton, 2013). CPH raises contention among various scholarly works, between studies endorsing the existence of this limited window of opportunity, and studies in opposition on the other hand. Qualitative and detailed investigation of the phenomenon reveals versatile findings, deeming literature in the area inconclusive; for example, late L2 acquirers' linguistic profiles show achievement of high levels of L2 proficiency on many counts, meanwhile some studies at the opposite end argue that even early sequential acquirers could still be distinguished from native speakers (de Bruin, 2019).

The order of language acquisition, as a relevant construct in studying bilingualism from the view of AoA, disseminates a few important notions in that context; namely, simultaneous bilingualism, which is acquiring two languages during infancy, and sequential bilingualism,

which is acquiring one language after another, either as toddlers or later in childhood or even as adults (Byers-Heinlein & Lew-Williams, 2013). In more detail, Montrul (2008) on incomplete language acquisition classifies bilingualism into four categories based on the age and order of L2 acquisition: a) Simultaneous acquisition (from age 0 to 3), in which both languages develop together as (2L1s) during early brain plasticity for linguistic functions; b) Early child sequential acquisition (from age 4 to 6); c) Late child sequential acquisition (from age 7 to 12); and d) late sequential acquisition (post puberty and in adulthood), in which an individual's L2 develops after the basic command of L1 is established.

Bilingualism in children is associated with linguistic and non-linguistic benefits, where bilingualism is hypothesized to function as a foundational resource for more efficient foreign language learning, being a base of honed cognitive and metalinguistic awareness. The ability to control and suppress a language and make decisions regarding code and lexical choices is said to be extended to other cognitive abilities (e.g.: executive control, attention and working memory), while metalinguistic abilities, such as linking meaning to form and manipulating linguistic units, lay solid ground for introducing a foreign language system. However, it is yet an area that is inviting for deeper and broader exploration whether or not those benefits could be realized across different groups of bilinguals, where many studies bring about the importance of the age of acquisition of both languages and the level of proficiency in them in pronouncing those benefits; those benefits are controversial in adult learners and unbalanced bilinguals (Hopp et al., 2019).

In view of the above introduction, previous literature has not been conclusive on the role of AoA and the benefits of early bilingualism in adults continuing to acquire English as an

L2, in addition to the difficulty of generalizing or transferring findings on this relationship from one context to the other for the high variability of bilingualism. In addition, studies in the Egyptian Arabic context are scarce to the best of our knowledge.

Having stated the controversial effect of AoA and the order of language acquisition on L2 proficiency development among other factors, a deeper understanding of AoA role in mediating language acquisition could be conducive to developing more convenient language education decisions and devising programs or approaches to second language learning that are better tailored for learners with consideration to their different linguistic experiences and bilingual profiles.

1.3. Statement of the Research Problem

Despite the association of early bilingualism with higher metalinguistic awareness, as mentioned in the previous section, the continuation of those advantages in adult L2 learners is debatable in comparison to their peers of a different linguistic history. It is also worth noting that only a portion of bilingualism studies takes into consideration the high variability of different bilingual manifestations as each bilingual demonstrates linguistic behavior that is different from another (de Bruin, 2019), a variability that requires studying those manifestations on a broader scale including as many L1-L2 combinations, yet in a deeper manner for a closer look at the peculiarity of the experiences of each study participant.

1.3.1. Significance and Scope of The Study. The current study attempts to explore part of how the age of L2 onset and age-related factors such as the order of bilingualism and length of exposure to rich L2 input are reflected in second language proficiency with focus on English L2 lexical attainment and English L2 oral proficiency in native

Arabic adult learners. The study is concerned with the Egyptian context where the study may inform different educational systems that follow different language educational schemes and programs with the probable representations of bilingualism later in life. Aiming to provide better insight for different involved stakeholders including language education policy makers, curriculum developers, parents, and language learners at later stages.

This study investigated the phenomenon cross sectionally using mixed methods. It measured and analyzed L2 lexical attainment quantitatively using the standardized PPVT-5 test scores as an indicator for vocabulary size (Hellman, 2011). In addition, it was coupled with a qualitative oral proficiency assessment of selected participants who varied in the age of their L2 acquisition onset. This was assessed by the means of spontaneous speech analysis adapted from Saito et al (2015). Following global and local speech measures of oral proficiency with focus on accentedness, comprehensibility, segmental errors, intonation, speech rate, lexical appropriateness, lexical richness, grammatical accuracy, and grammatical complexity (Appendix C). This multifaceted approach attempts to respond to the challenge existing in literature upon studying AoA in relation to attainment and proficiency, where encompassing a broad and deep view of the nuances and versatility of bilingualism is usually hard to achieve.

1.4. Research Questions

The research study is concerned with contributing to this investigation through attempting to answer the following research questions:

1) **How does early acquisition affect English lexical knowledge compared to late acquisition for adult Arabic speakers learning English as a second language?**
2) **How effectively does the age of acquisition (AoA) predict oral proficiency in English for adult Arabic speakers learning English as a second language?**

1.5. Delimitations of the Study

This study aims to shed the light on some facets of the possible influences of age of acquisition (AoA) on English L2 lexical attainment and oral proficiency among native Arabic adult learners in the Egyptian context. The scope of the study is limited to adult native Arabic speakers from Egypt, which may not generalize to other linguistic or cultural contexts. Participants were selected based on their varied ages of English L2 acquisition onset, representing early and late bilinguals who have been acquiring their second language mainly in foreign language classroom contexts. The selection of this specific demographic could contribute to compensating for the English-Arabic language pair underrepresentation in SLA literature concerned with AoA influences on L2 acquisition and L2 end state. Another motivation behind its selection is the relevance of the findings to language education in Egypt.

The study employed the Peabody Picture Vocabulary Test (PPVT-5) from Pearson assessments, which is an individually administered, norm-referenced instrument that assesses vocabulary knowledge in terms of size. PPVT-5 was used to measure English L2 lexical attainment, whereas spontaneous speech analysis was used to assess oral proficiency. Although those tools are recognized for their reliability, they do not capture all dimensions of L2 proficiency, such as pragmatic competence or sociolinguistic nuances. The focus on lexical

attainment and specific oral proficiency markers reflects the research questions but excludes other potential areas of language competence.

The study considers AoA and the length of exposure to rich L2 input (LoE) as the key factors influencing L2 proficiency. Other linguistic background factors, such as the distance between L1 and L2, comparing mode of L2 exposure (formal instruction vs. immersive environment), are acknowledged but not examined. The study delimitation is concerned with AoA and AoA related effects and their implications.

The cross-sectional approach, analyzing participants' L2 proficiency at a single point in time allows for the examination of AoA effects across different age groups, it does not capture longitudinal changes in language proficiency or the potential for late learners to improve their L2 skills over time. The findings should be interpreted with this limitation in mind.

The research focuses on English L2 learners and does not extend to other language pairs or other bilingual contexts. Therefore, the conclusions drawn are specific to the English language and its acquisition by Arabic speakers in Egypt.

1.6. Theoretical and Operational Definitions

1.6.1. Theoretical Definitions.

The **age of language acquisition** is a quantitative construct that indicates the initial state at which a learner started attaining a language via consistent, intensive and continuous exposure to that language, including their prior knowledge, neurological, and cognitive development, mode of instruction and attitude towards the language (Birdsong, n.d.; Ritchie & Bhatia, 2009).

Order of L2 acquisition is defined as the sequence at which a participant learned their L1 and L2, either simultaneously in childhood or sequentially, whether early in childhood or late post adolescence (S. A. Montrul, 2008).

Oral proficiency refers to the construct encompassing the different language subskills of grammar, vocabulary, pronunciation, and fluency; in studying oral speaking proficiency in relation to AoA related effects, it could be described as the final state of speech production with regards to comprehensibility and accentedness (Saito, 2015).

Lexical attainment is defined according to Hellman (2011) as the number of words known by the learner, also referred to as "vocabulary size," in addition to word knowledge, which refers to vocabulary knowledge depth.

1.6.2. Operational Definitions. Age of language acquisition (AoA) is operationally defined as the year at which the participant was first exposed to L2 intensively and consistently, either via immersion in an L2 speaking environment or via formal instruction. Data about AoA will be gathered via questionnaire items and semi-structured interview questions.

The **order of L2 acquisition** is operationalized as the chronological sequence in which a participant started acquiring their second language, whether simultaneously alongside their L1 or sequentially afterwards; this will be determined for the study via questionnaire items, then validated via a semi structured interview with participants.

Oral proficiency of participants is operationally defined in terms of the comprehensibility and accentedness of speech production following the judgements of experienced oral proficiency raters based on the Saito et al framework descriptors: segmentals, fluency, vocabulary, and grammar accuracy.

L2 lexical attainment in this study is operationalized as the number of words known to the participant and is assessed using PPVT-5 test scores and qualitative expert raters' assessment of participants oral speech production, where the study is concerned with measuring the participants' vocabulary size.

The following chapter sets the scene for the study, by reviewing key relevant literature concerned with age effects on how different language areas are attained. Afterwards, the methodology selected, and the findings obtained from the study will be detailed in chapters three and four. Finally, the interpretations of those findings, the implications and limitations of the study will be demonstrated in chapter five along with recommendations for future research directions.

2. Chapter Two: Literature Review

This chapter reviews previous studies on AoA and AoA-related effects in relation to how L2 ultimate attainment is representedin L2 learners and addresses some of the main findings and controversies relating to early versus late L2 acquisition in literature, with focus on some considerations for measuring L2 acquisition, common procedures and approaches for group design, relevant variables, and constructs in this research domain. In section 2.1 the chapter covers second language ultimate attainment, while section 2.2 touches on methods of measuring lexical attainment with consideration to age of acquisition related effects. Section 2.3 demonstrates how oral speech production and phonological domains have been researched in relation to the factor of age, while section 2.4 overviews some examples of research studies on the AoA effects in instructional L2 acquisition contexts versus naturalistic or immersive acquisition contexts. Section 2.5 touches on the role of L2 input quantity and quality as a confounding factor to age effects. Lastly, section 2.6 concerns the Arabic-English Language pair context

2.1. AoA-Related Effects and the L2 End State.

In the context of L2 acquisition, the end state is the term used to describe the eventual outcome or the “final state” of L2 representation by a learner, sometimes referred to as “ultimate attainment” (Birdsong, n.d.; Ritchie & Bhatia, 2009). Dissimilar to L1, there is high variability in how L2 is attained and represented, and one of the main concerns in SLA research is to understand the reasons behind such variability in L2 acquisition, while L1 acquisition does not demonstrate such diversity, rather attributed to a relatively high level of uniformity among its speakers (Bley-Vroman, 1989).

The end state at which L2 acquisition stabilizes is commonly captured in literature by benchmarking it to monolingual nativism, and despite this being a debatable standard, the degree of "nativelikeness" of the L2 learner is widely accepted in empirical research as a reliable metric for easily understanding and describing the L2 end state outcome (Birdsong, 2005). According to Klein (1996) AoA is associated with a number of variables that differentiate between early and late L2 acquisition, including neurological, cognitive, attitudinal, and linguistic/biographical. Therefore, AoA as a term should not be used to refer to those variables altogether, but rather a more accurate term to encompass those aspects interfering with L2 end state would be "AoA-related effects". Since this study is concerned with roles of age and order of L2 acquisition in shaping the final L2 state, both will be occasionally referred to as Age-related effects hereafter.

Another important contrast to highlight is the difference between L1 and L2 in terms of the "initial state;" In L1 acquisition, the initial state refers to the postnatal neurobiological, cognitive, and linguistic L1 development. In the case of L2, the initial state of the mental and linguistic apparatus is quite different, especially with later onset of L2 acquisition, where the late L2 learner has a well-developed linguistic and neurobiological system as L1 is already entrenched and has adapted the mental apparatus to its specifics including cognitive representation of the language, perception of L1 sounds, and auditory system (Bylund et al., 2013). Therefore, literature in L2 acquisition considers age or "initial state" to be the strongest predictor for how L2 ultimate attainment demonstrates, which raises the question whether late L2 acquirers could achieve a nativelike attainment (Birdsong, n.d.; Ritchie & Bhatia, 2009).

Commonly used approaches upon studying AoA-related effects on L2 end state, are either correlational among different groups of bilinguals while controlling for interfering factors, such as education, or comparing L1 to L2 in tested learners, or by carrying out performance intergroup comparisons (i.e.: Late learners vs early learners, while recruiting monolingual natives or simultaneous L1-L2 learners as control groups), other approaches factor in high proficiency and low proficiency in group design, as studies that do not consider the variable of proficiency mostly come down to results showing less nativelike attainment in late bilinguals compared to groups of earlier AoA (Birdsong, n.d.; Ritchie & Bhatia, 2009). However, the literature on AoA effects does also considerably report the possibility of L2 nativelike attainment in late acquirers, which suggests that methodological challenges need to be overcome in order to reliably measure or describe the end states of different groups. According to Hyltenstam and Abrahamsson (2003), a late acquirer could not achieve nativelikeness in all language areas. However, from a morphosyntactic point of view, a number of studies reported otherwise. For example, Birdsong (1992) tested the performance of 20 late second language acquirers with an Anglophone first language upon making judgements about subtle grammatical structures, and 15 out of 20 showed near native performance.

A decade later, Montrul (2003) reported that 70% of her study participants achieved a native like performance in interpretation tasks to test the acquisition of Spanish as L2 in late acquirers with anglophone backgrounds. Studies that tested more than one language domain in late L2 acquirers also reported interesting results, for example, a case study by Ioup et al. (1994) showed that two late Anglophone learners of Cairene Colloquial Arabic managed to

perform similar to native control participants in two tests of Arabic dialect identification, three tests of grammar knowledge and a pronunciation accuracy task.

Since the way AoA affects second language acquisition, literature is in need for enrichment with as many observations as possible, and from various contexts along with creating methodological approaches that account for less biases and controls for interfering factors. The study of age effects on L2 attainment and representation is central to SLA research, as no theory of SLA would be deemed as complete without understanding those effects (Bowles, 2007).

2.1.1. The Critical Period Hypothesis (CPH) vs. Cognitive Aging Hypothesis (CAH).

Referring to the theoretical backdrop fueling the contention around the effect of age on language attainment in general, it is worth highlighting the differences between two key theoretical positions towards understanding age effects on L2 attainment. As mentioned in earlier sections, the Critical Period Hypothesis (CPH) entails that late L2 bilinguals lose the ability to benefit from naturalistic exposure to L2 input, where implicit exposure to the language could only be effective within a strict maturational window before puberty. In opposition, the Cognitive Aging Hypothesis (CAH) interprets the salient non-nativelike L2 attainment in late bilingualism as a result of cognitive functions decline, rather than a maturational cutoff. In other words, CAH suggests that late bilinguals could keep benefiting from implicit exposure to the target language if provided with the environmental conditions like those provided for learning an L1 (Saito, 2015) This section reviews

a number of influential studies investigating age effects on different language in light of the aforementioned competing two positions.

2.1.1.1. The critical period hypothesis. The Critical Period Hypothesis, initially coined by Lenneberg (1967) supports the presence of a biologically determined window, between the age of 2 and until puberty as a cutoff, during which language acquisition occurs most efficiently. Lenneberg's work was greatly influenced by Chomsky's criticism of Behaviorism, where CPH understands language acquisition as genetically underpinned and maturational, assuming that the high neural plasticity during childhood mediates the efficient acquisition of language (Wu & Bulut, 2020). Many studies since then have been trying to emphasize the soundness of the critical period hypothesis as a reason behind the differences in language performance between early and late learners (Abrahamsson, 2012; DeKeyser, 2000; Hyltenstam & Abrahamsson, 2003). For example, DeKeyser's study (2000) main findings support that language in children has a nature that differs from language in adults (i.e.: Fundamental Difference Hypothesis by Bley Vroman). According to the study, language learning in children is implicit, domain-specific and occurs without conscious awareness of language structure, while in adults, explicit learning, problem solving, and cognitive functions are mainly relied on for language acquisition. DeKeyser's study was conducted on 57 adult native Hungarian immigrants who arrived at the USA at different ages, using an adaptation of the grammaticality judgement task

from Johnson and Newport (1989) to test the interaction between age and verbal aptitude. The recruited participants either immigrated before the age of 16 or after the age of 16, with a range of arrival ages ranging between one and 40 years old, and all have been residing in the United States for 10 years at least with an average length of residence of 34 years. The linguistic background data was collected via a questionnaire, and the verbal aptitude of participants was assessed using Carroll and Sapon's (1959) Modern Language Aptitude Test as a reliable predictor of language learning intelligence. Then participants sat for the grammaticality judgement test, where they listened twice to each item then indicated if they believe the item was grammatical or not in an answer sheet.

The results confirmed the negative correlation between AoA and the test scores, which seconds the findings of the replicated seminal work of Johnson and Newport (1989) However, DeKeyser's study showed a lot less of an overlap between the scores of early AoA and late AoA participants, providing stronger support to the CPH position, while the length of residence (LOR) did not show correlation with the test scores. Another interesting finding confirmed by the study is that only the adults who scored high in the verbal aptitude test, and with an AoA above 16, achieved grammaticality judgement scores similar to early AoA participants, assuming that adult learners recruit their analytical skills to acquire language, which supports the Fundamental Difference and the Critical Period Hypotheses even more. However, a

limitation that may weaken the confirmations of Dekeyser's study is that the participants varied greatly in their level of education which is a socioeconomic factor that should have been considered. It is agreed that despite the ample studies supporting the CPH position, it remains controversial for the methodological challenges as such. Abrahamsson's (2012) referred to earlier, attempted to investigate whether children acquire the language differently compared to adults by studying the relationship between the Age of onset of language acquisition (AO) and ultimate attainment (UA). Abrahamsson's study tested the UA of grammatical and phonetic intuition for L2 in 200 adult native Spanish speakers who had been residing in Sweden for at least 15 years and 25 years on average. The study participants had arrived in Sweden at different ages ranging from 1 to 30 years old, to ensure even distribution, six to eight participants represented each Age of onset on that continuum. Unlike previous studies, the grammaticality judgement test used in Abrahamsson's study was devised using test items that were complex enough to represent a cognitive load even for native speakers. The test design was assumed to serve as a better means for differentiating nativeness, near nativeness, and non-nativeness; that was one way to overcome the challenges faced by previous studies in terms of the under analysis of some interfering factors. Elaboratively, Abrahamsson(2012) based the study design on the notion that we should investigate what a highly proficient or a near native speaker cannot do compared to a native speaker. The grammaticality judgement test (GJT)

was coupled with a categorical voice onset time test (VOT) to investigate the participants phonetic intuition for L2 phonological features. Abrahamsson chose a multivariate approach that devised testing the learner's implicit unconscious knowledge (i.e.: intuition), out of the belief that this should overcome the methodological biases arising from using performance tests that may not accurately capture the differences between nativelike learners and native speakers. The results showed a high correlation between the Age of onset and the GJT and VOT scores for early learners, concluding that AO is the strongest predictor of morphosyntactic and phonological intuition. The scores were also significantly different among the three participant groups: native speakers, early learners, and late learners. The AO and UA in late learners negatively correlated, giving support to Johnson & Newport (1989) findings, which is one of the earliest studies giving robust evidence for CPH and the maturational constraint for language learning. Another very interesting insight from Abrahamson's study is the weaker correlation found between UA and other independent variables such as the length of residence and L1 use.

2.1.1.2. The cognitive aging hypothesis. While the CPH sets a maturational cutoff for language acquisition, at the age of 12 according to some researchers or at the age of 16 according to others (Flege et al., 1999), the CAH position does not support the existence of any cutoff, but rather claims that the ultimate

attainment of L2, whether in early or late bilinguals is affected by the age factor along an individual's lifetime. In other words, CAH endorses that our capacity for learning L2 after puberty is the same as our capacity used for L1 acquisition, yet it acknowledges a gradual monotonic decline in language acquisition with age, but for environmental reasons such as the limited exposure to the target language or the dominance of L1, rather than maturational reasons (Saito, 2015).

Bialystock (1997) analyzed two studies that investigate the evidence for a sensitive maturational period for learning a second language, the results showed that AoA is not the most significant factor, but it is rather other factors such as language correspondence, the length of residence, and the amount of exposure to the target language that could be more significant; suggesting that language acquisition is not primarily maturational. For example, one of the studies approached the question of CPH by examining how L2 learners of French gender mark French nouns (Marinova-Todd et al., 2000); interestingly, the participants recruited for this study came from different L1 backgrounds; 26 university level students who were either native speakers of English or German have begun learning French as an L2 before or after adolescence. English and German differ as language systems in terms of gender markedness of nouns, as English does not designate a specific gender to a noun, while German does classify nouns by gender. The results showed no differences between age groups performing the study tasks, but even

favored participants who were late learners of French in translation tasks. Another interesting conclusion drawn from Bialystock's analysis is that the Language system of L1 had a great influence on the strategies learners used to designate a gender to a noun. English native speakers followed the strategies of children learning French as an L1 in terms of relying mainly on phonological cues to determine a noun's gender, while German native speakers followed the strategies of adult French native speakers, who rely on the semantic information of the noun to designate a gender to it. Which underscores the significant effects of L1 on performing in L2, prioritizing the effect of language correspondence compared to the age of acquisition upon learning some specific areas of the L2. Bialystock's work draws attention to the inconsistency of those findings with the existence of a sensitive period for learning languages that is bound by maturational changes and a cut off age. Bialystock questions the reasons or mechanisms by which late learners of L2 show different performances based on the task they are asked to carry out, whether it is oral or written; in other words, if there is a sensitive period for acquiring a language this should consistently show in different types of language performance according to Bialystock's view.

Other important studies supporting the cognitive decline position but only for some language areasinclude Flege and Yeni's work (1999). The study investigated the CPH position through evaluating the English pronunciation of 240 native Korean participants with a mean age of 26 who had arrived in the

United States at different ages ranging between one and 23. Listeners rated the Korean participants' overall degree of accentedness compared to 20 native English controls, the study also tested their knowledge of morphosyntax through a 144-item grammaticality judgement test. The factor of AoA influenced the degree of foreign accent in the participants' English pronunciation, while the decline in morphosyntactic knowledge scores was more attributed to the level of education the participants received in the United States specially when all other interfering factors were controlled for, which entails the importance of the amount of L2 language use over the factor of AoA when it comes to the morphosyntactic domains. The key findings of the study is that AoA effects on the phonological domain may be because of the presence of a maturational sensitive period, but also probably resulting from the interaction between the language systems of L1 and L2. On the other hand, the AoA effects on the morphosyntax are interpreted as a result of environmental factors such as the differences in education and language use.

2.2. AoA-Related Effects and Lexical Attainment of L2

One very important determiner of overall language attainment is the lexicon, deemed as a central part of the process of language acquisition (Spadaro, 2013). Therefore, lexical knowledge has been researched in relation to the onset of L2 acquisition with consideration to the critical period hypothesis, where investigating whether there are maturational constraints

on vocabulary knowledge, organization, and recall was aimed at. However, research results in this domain have been controversial. For example, In Kim's work (1997), it was concluded that native Korean late bilinguals, whose L2 onset started later than the age of six, responded slower to a lexical decision test compared to the native speakers control group. The study was run on 70 Korean-English speakers of different AoA of L2, the reaction time and accuracy were evaluated for the participants, who were asked to discriminate between actual English words and non- words, those results are suggestive for the existence of a sensitive period for lexical attainment.

In agreement with those findings from the lexical point of view, the study of Spadaro (2013) followed a standard protocol of 7 written tasks (i.e.: Kent-Rosanoff battery of tests) in addition to an oral video retelling task, to probe the lexical knowledge of 38 bilinguals who varied in their L1s, and had moved to Australia at different ages, participants had attained a high English level by immersion since their immigration. The tasks mainly focused on the participants' knowledge of collocations and multiword units or idiomatic awareness. Spadaro's results supported the presence of a critical period for lexical acquisition that closes at the age of six.

Contrary to the abovementioned examples, recent neurolinguistic research has been suggestive of the possibility of native like lexico-semantic foreign language attainment in late bilinguals. Stemming from this recently introduced notion, Hellman (2011) attempted to resolve the methodological difficulties in AoA-lexical knowledge research by examining the vocabulary knowledge size and depth of three groups of participants, a group of highly successful late L2 English learners, monolingual native English speakers, and bilingual native English speakers.

And although the native speakers outperformed non-native speakers overall, the results suggested that the native-like attainment of late acquirers is possible, where 5 non-native participants were able to achieve very high scores that were described in the study as native-like. Hellman's study used a number of standardized vocabulary testing instruments of high reliability and validity, one of which was be adapted for the current study: *the Peabody picture vocabulary test, Fourth Edition (PPVT-4),* a 15-minute standardized test from (PearsonAssessments.com) that was normed on 5,543 test takers. PPVT-4 is reliable to measure vocabulary size through testing aural receptive lexical knowledge in adult native speakers of English, where a test taker is asked to point to one of four pictures to identify words they hear. The findings of Hellman's study suggest that the lexicon may be the most successfully attained domain in case of late L2 learning. However, data on the final attainment of the lexical domain is relatively limited, in terms of vocabulary knowledge in late L2 acquirers (Hellman, 2011)

Most recently, Saito et al (2022) conducted two studies to examine age effects on spoken L2 vocabulary attainment in late bilinguals. The first study used spontaneous speech elicitation via storytelling tasks and interviews, where corpus analysis of the data from three groups was carried out: 41 experienced Japanese-English L2 speakers (i.e.: highly proficient, and have been immersed in a native community after the age of 16), 40 inexperienced Japanese-English L2 speakers (i.e.: Japanese controls who only received late formal school English instruction for 6 years, without any experiences in a native community), and 10 native English speakers. Experienced learners showed a nativelike performance in terms of vocabulary richness, however AoA was found to be a strong indicator of vocabulary attainment in terms of

appropriateness. Vocabulary richness was analyzed following Crossley's L2 vocabulary framework using "TAALES" or the tool for the automated analysis of lexical sophistication, while the vocabulary appropriateness was evaluated via experienced 6 native English-speaking raters. Those findings were confirmed by the second study, which was a replication of the first study on 50 Polish-English L2 speakers. Conclusively, Saito's results support the non-maturational position in literature towards L2 ultimate attainment in terms of the lexicon, where late acquirers could achieve native like proficiency in proportion with the long exposure to the second language with consideration to the amount and quality of L2 input and opportunity for output.

On the other hand, one of the notions integral to the maturational position (i.e.: the earlier the better) on L2 acquisition is how established the L1 system is in the mental apparatus of the learner, viewing this establishment or entrenchment of L1 a factor competing with L2 acquisition, hence compromising the ability of late acquirers to achieve native like proficiency (Muñoz, 2019). In a related sense, Bylund (2020) challenged the rising suggestion in SLA scholarship that bilingualism (i.e.: Two language systems influencing each other) is a predictor that is stronger than AoA for the unsuccessful or non-nativelikeness of the L2 ultimate attainment. Bylund's multidomain study followed an interestingly comprehensive methodology design to investigate the primacy of either variables, where 80 adult Swedish speaking participants took part in the study; participants were grouped as follows: 20 monolingual speakers of Swedish, 20 simultaneous L1 swedish- L2 spanish speakers, 20 sequential monolinguals who are L2 speakers of Swedish (i.e.: adoptees who lost their L1 proficiency), and 20 Sequential L1 Spanish-L2 Swedish speakers. All groups were highly proficient in Swedish

without prominent deviations. The findings of the study support the primacy of AoA over bilingualism in determining nativelike attainment of L2, via eliciting data from speech production tasks, that was analyzed in terms of a range of linguistic competencies and abilities of production and perception with consideration to accuracy and lateness (e.g.: voice onset time "VOT," and grammaticality judgement). Such findings being in alignment with the maturational explanation of L2 ultimate attainment, supporting AoA as a main predictor of verbal behavior of L2 acquirers adds to the contention between both positions.

2.3. AoA-Related Effects on L2 Oral Speech Attainment

As this study intends to explore the AoA related effects on L2 oral proficiency as well as lexical attainment, the following part specifically demonstrates an overview of the literature investigating age effects on oral speech domains.

Assessing oral speech in applied linguistics research has been a subject of debatefrom different perspectives, especially with regards to the nature of spoken language and its linguistic description, attempting to reach a consensus on the most proper and meaningful ways to assess the ability to speak a language. A lot of the research in that domain focused on evaluating the sound of speech, which is a controversial discussion in language assessment, mainly because there is no specific consensus on the standards against which this assessment should be done, judging non-nativism through the sound of speech (i.e.: pronunciation). It is difficult to set a particular combination of speech features as the native standard a learner should approximate (Luoma, 2004). Generally, if speech is only formally assessed based on how native-like it sounds, most adult learners may not achieve a successful attainment. Therefore, in the quest of speech assessment research took into account communicative effectiveness based

on the native standards for comprehensibility as a more realistic benchmark for assessing learner pronunciation (Luoma, 2004). Another two facets of oral speech are to be looked into: interactional efficiency, and expressiveness, which indicate the native-like use of stress, intonation, pauses, tone, pitch and volume changes to increase comprehensibility (Luoma, 2004) In addition to speech sound, spoken grammar is also accounted for as an important indicator for proficiency upon designing speech assessments. Spoken grammar differs from literate grammar in how it is not formed out of complete sentences, but rather "idea units," which are short 2-3 seconds of speech strings spoken next to each other surrounded by pauses or hesitations (Chafe & Danielewicz, 1987).

Whether the speech is planned or unplanned, formal or informal or even ranging between both extremes greatly affect how the assessment should be designed, as the level of planning and register may considerably influence pronunciation and word choice (Luoma, 2004).

Within the context of assessing oral speech with regards to AoA related effects, researchers have primarily relied on controlled speech tasks in order to elicit certain features of interest in participants' speech production (Saito, 2015). However, controlled speech elicitation may not capture the learner's level of proficiency accurately, because speakers show a higher level of proficiency in formal controlled contexts compared to spontaneous speech production (Major, 2008). Consequently, researchers started to adopt spontaneous speech production tasks in SLA research, where participants can better demonstrate their oral competence naturally in terms of the phonological, grammatical, morphological, discoursal, and temporal

aspects of the speech; without consciously attempting to avoid mistakes or by focusing on one sole aspect of their oral production (Spada & Tomita, 2010).

Derwing & Munro (2013) in a longitudinal study, then Saito (2015) in a cross-sectional study, investigated the effect of length of residence on the development of L2 oral speech in late learners of English. Derwing & Munro investigated the proficiency of Slavic and Chinese English learners at three points since their immigration to Canada, at 0, 2 and 7 years of residence. Participants' oral proficiency enhanced over the years in terms of comprehensibility, while the level of foreign accent in their L2 speech remained the same. Saito (2015) replicated the study cross-sectionally on 3 different groups of native Japanese learners of English who varied in their length of residence in the United States. Using regression analysis, Saito's results agreed with Derwing & Munro's findings in terms of increased comprehensibility with extended language experience, but reported developmental patterns in oral speech, where from the early years after residing in the country of the target language and up till 5 to 6 years of residence, learning progress seems to be higher than later stages, in terms of lexicogrammar first, then development continues in terms of speech sound, and speech rate, however, complexity of grammar or vocabulary richness are areas that do not improve as much. Entailing that late learners' oral speech production develops with regards to functionality, where the areas of improvement center around attaining a higher comprehensibility for better communication. Yet this does not necessarily refute the possibility of attaining higher proficiency and higher levels of complexity for late learners. Hence, many SLA researchers believe that AoA related effects on proficiency should be studied in highly proficient L2

learners, who are extensively exposed to the target language and are motivated to use it on daily basis (Birdsong, 2005).

Therefore, as mentioned earlier, a key study that is fundamental within the context of the current research work is Saito (2015) investigated the role of AoA in experienced late English acquirers (above the age of 16) with regards to oral proficiency. The study was run on 88 experienced native Japanese late learners and compared them to two control groups: inexperienced Japanese speakers, and native English speakers. Their oral proficiency was assessed by 10 native English-speaking raters in terms of accent nativelikeness, ease of understanding, and speech sound including features such as segmentals, speech rate, vocabulary, and grammar usage. Participants were elicited to spontaneously orally respond to a picture description narrative timed task. The results came in support of the CAH view, where experienced learners showed a significantly higher performance compared to the inexperienced baseline Japanese control group. Suggesting that it is possible to successfully attain L2 oral proficiency with extensive exposure to the target language. However, the age factor could function as a predictor for the phonological domains such as accentedness and ease of understanding but does not correlate to other domains such as speech rate and lexicogrammar use.

2.4. Assessing AoA related factors in Instructional Foreign language Learners

The above studies focused on evaluating oral speech in naturalistic contexts, where learners acquire the language by immersion in a native speaking environment. Another important vein in SLA research, which has not been receiving as much attention, is investigating how L2 ultimate attainment occurs in learners who acquire the language in foreign language

(FL) classrooms without experience in a native speaking country. Research studies in that domain focused more on speech sound and pronunciation and are usually criticized for their methodological limitations, some researchers such as Saito (2019) evaluated the lexical attainment of L2 speech in an FL environment, capitalizing on Crossley's computational framework of L2 vocabulary (Crossley et al., 2015) which investigates speech lexical domains from the lens of appropriateness and sophistication. 'Appropriateness' as a descriptor for semantic and morphosyntactic accuracy with regards to the context of the spoken language, and 'Sophistication' which describes how the learner uses less common and abstract words. Only a number of studies compared L2 proficiency of FL learners to basal control groups. And despite the major differences between their linguistic profiles compared to naturalistic L2 acquirers, in terms of the limited exposure to incidental or implicit linguistic patterns, FL L2 leaners do respond quickly to instructional language acquisition, however literature reports that FL L2 learners' final attainment is not strongly related to the factor of AoA. For example, Jaekel et al., (2017) longitudinally studied the long-term effects of early FL education by assessing the receptive skills of two groups of German English as an L2 language learners, a group with an early AoA (6 to 7 years old), and the other with a late AoA (eight to nine years old). The study compared their performance in the year five which is the beginning of secondary education in the German system and in the year seven. The positive effects of the early onset were observed in year five, where early learners outperformed late acquirers. However, in year seven the late acquirers outperformed early acquirers. The interfering socioeconomic factors were statistically controlled for. The study was concerned with receptive skills of listening and reading comprehension. At the first time point at year five participants

had received 140 hours of FL instruction for the late starters, and 245 hours for early starters. In year seven, which is the second time point, participants had received 444 hours of FL instructions for late starters, and 549 hours for early starters. Standardized listening and reading comprehension test scores were used for the comparison between both groups, using independent-samples t tests, where the p-values confirmed the significant performance differences between both groups. Those results suggest that late acquirers were able to surpass early learners, which does not only imply a possibility for late acquirers from that age group to attain L2 but also have an advantage to acquire the language faster than early learners and implies that recruiting cognitive abilities for language learning is an important predictor for receptive language skills attainment in case of explicit language learning. This agrees with earlier work by Munoz (2008), who was similarly motivated to point out the differences between AoA effects on formal learning outcomes and naturalistic acquisition, as the findings, interpretations, and assumptions from immersive learning contexts have been overgeneralized to instructional contexts, which does reflect on policy making and stakeholder choices when it comes to setting a framework for second language education. Within the context of the Barcelona Age Factor project (BAF), Munoz series of research work argued that the L2 input a learner gets in terms of its amount and quality impacts how the effect of AoA demonstrates. According to her study, input is a very influential factor that explains the long-term advantages that late learners show in terms of the faster rate of learning. She explored AoA effects through a longitudinal study over 3 time points (after 200 , 416, and 726 of FL learning) covering different language areas in four groups of Spanish-Catalan native speakers who were learners of English as L2 with different AoAs (eight, 11, 14, and 18+ years old) and different ages at

testing (10,12,15,and 28 respectively). Socio-economic information about participants was collected via a written questionnaire in addition to other factors such as learning strategies, attitudinal and biographical information. Participants answered a battery of tests covering areas such as dictation, grammar, listening, and writing. A number of participants were selected for an oral interview, a picture description narrative task, role play performance, minimal pairs discrimination, and a word imitation test. The scores comparison revealed that late learners outperformed the early learners in all three points, confirming the learning rate advantage for late acquirers. Yet there were no significant differences in the scores of tasks which do not require high cognitive functions to solve.

Conclusively, similar to previous literature, the study suggests that late learners in the FL context show a higher speed of learning rate owing to their developed cognitive abilities, while early learners have an ultimate attainment advantage, assuming that when the gap in the cognitive abilities between groups closes, there will not be differences between cohorts with different AoAs in the long-term. Munoz series of studies point out the importance of extensive language input, and the existence of differences between naturalistic and instructional contexts, mainly that explicit instruction is more suitable for late learners, and that the interpretation of the positive age effects in naturalistic early acquisition offered by SLA research cannot be overgeneralized.

As Saito (2022) was concerned with the context of naturalistic acquisition, a similar study by Saito was concerned with instructional FL learning (Saito, 2019). It innovatively approached studying lexical development in FL classroom L2 learners in 72 Japanese university students who only learned English within instructional settings for seven years. Spontaneous

speech production was elicited from participants as a response to picture narrative description tasks. An average of 3 minutes of their oral speech production was then transcribed and analyzed with respect to 10 lexical features which are constituents of the concepts of appropriateness and sophistication, including semantic and morphosyntactic measures, in addition to frequency, range, correctness, meaningfulness, and hypernymy. The analysis was done subjectively by experienced raters, in addition to an objective analysis run via the Tool for Automated Analysis of Lexical Sophistication (TAALES) (Kyle & Crossley, 2016). Their oral speech performance was compared to that of an advanced level Japanese group of learners who have been learning English in an immersive environment in Canada for 10 to 23 years of residence, in addition to prior six to nine years of English language education in Japan. The results come down to two conclusions: first, that classroom extensive language learning experience could relate to high appropriateness and sophistication in lexical development overall, yet some difficult features such as semantic and morphosyntactic appropriateness could relate not only to the frequency of practicing L2 but also to how recent it is.

Examining AoA effects on L2 oral proficiency provides a variety of insights into how late learners develop their speech capabilities over time. Literature has been considering various aspects of oral proficiency, including comprehensibility, interactional efficiency, expressiveness, appropriateness, and sophistication, alongside traditional measures like pronunciation and grammatical accuracy. While late learners may face challenges in achieving native-like pronunciation, they can still improve with prolonged exposure and practice, however the AoA factor remains a strong predictor with regards to some language areas specially in the case of

naturalistic and implicit language acquisition. However, the interpretation of one study or a limited number of studies cannot be overgeneralized.

2.5. Quantity and Quality of L2 Input as a Confounding Factor to AoA Effects

Language skills development of bilinguals as stated and explained earlier is mediated by a number of internal and external factors, and the degree of contribution of each factor in shaping bilingual outcomes in terms of the morphosyntax and lexical knowledge has been an area of interest for SLA researchers in the recent years (Faraj & Hamid, 2023). An external factor that is one of the most prominent contributors to L2 development in bilinguals is language input, whether in an instructional or an immersive context (Muñoz, 2014). Language input in literature is described in terms of quantity and/or quality, being the two major components of the construct (Paradis, 2011). Although both components are intuitively considered important in forming a bilingual profile, few studies have paid attention to studying both components together and their effects on a range of linguistic domains, let alone studying their effects on bilingual outcomes within an instructional acquisition context (Faraj & Hamid, 2023). Input quantity is strongly supported in literature as a factor that greatly influences bilingual development, while quality is specifically influential in the case of young bilinguals for the sake of differentiating both of their linguistic systems at the syntax-pragmatics interface (Faraj & Hamid, 2023). Input quality neutrally refers to the variety of dialects, proficiency levels, and morphosyntactic structures present in the environment of the learner (Paradis, 2011). One of the determining features of input quality is the richness of L2 input, which refers to the amount of exposure to native content, whether in occasions of language contact with native speakers, or through cultural content in different media forms (e.g.: Movies, song lyrics,

podcasts), playmates in virtual gaming, or other extra-curricular out of class activities (Paradis, 2011). On the other hand, a determining feature of input quantity is the Length of Exposure (LoE). According to Bohman et al (2010), cumulative LoE had a great role in developing the semantic and morphosyntactic subskills in Spanish-English young learners. Other subskills such as larger vocabulary size, and better narrative comprehension were found to be positively correlated to a longer LoE to Italian as an L2 with the control for the socioeconomic status of learners (Dicataldo & Roch, 2020). The amount of input was also found to be a good predictor of receptive vocabulary size in Chinese-English bilingual children according to the findings of Sun et al (2018).

2.6. AoA-Related Effects in the Arabic-English Language Pair Context

Studies investigating age effects on Arabic-English as a language pair are scarce. (Ioup et al., 1994) was a pioneering study investigating age effects on ultimate attainment, where two highly proficient adult learners of Egyptian Arabic (AoA=21 years old) were examined for spontaneous oral production, dialect differentiation, and grammatical intuition. And both learners performed comparably to native speakers in terms of grammatical intuition. Despite their very high scores some performance deviations could still differentiate them from the native speaker control group. However, the study offers weakening evidence to the CPH position and offers insight with regards to language correspondence as an interfering factor upon studying AoA effects within the context of this language pair in late learners. However, the study was conducted on two participants only, which limits the generalizability of its findings.

This chapter aimed at providing a relatively comprehensive review of the literature on Age of Acquisition (AoA) and its related effects on second language (L2) ultimate attainment. By examining key studies and theoretical perspectives, the chapter attempted to highlight the complexities and ongoing debates surrounding early versus late L2 acquisition, where it has explored the various approaches used to measure L2 attainment, particularly in relation to lexical and oral speech proficiency. It has also discussed the impact of confounding factors such as the quantity and quality of L2 input. The chapter additionally emphasized the importance of context, comparing findings from naturalistic and instructional settings, and touched on the unique challenges and insights arising from studies on the Arabic-English language pair. Overall, this review intended to give a background to contextualize the coming chapters, underscoring the significance of AoA as a critical variable in understanding L2 acquisition.

3. Chapter Three: Research Methodology

In this chapter, the methodological framework is presented. An overview on the research design is in section 3.1, while section 3.2 describes the study participants' linguistic profiles and demographic information. Section 3.3 offers a detailed description of the four data collection constituents of the framework along with the data analysis approaches in sections 3.3.1, 3.3.2, 3.3.3, and 3.3.4., and finally section 3.4 offers details on data handling and analysis.

3.1. Research Design

For a comprehensive overview on the effects of AoA, the research methodology followed a mixed-methods approach: **quantitative analysis** of the standardized test scores of the PPVT-5 lexical knowledge tool for measuring the vocabulary size of participants, and **qualitative analysis** for analyzing the participants responses to the LEAP-Q questionnaire along with semi structured follow-up interviews. The questionnaire and interviews elicited and validated information about the participants' language biographical background. As detailed in the following sections, the responses to the interviews were also used for qualitative analysis to evaluate the oral speech production of participants across various global and local speech criteria.

The abovementioned multidomain approach was selected to suit the complex nature of AoA effects on language performance. As Birdsong (n.d.) states, the age at which the acquisition of the second language occurs may influence linguistic subsystems differentially, hence, a multidomain investigation is necessary for a better understanding of the bilingual phenomenon. This is especially due to the fact that it has been frequently reported in literature

that specific domains or subskills are probably more sensitive to the age factor than others (i.e.: the phonological domain) (Flege et al., 1999).

Mixed methods were also selected to account for the different natures of the selected subskills of the study on one hand, and to account for a relatively broader yet deeper understanding of AoA effects on the other hand (Gass & Mackey, 2007). Quantitative methods could objectively measure a feature such as the vocabulary size, while qualitative and subjective evaluation of speech production could adequately complement our understanding of AoA effects given the broad range of individual variations among bilinguals. Mixed methods could decrease the chances of missing out on the nuances and complexities of how the L2 end state manifests, with consideration to analyzing the linguistic biographies of participants, which could only be validated and categorized qualitatively. Therefore, a mixed methods approach is believed to add to the robustness and validity of the investigation (Pavlenko, 2009).

The research study attempted to explore the relationship between AoA and second language proficiency with focus on two domains (i.e.: Lexical knowledge and oral proficiency) by statistically studying the predictive power of AoA for L2 performance via analyzing the correlation between the age factor and the vocabulary size and oral speech. To elaborate, The AoA factor was compared to the length of exposure to rich linguistic input (LoE) as a confounding factor, in terms of its influence on participants' performances, and how strong AoA could predict such performance in adulthood, whether this performance is more target like (i.e.: close to the native performance), or non-target like (i.e.: far from the native performance).

Another component of the study compared intergroup performance patterns related to L2 attainment in early and late bilinguals. The study focused its intergroup comparisons only on

the early childhood sequential learners, whose English acquisition started between 4-6 years of age, and the late childhood sequential learners whose English acquisition started between 7-12 years of age. This categorization was guided by Montrul's (2008) classification of bilinguals: early simultaneous acquirers (Zero to three years); early childhood sequential acquirers(Four to sixyears); late childhood sequential acquirers (Seven to 12 years); and late Bilinguals (>12 years). Although the critical period hypothesis does not clearly draw the line at which the maturational window for L2 acquisition closes, but the age of 12 has been the most reported in literature, other researchers reported the age of 15 while others reported the age of six or seven (Mackay et al., 2006). For the current study, it has been decided to compare early to late childhood acquirers mainly for two reasons; first, it was more feasible to analyze the performances of those two cohorts without compromise on the statistical soundness of the analyses, given the available sample sizes. Second, most SLA research investigating age effects compare early acquirers (i.e.: AoA: before the age of 12 or puberty) to late acquirers (AoA: after the age of 12 or puberty) without much attention to studying the differences that might be observed when comparing early to late childhood bilingualism (Tsimpli, 2014), especially that those two categories differ in terms of the level of L1 establishment in the initial state, and also differ in terms of cognitive development and in terms of the mode of acquiring the second language according to Montrul's classification, where late childhood acquirers begin at around the age of 6 to be exposed to instructional language acquisition, which is not the case for the fourto six cohort. However, some research findings consider early childhood acquisition to be up until the age of four years old, and late childhood acquisition starts at the age of four onwards, with support to pattern similarity in the performance of simultaneous acquirers and

early sequential acquirers (Tsimpli, 2014). It is also worth noting that Granena and Long (2013) for example, in support of the critical window for acquisition, compared the following ages of onset: Three to six; Seven to 15; and 16-29 and confirmed that each could be a sensitive window for a specific language domain, where L2 phonology closes first, then lexis and collocation, and finally morphosyntax. Since the current study is concerned with how the age of acquisition may influence performance in the long term, and how far it could predict such performance among other factors, comparing two groups who fall under the commonly claimed as a cutoff age could offer a closer and a more differentiated look into the effects of AoA.

In an exploratory stage, information about the linguistic background and bilingualism experiences of the participants was collected through and adaptation of **the language experience and proficiency questionnaire (LEAP-Q),** (Available at: LEAP-Questionnaire « Bilingualism and Psycholinguistics Research Laboratory (northwestern.edu)).

Prior to the questionnaire, participants were offered a detailed explanation of the purpose and steps of the study by the researcher and were asked to sign the digital consent form approved by the Institutional Review Board (IRB) at the American University in Cairo, in case they opt for participation. Participants were later invited for a follow up semi-structured interview for 15 minutes to validate the self-reported information provided via the questionnaire, and to elicit further and deeper information about their language acquisition biographies and linguistic backgrounds. Participants were then sent a link to take an individual **15-to-30-minute vocabulary knowledge test (i.e.: PPVT-5) to assess each participant's vocabulary size.** The spontaneous oral speech responses elicited during the follow-up

interviews were further analyzed for oral proficiency assessment based on **Saito et al (2015) oral proficiency assessment metrics** (Appendix III). Participants were categorized based on the age and order of acquisition according to **Montrul's (2008) classification of Bilinguals** into **early simultaneous bilinguals, early sequential bilinguals, late sequential bilinguals, and late bilinguals.**

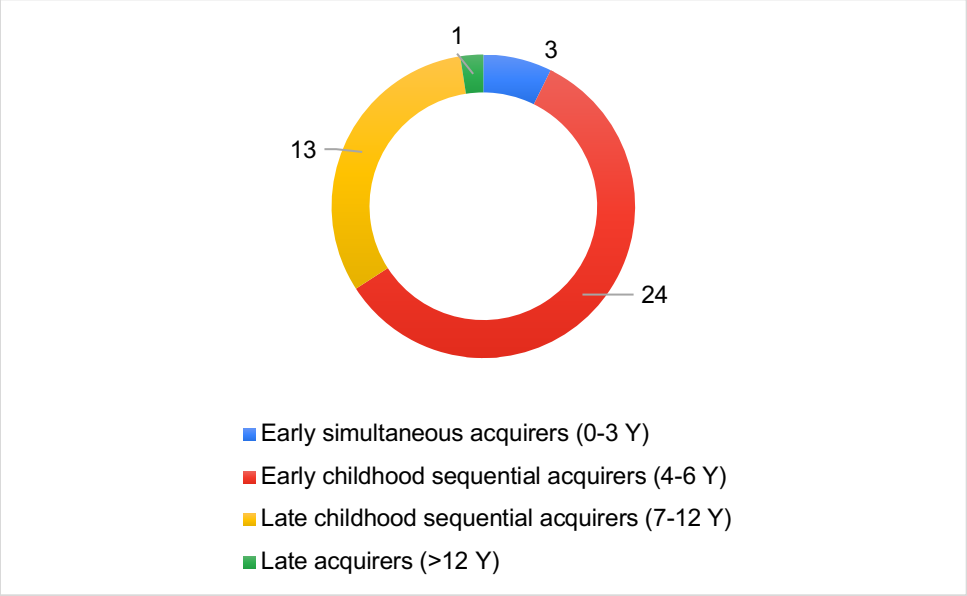
3.2. Participants

Forty-two native Egyptian Arabic bilingual graduate students at the Information Technology Institute (ITI) of ages ranging between 23-28 voluntarily participated in the study. ITI is a prestigious Egyptian graduate level institute affiliated to the Ministry of Communications and Information Technology (MCIT). The institute offers a highly competitive scholarship based 9-months program for fresh graduates in the disciplines of information technology to prepare them for employability in international top tier IT companies. ITI students study English as a core component of the program for 99 hours over a duration of nine months. It was convenient to recruit participants from ITI, because all students fall within the same age group, with almost similar educational levels and professional backgrounds, those factors in case of great variation among participants could interfere with the reliability of data collected if not controlled for. Using convenience and stratified sampling, participants were recruited via sending out a digital version of the LEAP-Q questionnaire as a google form where information about their linguistic biographies was collected. All Participants were upper intermediate to advanced level learners of English as an L2 according to the placement tests run at the institute by the English Instruction Department at ITI. The recruitment of experienced learners with high proficiency is emphasized in age related SLA research, where participants

should have been long exposed to the target language and show attitudinal motivation towards using and interacting in L2 (Birdsong, 2005; DeKeyser, 2000).

The placement tests were run at the beginning of the program, 8 months prior to the time of this study. During those 8 months all participants have been receiving an average of 6-9 hours / week of English language classroom instruction. The pedagogical approach relied mainly on communicative and task-based approaches, with ample opportunity of exposure to authentic language and performing authentic language related tasks in classrooms and in group projects. **Figure 1** visually represents the categorization of the 42 participants based on their age and order of acquisition.

Figure 1:
AoA Based Categorization of Participants



3.3. Data Collection Instruments

3.3.1. LEAP-Q Questionnaire. LEAP-Q is a validated questionnaire that is used for capturing the bilingual profile and language experiences of participants via self-reported measuring (Appendix A). The questionnaire is designed to sensitively capture experiences of language immersion, age milestones in language learning, extent of language exposure, contributors to language acquisition, self-reported foreign accent, and self-reported proficiency (Kaushanskaya et al., 2020). It was developed in the Northwestern Bilingualism and Psycholinguistics Research Lab and published in 2007. It is suitable for a wide range of multilinguals, aged from 14 to 80 years old. LEAP-Q has been used over the past years with various adaptations across several disciplines including linguistics and education. It is advised by the questionnaire developers not to alter the wording or delete questions or change the order of questions, to maintain its sensitivity and validity, however, it is also possible to adapt it by adding questions towards the end of the questionnaire (Marian et al., 2007). The current study used the adapted trilingual version of the questionnaire, which was modified to suit learners whose linguistic background included more than 2 languages.

An important function of the questionnaire was to allow considering the variations among participants, with regards to controlling for interfering factors other than AoA and order of L2 acquisition, such as the mode of L2 acquisition or

instruction, length of language acquisition, in addition to language use practices and contexts.

3.3.2. Semi-structured Interviews. The LEAP-Q questionnaire was followed up by a semi-structured interview (Appendix B) for the validation of questionnaire responses and to allow test takers to elaborate more on their linguistic backgrounds, this is to attempt reducing the downsides of self-reported measurement of linguistic experiences. Interview questions were open ended questions adapted by the researcher based on the LEAP-Q themes. Semi-structured interviews are commonly used for eliciting rich and detailed information about linguistic backgrounds and acquisition biographies. Unlike structured interviews, it allows for more flexibility, enabling the exploration of participants' experiences and insights more deeply. Therefore, a semi-structured interview was devised for this study in an attempt to capture the complexities of L2 acquisition history of participants, especially that individual and contextual variations may significantly influence language learning outcomes (Gass & Mackey, 2007). Open-ended questions were used to probe into the themes of AoA, order of bilingualism, language use patterns, motivation, learning strategies, and L2 end state .The interviews were either run individually in a quiet room at the ITI, and recorded using a digital audio recording mobile application, or run individually online and recorded via Zoom application. The interviews adapted to the conversational flow, making participants feel more comfortable and willing to share more about their

experiences, aiming for enhancing the depth and authenticity of the data collected (Brinkmann & Kvale, 2018).

Biographical information elicited via the questionnaire and the interviews allowed the attempt to overcome some of the methodological challenges that usually encounter studying L2 performance of bilinguals by controlling for interfering biographical factors and individual variations, where all participants reported being university graduates who had received an average of 20 years of formal education. All participants reported their ages of first exposure to English as an L2 within instructional contexts and had been exposed to rich linguistic input of L2 at varying ages. They have all also reported current use and/or interaction using English for either social, professional or educational purposes no less than five hours a day and on an average of 30% of all the languages they use..

3.3.3. PPVT-5 Lexical knowledge measurement. The study measured the vocabulary knowledge of participants using the digital Q-global platform version of the Peabody Picture Vocabulary Test (PPVT), which is a highly precise and norm-referenced receptive vocabulary indicator. PPVT measures the breadth of vocabulary knowledge based on age (from toddlers to elderly adults) and it continuously undergoes revisions to adapt to the updates in vocabulary and population changes. The 5th edition of the PPVT was used for this study as it is the most recently revised form. A link to a single word individual test was sent via email to each participant, where the examinee listens to a single word and clicks one of four pictures on the screen that they believe corresponds to the word they

hear. The test sets are designed to suit the examinee's age group; and the difficulty of vocabulary gradually increases. Test scores were automatically calculated through the digital Q-global platform after a threshold of mistakes within a specific number of word sets. The use of the PPVT test is mainly for assessing the development of vocabulary and vocabulary knowledge in correspondence to age in native speakers, however, the test has been devised within the context of vocabulary size measurement in L2 speakers (Pae et al., 2012). Test scores were automatically generated as individual and group reports, that were then quantitatively analyzed by creating two simple linear regression models to plot two relationships: 1) The correlation between the reported AoAs of participants and their standardized test scores, and 2) The correlation between the reported Length of Exposure to rich linguistic input (LoE) and the test scores. The regression models were chosen to show whether there is change in the performance of participants that could be mediated by the age factor, while depicting the pattern of this change. In addition to showing how statistically significant the contribution of the age factor is to the change in scores as the AoA increases. And since LoE to rich content is age related yet a confounding factor to AoA influence, it was sensible to use a regression model to plot its relationship to test scores as well, and investigate whether the change in scores is more caused by the age factor or the length of exposure to rich input, hence investigating which of the two factors has a stronger predictive power of L2 performance in adulthood.

3.3.4. Oral speech assessment. An average of 3 minutes of the recorded semi-structured interview responses of the participants were analyzed for oral speech proficiency following the framework of Saito (2015) (Appendix C). Oral speech production from interviews were found suitable for the study as spontaneous speech elicitation offers a richer and more comprehensive dataset of linguistic features, which allowed for a more accurate evaluation of a learner's spoken language capabilities compared to controlled speech tasks to measure L2 end state of spoken L2 attainment under natural language use conditions and a variety of features to evaluate (Yoon et al., 2013). The current study attempted to capture the effect of AoA on different oral speech domains through two sets of oral speech measures: 1) Oral speech **global measures**, represented in "comprehensibility" (ie.: the ease or difficulty to understand the speaker) and "accentedness" (i.e.: the degree of foreign accent in oral speech), and 2) Oral speech **local speech audio measures** represented in segmentals, intonation, speech rate, lexical appropriateness, lexical richness, grammatical accuracy and complexity.

The global and local measures were assessed by 2 experienced native English-speaking raters. The audio files of the 42 participants were shared with the raters (i.e.: 3 minutes per participant), without sharing the identification details of participants as all names were replaced with numbers. In addition, the audio files were all cropped to remove AoA related information so that the rater would not

have prior knowledge of a participant's age of acquisition to increase the objectivity and reliability of their judgements.

3.3.4.1. ***Assessed oral speech features.*** Following Saito (2015) description of the oral speech criteria of concern to this study, global and local measures were evaluated as follows: A segmental error was counted if the speaker made an individual consonant or vowel mistake, where the speaker added, omitted or substituted a one letter sound to a word.. Intonation describes the changes in pitch upon speaking, where normally the pitch goes up and down as we speak, if the speech was monotonous or did not follow English intonation patterns it was considered relatively poor intonation. Speech rate is the speed at which participants spoke, not too quick nor too slow, and should sound natural. Lexical appropriateness was considered high if the speaker uses frequent and accurate words and expressions in the English language without unnatural word choices or words from the native language to convey meaning. As for lexical richness, it indicated the sophistication of vocabulary used by the speaker that reflects variation and nuance. Grammatical accuracy, was evaluated according to the number of grammar errors made by the participant including word order errors and inflection errors, while grammatical complexity was assessed based on how sophisticated and elaborate the grammar structures a participant used versus how basic and fragmented their sentences were.

The above measures were assessed by the raters using a 9-point scale for each criterion over a duration of four hours, where their judgements were submitted via a google form (Appendix D).

3.3.4.2. Raters. Two expert native English-speaking raters were chosen for the study based on their nativeness and previous teaching experience as TESOL teachers to Egyptian students, which follows the definition of an expert rater according to Isaacs and Thomson (2013) and aligns with Saito's framework (2015). Evaluation criteria were explained by the researcher to the two raters in a one-hour online norming session to ensure the consensus of understanding and judgement between raters. During the norming session, the raters individually rated five participants, then the way they rated each participant was discussed with the researcher and with each other, this allowed opportunity for revisiting and elaborating on how the scoring guidelines should be applied, to ensure the consistency of ratings. After the submission of the ratings using google forms, Cronbach's alpha coefficient was calculated to ensure interrater reliability and the consistency of the ratings. Although written reflections on the process of rating was not required. Rater one, informally communicated her written observations and reflections to the researcher, where some of her key observations will be demonstrated in the results chapter.

3.4. Data Handling and Analysis

Data sorting and categorization was carried out using the sorting function in an MS Excel workbook. All the statistical analyses including the simple linear regression models, mean values, standard deviation values, t-tests, bar charts and scatter plots were also generated using Microsoft® Excel® for Microsoft 365. The correlation coefficients and R^2 values of the regression models were also calculated using MS Excel while the p-values to determine the significance of the contribution of each factor to the demonstrated change in participants performances were calculated using Graphpad online calculator at https://www.graphpad.com. Graphpad was also used before running the above-mentioned statistical analyses, to apply Grubb's test on all data sets to ensure the absence of any outliers that could weaken the reliability of the data

.

4. Chapter Four: Results

In this chapter, with the focus on understanding the impact of the age of acquisition (AoA) compared to the length of exposure to rich language input (LoE) on both lexical knowledge and oral speech performance in English as a second language, the results of the detailed investigation into the linguistic biographies, backgrounds and socioeconomic factors of the 42 study participants will be discussed in section 4.1; as collected through the LEAP-Q questionnaire and validated via the follow-up interviews. Section 4.2 represents the results pertaining to research question one (RQ1), quantitatively exploring the effect of the age of acquisition (AoA), along with LoE as an interfering factor, on the vocabulary size of participants. The results are represented graphically and described in terms of correlation and significance based on linear regression analyses which was selected for its suitability to describe how changes in an independent variable could influence a dependent variable, which is relevant to RQ1. Section 4.3 attempts to respond to research question two (RQ2), where the various global and local oral speech measures composing a participant's oral proficiency profile are explored in relation to the age of acquisition, and the results are also represented in scatter plots and statistically described.

The data have been analyzed to identify patterns and correlations that may contribute to inform on how early and continuous exposure to the target language influences later lexical attainment and oral proficiency compared to later exposure.

4.1. Study Participants' Linguistic Biographies

Initially, 73 participants responded to the LEAP-Q questionnaire, where information about their linguistic backgrounds was elicited via 86 question items. The questionnaire probed language experiences in terms of the number of languages known by each participant, language dominance, language use preferences, order of acquisition, percentage of current overall exposure to each language, the cultures each participant identifies with, level of education, and the years of formal education. Then the questionnaire elicited further information about each language a participant knows or uses, with focus on the age of acquisition, the mode of acquiring each language, reporting the number of years for each contributor to a participant's language acquisition (i.e.: living in a country that natively speaks the language, use of the language at home, educational and professional contexts). Then respondents reported on different language use and exposure experiences by assigning a scale point between zero and 10 to each (i.e.: Interaction with family and friends, cultural content through different media, reading, and self-instruction).

The answers of participants to the questionnaire were then validated via their responses to the 10–15-minute interviews conducted afterwards. The information elicited by the interview questions validated their self-reported AoA information by further probing into their perceptions of language experiences. For example, when asked how the age at which she started learning English has contributed to her current proficiency, participant 1, who was considered in the study as an early learner, replied *"I think the age impacts learning greatly, the way you are taught because of your age is different, the approach itself is different,.. at a*

younger age, it is easier" and when asked once more about the major contributor to her language development she answered *"…learning at a young age I think."*

Likewise, participant 4 reported their early acquisition as follows: *"It was at a very young age, when I first joined school, my family..it was important for them that I learn the language, I was in an English language school to begin with."* As for Participant 6, she said: *"I was in a national school, we started learning English in Kindergarten , I think I was 4 or 5,"* to validate whether this was consistent exposure without pauses she was asked about the number of years she has been exposed to the language without long pauses she replied *"I think 20 years….and during university I used to read the news in English, watch a lot of movies, and listen to music in English."* Participant 15, when asked about the age at which she started learning English, she answered *" Maybe at four years old, at school, KG1, it was through games and vocabulary. At six or seven they started making conversations with us."*

On the other hand, when asking participant 37 who was considered in the study as a late childhood learner replied *"…I think learning from a younger age is better….it affects me a lot actually, I think I cannot be like someone from a language school who started earlier."*

participant 38 reported: *" My journey started many years ago, as far as I remember in grade 4 or 5, I was in in a governmental school in Saudi Arabia back then, at the time in Saudi Arabia, they were not interested that much in teaching English at schools, but my parents had that interest to teach us, me and my brother, English and other languages, so they provided us with special English tutors, I remember in 6th grade I counted the numbers from 1 to 10 in English in class and the teacher was impressed."* As for Participant 40 when asked about his first exposure, he said *" at primary school I think, I think like 12"* and when asked how he thinks the

age at which he started learning English might have affected him, he continued*: "I think if I started before that, it was wonderful to started before 12, I know when I talk with someone, I understand his language, but my accent and my way to express what I want to deliver to him, I think I need to work on it more"*

As for participant 41, he reported: *"I think in school, we all learned English at school, I was drawn to music in general when I was in preparatory school, I didn't really like Arabic songs, so I went full ahead into English songs from that age, primarily music and movies, I used to watch a lot of movies"* and when asked about the age at which he started, he replied: *"In school, I think I was 12 or 13, but when I started actively seeking learning from music and movies, I think I was 15 or 16, before that it was minimal."*

Regarding the exposure to rich input, in addition to the 10-point scale responses for LEAP-Q question items, participants were also asked in the interviews to elaborate more on the input they have been exposed to and the ages at which this exposure occurred. For example, Participant 7 who was exposed to rich input in an early age said: *"I was born and raised in the UAE, I was in a British school system since kindergarten till my 7th grade, and then I came here to Egypt, it was an English school but with a national curriculum, back in the UAE, there were different cultures and different nationalities, so it was forbidden to speak in your native language because it was inappropriate to speak a language not everyone can understand, so English was the common language, so it was the language we spoke and taught "* when asked whether she has been exposed to English in a native community before the age of 4 when she started school she replied: "*I don't think so…. I had an aunt, she is English, she's British, so at school I communicated with my friends, with my teachers, when I get back home, I used to*

speak to my aunt and my cousins, all are either English from Britin or from America, while I was 4, like parallel with school, before school, I do not remember ."

Participant nine reported her consistent exposure to rich input at the age of four as follows *"..it was consistent I guess, my mother was an English major in college, so that of course helped me out, the thing that made me actually learn English a lot, is that I listen to music in English, and that I watched shows in English, I and my siblings speak in English all the time together...it just came naturally, I also had native friends online and we text each other a lot."*

Other participants reported their exposure to rich input at later ages despite their earlier first exposure at school, yet school instruction was considered of minimal contribution as the input did not rely on conversational or authentic approaches. For example, participant 14 said: *"For me…the major contributor... I think the internet, movies, songs, watching native speakers in podcasts"* and when asked about the age he started relying on those resources consistently, he answered: *"I think when I was like 14 to 16"* then later added *"a year ago I used to work in Hurghada for six months, I made friends there from different cultures, the only common language that we used at that time was English, I think that gave me the chance to practice English. "*

Participant 26 reported first exposure at school at the age of Six, however started their exposure to rich input later as he said: *"We can say that I started using English outside schools, like watching movies.. reading books, at 16 or 17 years old, I started to watch movies and series and started to read more, even if it was related to academic or not academic, it's become more at university because we read papers and books, and for me, my habits is that I read about economics and politics, sometimes I read in journals and websites in these fields in English."*

As demonstrated in the above examples the age of acquisition (AoA) which is the very first exposure to the language was set apart from the time at which a participant was exposed to rich linguistic input, where the length of exposure (LoE) was calculated by subtracting the age at which consistent exposure to rich input started from the age of the participant at the time of the study.

As shown in **Table 1**, the data collected via both collection tools about participants' biographical information was qualitatively coded and categorized under the following main themes: 1) Age of acquisition (AoA), which is the very first continuous exposure to the language 2) Exposure to rich input, whether a participant was exposed continuously to rich language input via engaging in authentic language contexts and exposure to input from native speakers. 3) The length of exposure to rich input, which is the number of years spent by the participant consistently and continuously exposed to such content, and 4) The knowledge of other languages and their order of acquisition.

Based on the analysis above, the test scores and oral speech performance of 42 participants with ages ranging between 23 and 28 (Mean=24.5) were selected for further analysis. This filtration was carried out to control language acquisition interfering biographical and linguistic factors as much as possible. All participants reported Arabic as their dominant language, English was their second language based on order of acquisition, while participants who reported English as their third language were excluded to attain a better control over the linguistic biographies of participants. All participants reported either no or very limited experience living in a native community, and their mode of L2 acquisition at the age of onset was mainly instructional, but all had the opportunity of continuous exposure to rich language

input that started at a specific age either via an international school system, native teachers, extensive exposure to English cultural content through media, online gaming, or in professional contexts where a participant was highly engaged in interactions with native speakers.

Table 1:
Participants Ages of Acquisition and Length of Exposure to Rich L2 Input

	Participant number	**AoA**	**Age at exposure to rich input**	**Length of Exposure to rich input (number of years)**
Early simultaneous acquirers	1	3	3	24
	2	3	3	21
	3	3	3	20
	4	3	3	21
Early sequential acquirers	5	4	4	21
	6	4	4	20
	7	4	4	20
	8	4	4	20
	9	4	4	19
	10	4	6	18
	11	4	6	18
	12	4	10	13
	13	4	13	12
	14	4	15	9
	15	4	16	8
	16	4	18	6
	17	4	21	2
	18	5	5	23
	19	5	12	12
	20	5	18	7
	21	6	6	18
	22	6	6	20
	23	6	6	22
	24	6	12	14
	25	6	15	13
	26	6	16	10
	27	6	20	3
	28	6	20	7
	29	7	7	17
	30	7	16	7

Late sequential acquirers	31	7	16	7
	32	8	18	6
	33	8	18	5
	34	9	14	9
	35	9	14	9
	36	9	15	12
	37	9	15	8
	38	9	16	11
	39	10	16	10
	40	12	12	11
	41	12	15	10
Late acquirer	42	15	17	7

4.2. RQ1: AoA Effects on Lexical Knowledge

Research question one (RQ1) is concerned with how far early L2 acquisition could be advantageous over late L2 acquisition with regards to L2 lexical knowledge later in life. Therefore, the vocabulary size of the study participants was measured using the PPVT-5 aural vocabulary knowledge testing tool. Standard test scores of the participants are demonstrated in **Table 2,** where the overall mean score is 83.6 with a standard deviation of 14.3. The mean score for the early childhood sequential acquirers and the late childhood sequential acquirers is 86.6 and 76.4 with a standard deviation of 4.2 and 3.2 respectively. The early simultaneous and the late learners' groups were excluded, owing to the small sample sizes. To ensure the normality of data, Grubbs' test was run on all the datasets in the study, and no significant outliers were detected.

Table 2:
Descriptive statistical analysis of the PPVT-5 test scores

	Mean	**SD**
All participants	83.6	14.3

Early childhood sequential acquirers	85.2	14.5
Late childhood Sequential acquirers	77	7.8

4.2.1. AoA and Test Scores Correlation. To investigate the strength of AoA as a factor influencing the lexical knowledge of participants, linear regression analysis was run to identify the correlation between the AoA as an independent variable, and the standard test scores of PPVT-5 results as shown in the scatter plot in Figure 2. The regression model showed a strong negative correlation between the age of acquisition and the dependent variable of vocabulary size represented by the PPVT-5 standard scores. The AoA correlation coefficient is equal to (-2.4143) with a significant p-value of ($0.0018 < 0.05$). Which indicates a linear relationship between the age factor and vocabulary knowledge; elaboratively, the results show that the smaller the value of the AoA, the higher the standard score of a test taker could be.

To evaluate the interference of the length of exposure (LoE) to rich input as a predictor of vocabulary knowledge, another linear regression analysis was conducted to evaluate its influence on the test results, and as shown in the scatter plot in **Figure 3,** a significant positive linear correlation exists between the LoE variable and the test results, with a correlation coefficient equal to (0.9756), and a significant p-value of ($0.0056 < 0.05$), indicating that the longer the exposure to rich input the higher the test scores could be, yet the correlation is less significant than that of the AoA. From which it could be inferred that the age of acquisition might be a stronger predictor of lexical knowledge than the length of exposure in

L2 learners who have been learning the language mainly within instructional contexts, or at least for this group of participants. Hence, it could be concluded that early childhood learners might be at advantage compared to later acquirers.

Figure 2:

Scatter Plot of PPVT-5 Test Scores in Relation to Age of Acquisition (AoA)

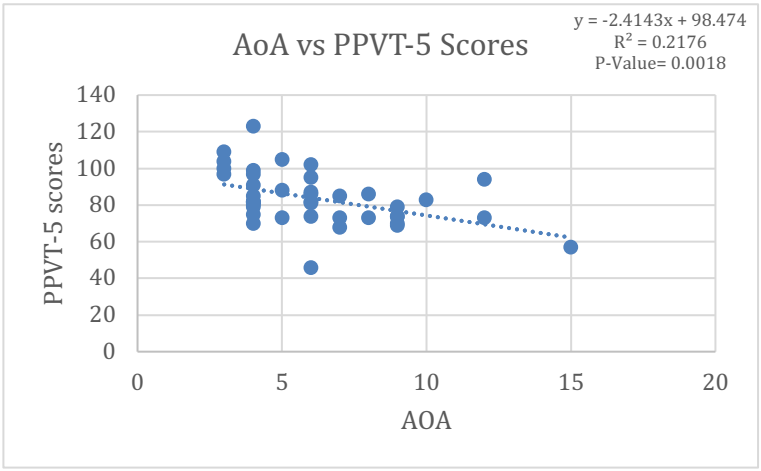
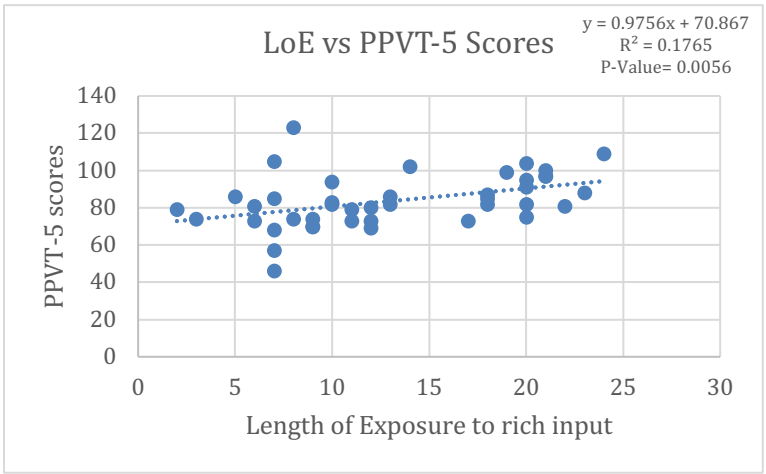


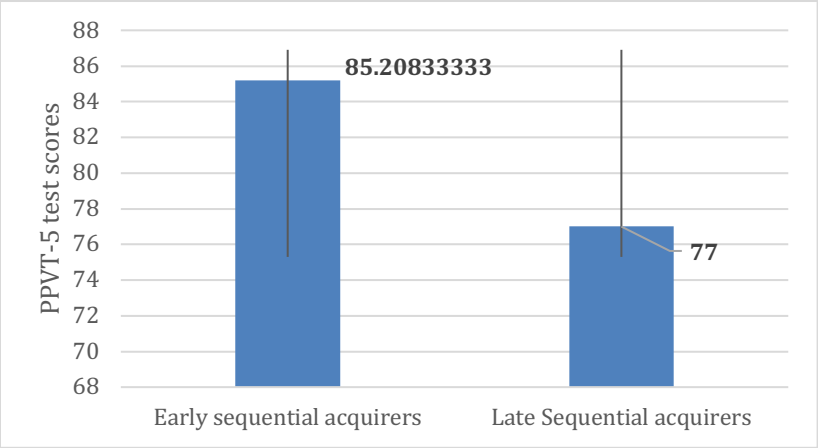
Figure 3:

Scatter Plot of PPVT-5 Test Scores in Relation to Length of Exposure to Rich Input (LoE)



4.2.2. Early Childhood Sequential vs Late Childhood Sequential Acquirers. Upon running intergroup comparisons, the early simultaneous and the late learners' groups were excluded, for the small sample sizes as mentioned earlier. An intergroup comparison was run between the early sequential (n=24) and the late sequential groups (n=13) to explore if early childhood acquirers are at an advantage compared to later childhood acquirers, as listed above in **Table 2**, The mean scores and standard deviations of the test scores of both groups were calculated and graphically represented in **Figure 4.** Since the ratio between the standard deviation values of both groups is equal to 1.8 > 4 according to the variance rule of thumb, the assumption of unequal variance is excluded. Hence, a paired t-test analysis was suitable to be performed in order to evaluate the significance of intergroup score differences. The p-value was found to be equal to 0.0641 > 0.05, which shows very low or non-existent statistical significance between group scores. This may indicate minimal or no advantage for the early sequential learners over the late sequential learners till the age of 12 in terms of lexical knowledge attainment.

Figure 4:
PPVT-5 Scores in Early Sequential Acquirers (4-6 years old) and Late Sequential Acquirers (7-12 years)



Graphical representation of PPVT-5 scores showing no significant difference between early sequential acquirers (4-6 years old) to the late sequential acquirers (7-12 years) (p-value= 0.0641)

4.3. RQ2: AoA Effect on Oral Speech Performance

The oral speech performance of the 42 participants was evaluated by two expert raters against nine criteria guided by the framework of Saito (2015) using a nine-point scale for assessing each criterion. The raters qualitatively assigned a point from zero (non-target language like) to nine (target language like) to evaluate global measures of oral speech (i.e.: accentedness, and comprehensibility); then local oral speech measures were evaluated using the same nine-point scale (i.e.: segmental errors, intonation, speech rate, lexical appropriateness, lexical richness, grammatical accuracy, and grammatical complexity). Average ratings were calculated for each participant for accentedness, and comprehensibility separately, while the average ratings of the local oral speech measures, including all the sub-measures of pronunciation, fluency, vocabulary, and grammar, were calculated separately and as a whole. Cronbach's alpha coefficient was calculated to assess interrater reliability, yielding an acceptable value of 0.66, indicating a moderately high agreement between raters'

judgements. The mean value of each measure is shown in **Table 3.** A paired two tail t-test analysis showed that comprehensibility ratings were significantly higher than accentedness and higher than the local measures (p-value=0.00 < 0.05), which may indicate that the attainment of a high or low oral speech nativelikeness could only be viewed as domain specific, and that language acquirers of different AoAs may not uniformly develop across all L2 speech domains.

Table 3:
Descriptive Statistics of Global and Oral Speech Measures

	Accentedness	Comprehensibility	Local oral speech measures
Mean	**4.1**	**6.7**	**6.0**
SD	**1.0**	**0.9**	**0.9**

4.3.1. Global Measures. Both global measures were generally and subjectively judged by the raters with reference to their spoken native oral production familiar to them, yet the high interrater agreement somehow supports the reliability of their judgements. Linear regression analysis, graphically represented in Figure 5, showed that accentedness negatively correlates to the age of acquisition with a correlation coefficient of -0.1859, and a p-value of 0.0005 < 0.05, and an R^2 of 0.2647, which means that 26% of the influence on the measure of accentedness possibly owes to the age of acquiring a language. Indicating probable strongly significant influence of the factor of AoA on accentedness, where the older the age of acquisition the more likely foreign accentedness is observed in a learner's oral speech.

The length of exposure to rich content of the target language (LoE) has also shown a quite significant positive correlation with a coefficient of 0.0582, and a p-value of 0.0195 < 0.05. Yet, the AoA is by far a stronger predictor of either nativelikeness or foreign accentedness, based on this analysis. Likewise, as demonstrated in the scatter plot in **Figure 6**, the measure of comprehensibility has shown a significant negative correlation with the AoA, and a significant positive correlation with the LoE, with correlation coefficients of -0.1503, and 0.062, and significant p-values of 0.002 and 0.0056 respectively.

Figure 5*:*

Scatter Plots Representing the Correlation Between AoA, LoE and Accentedness

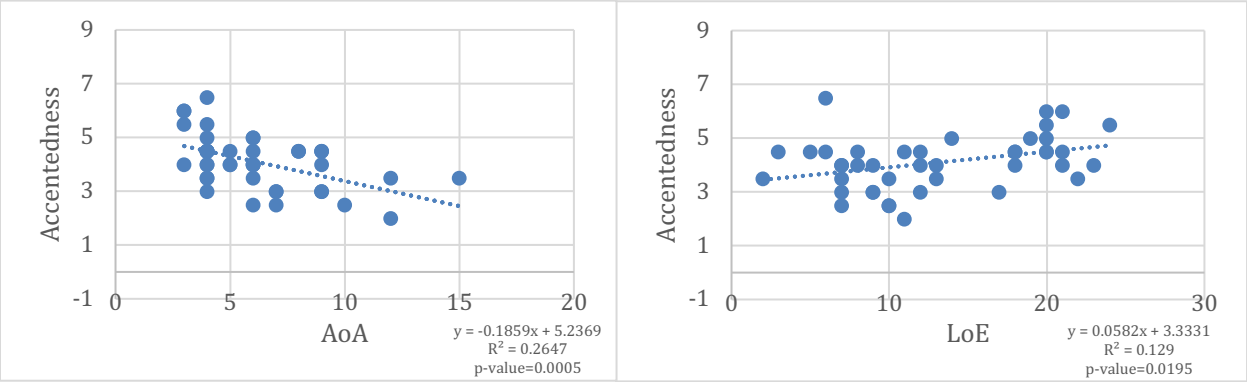
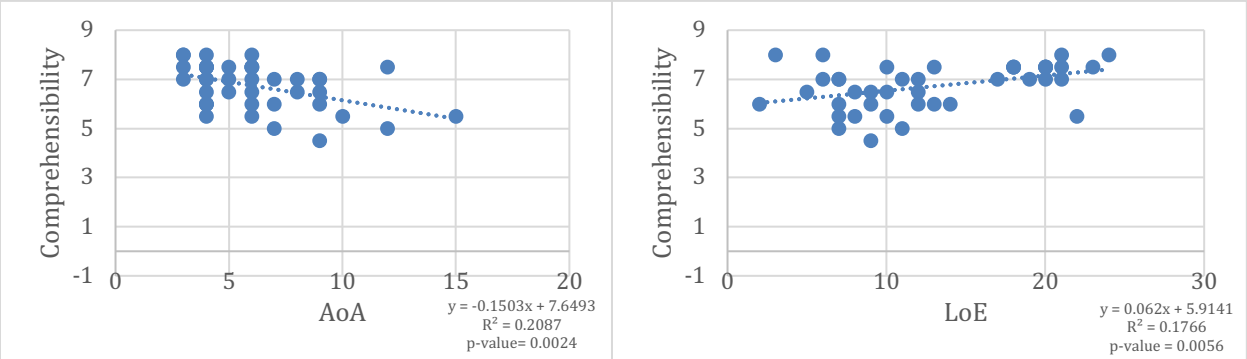


Figure 6*:*

Scatter Plots Representing the Correlation Between AoA, LoE and Comprehensibility

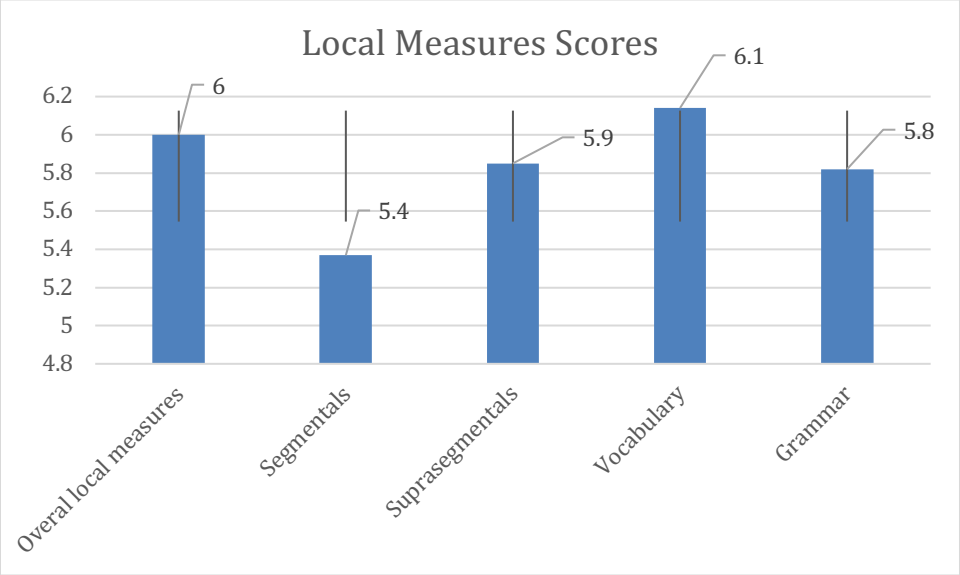


4.3.2. Local Measures. The way local measures were rated followed the descriptors of Saito (2015) and were discussed and shared with the raters during the norming session (Appendix E). With a modification to Saito's framework, the raters evaluated each criterion based on a 9-point scale, which is a commonly used scale as it achieves a balance between the granularity required to capture the measured criteria and the ease of use by the raters (Dawes, 2008). All criteria followed the same description of the scale points with one at the non-target like end, and nine at the target like end (Appendix D). Also unlike Saito's framework, raters in this study evaluated participants' speech only by listening to the audio files without relying on interview transcripts. Although Saitio 2015 preferred transcripts for the vocabulary and grammar measures to avoid the influence of foreign accent on a rater's judgement, this study preferred the audio files to avoid the confusion that may arise because of the differences between spoken grammar and literate grammar, where spoken grammar is more described as units of ideas rather than complete sentences (Luoma, 2004). The mean scores for all the rated qualities are visually represented in **Figure 7,** where the overall score for the local measures as a

whole for the 42 participants was equal to 6.0, while the mean score for segmental errors was 5.4 with the highest variability in scores among participants, and a mean score of 5.9 for the suprasegemntals (i.e.: intonation and speech rate), and 6.1 for the vocabulary qualities (i.e.: Lexical richness and lexical appropriateness), and finally 5.8 for the grammar qualities (i.e.: Grammatical accuracy and Grammatical complexity).

Figure 7:

Mean scores of the local oral speech qualities and measures



Elaboratively, a segmental error was considered in case of faulty vowel or consonant pronunciation, as in the case of changing, adding a sound, or the omission of a phonological feature that is usually expected to be heard in a range of varieties of native speech, making it less target like, as in the case of the ‘th’ sound being pronounced as ‘z’ and ‘een’ rather than ‘in.’ For example, participant 30 who had been

rated with an average overall score of 4.1 and a score of 3.5 for segmentals, which fall at the lower end of the local measures scale, would say the word “Learned” with emphasis on the “ed,” and ‘Sixeteen’ instead of ‘sixteen,’ ‘friendes’ instead of ‘friends,’ and ‘abouet’ instead of ‘about’ with an addition of an extra syllable to the word which is noticed in the added letter ‘e’ upon pronunciation. Participant 31, who scored an overall average of 4.7 and also 3.5 for segmentals would pronounce ‘onn’ instead of ‘on,’ and ‘stob’ instead of ‘stop,’ and ‘collej’ instead of ‘college’

As for suprasegmentals and the evaluation of prosodic criteria (i.e.: intonation and pitch variation), an interesting remark was shared by rater 1, as she reported the following observation: “I had an interesting observation on the intonation – a lot of the participants raise their pitch at the end of sentences, even when making a statement. This I thought was interesting because I haven’t really noticed it before. Whilst listening to the participants I realised that this is a more common occurrence. The raising of pitch at the end of statements. In L1 English (that I know) we tend to only inflect at the end of sentences, when we’re questioning or showing uncertainty (like an implied question).”

As for the speech rate criterion, a participant who frequently paused after each word, or use frequent fillers like ‘aah’ or ‘um’ would score towards the lower end of the scale, as in the case of participant 20 who despite scoring an overall of 5.8, scored 4.5 for speech rate because the pauses between words were relatively longer than average, and with very limited occasions of linking words. Participant 42 frequently used fillers or resorted to repeating words to extend time before making a vocabulary choice.

As for the vocabulary measures, they evaluated according to lexical appropriateness and lexical richness. Lexical appropriateness was considered less target like if a participant's word choices were inaccurate or bizarre and do not deliver the message intended correctly, while a more target like production properly used accurate expressions that are idiomatic and sounded natural. Below is an example from participant 35, who scored an overall score of 5.1 and scored 6.0 for lexical appropriateness which is considered averagely target like:

"In my high school I had to choose French or Deutch or Germany, so I chose Germany, but I unfortunately now I remember nothing from it" and in another instance he completed "in my free time I practice with strangers."

As observed, there were faulty word choices as in the case of 'Germany' instead of 'German,' and redundantly mentioning 'Deutch' and 'German' as two different languages, while in the second occurrence, he used the word 'strangers' instead of 'foreigners'

More towards target like production, participant 1 scored an overall of 7.6 and scored 8 for lexical appropriateness, an extract below demonstrates her proper use of vocabulary:

"Actually, I was traveling for a competition…maybe at first you feel your hands are tight, using the language for the first time, exclusively for the first time, you have to recall everything on spot, we had to explain everything in English"

Lexical richness measured how sophisticated, nuanced and varied vocabulary used were, as in the extract from participant 24 below, who scored an overall of 7.1, and

8.5 for lexical richness which is a very high score on the scale, he managed to elaborate on his ideas using varied word choices and nuanced descriptions:

"I indirectly learned the language just because I was imitating the media I was consuming" and when asked about how he believes the age at which he started learning English influenced him, he replied: "I would say it gave me that weird accent, you could tell I am not a native speaker just because the heavy way we pronounce things in Arabic, it just crawls its way into my English, my English is not like smooth, people who natively speak English.. they have this smooth transition between..umm...I don't know how to say it….their words are not as choppy as mine"

As for the Grammar accuracy criterion, it was evaluated based on the frequency of grammar errors a participant makes, as in the extract below from the interview with participant 28, who had an overall score of 6.1, and a score of 5 for Grammatical accuracy, which is an average score on the scale

"I have my aunt, she's in the united Arab Emirates, she has two children, they speak English so amazing, they are in international school, so when they come to Egypt in vacations and so on and I start talk with them I feel like there's a huge English level between me and them, however they speak very easily and express themselves in very perfect ways " …"when I have something to do it, I just do it, but right now we just work on the technical skills"

Although the participant used different structures properly, some occasional errors compromised his score, where there was incorrect use of adverbs and prepositions, awkward phrasing, and redundancy. Such as using 'amazing' instead of

'amazingly,' missing articles such as omitting 'an' from 'they are in international school', awkward phrasing like 'huge English level' instead of 'huge difference in English level,' and redundant words like 'it' after 'something to do.' Additionally, 'perfect ways' should be 'perfectly' for correct expression.

Finally Grammatical complexity was considered more target like if it was varied, sophisticated and elaborate, while considered non-target like if the structures used were basic, simple and fragmented.

The extract below from the interview of participant 39 shows a non-target like grammar complexity:

"I really want to be fluent in English and I excited to make that, but I don't have time this days or this months as we focus on our programming skills and working skills in mobile development, so I will start my online courses after this diploma"…."I think I have spent most years without learning English and it was a disability, I will not spend any time wasting..uhh.. I will not waste my time at all after that, I just wait the chance to start improve my skills in English"

This participant scored an overall of 4.7 and 4.5 for Grammatical complexity, which tends more towards the non-target like end as the sentences are all straightforward and simple with limited variation in verb tenses and minimal elaboration. In contrast participant five scored 6.8 overall, and 7.0 for grammar complexity where more elaborate and varied grammar was used when she was talking about her experience as a call center agent as follows: "I also gained a lot of confidence in my English, because usually..I am not bragging but..usually they wouldn't know I'm an

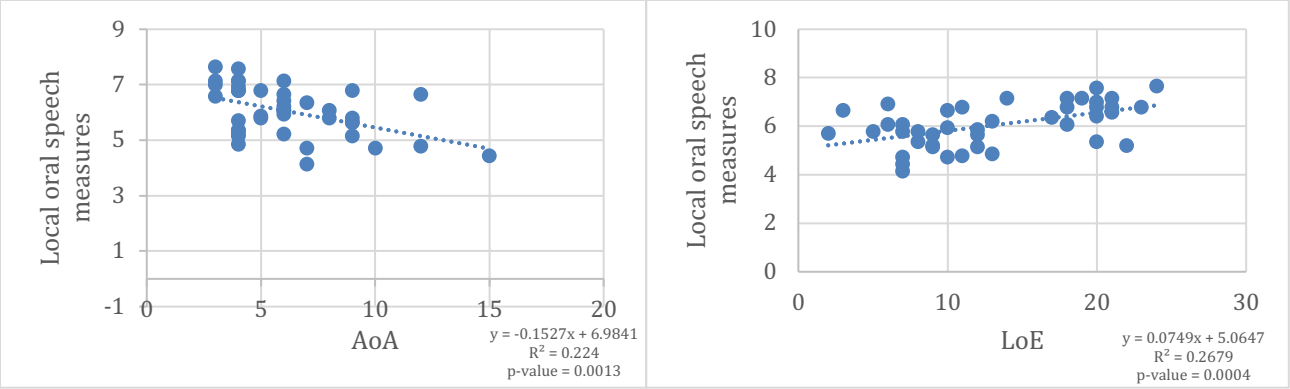
Arab, they knew I had a kind of accent, but they would guess I am European, they wouldn't guess I am an Arab, so I would be very confident, Americans didn't know I am an Arab, I feel Arab accents are kind of thick so they didn't think that…..I feel like I would usually overthink the grammar when I am talking to them"

The participant here used more varied grammar, where she used coordinating conjunctions such as 'but' and 'so,' in addition to elaborative and sophisticated structures to express self-reflection like 'I feel' and 'I would usually.'

As for putting the ratings and raters' judgements into a statistical perspective through correlation analysis, the regression models for the local measures of oral speech in Figure 8 also showed significant correlation to AoA and LoE. With correlation coefficients of -0.1527 for the AoA variable, and 0.0749 for the LoE variable, and significant p-values of 0.0013, and 0.0004 respectively.

Figure 8*:*

Scatter Plots Representing the Correlation Between AoA, LoE and Local Oral Speech Measures



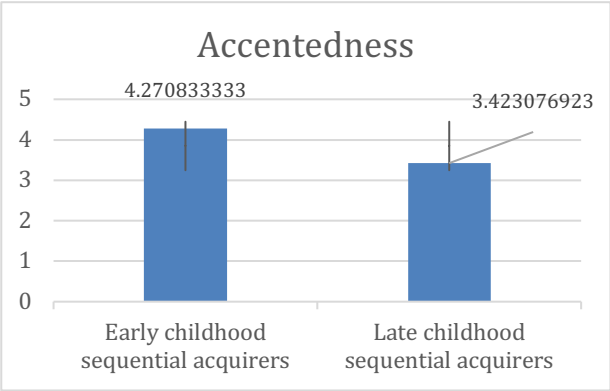
4.3.3. Oral speech of Early childhood sequential vs Late childhood sequential acquirers.

Intergroup comparisons using a series of two tailed t-tests between the early childhood acquirers and the late childhood acquirers has shown advantage in favor of the early acquirers with regards to both global measures and local measures based on raters' judgements of participants oral speech. With significant p-values of 0.006 < 0.05 for accentedness, 0.015 < 0.05 for comprehensibility, and 0.02 < 0.05 for the local speech measures (**Figure 9**). With accentedness being the most sensitive to the age factor based on the p-values calculated.

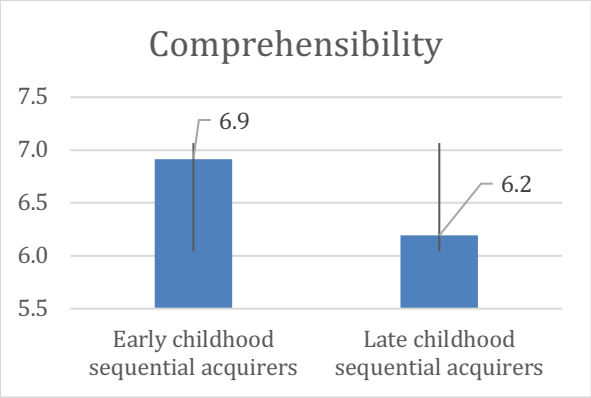
Figure 9:

Intergroup comparisons for the Raters' Scores for global and local oral measures

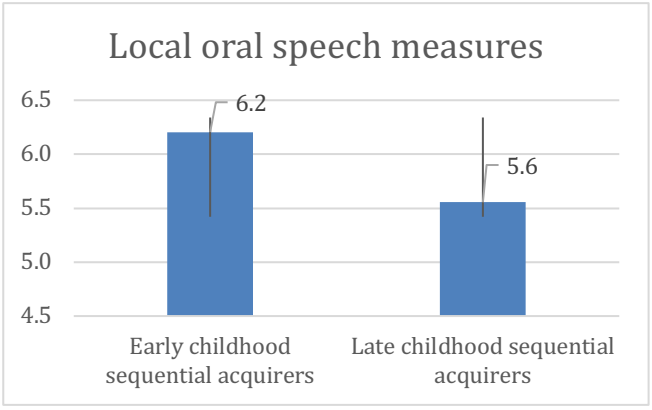
(a)



(b)



(c)



Graphical representation of raters scores showing highly significant difference between early childhood sequential acquirers (4-6 years old) and the late childhood sequential acquirers (7-12 years) for (a) accentedness,(b) comprehensibility, and (c) the local speech measures.

4.4. Conclusion

The findings support the existence of a strong negative correlation between AoA and lexical knowledge, as well as a strong positive correlation between lexical knowledge and the length of exposure to rich linguistic input of the target language. Suggesting that earlier exposure to L2 could possibly predict a broader vocabulary size later in life. The intergroup analysis showed that early acquirers, particularly those exposed to English before the age of six, demonstrated higher vocabulary test scores compared to late acquirers. However the results of early acquirers were not significantly higher (p-value=0.06). This suggests that the timing of initial exposure to a second language may result in relatively similar L2 lexical attainment among early childhood sequential learners aging between 4 and six, and late childhood sequential learners aging between seven and 12 years old at the time of acquisition onset.

Participants who had prolonged and continuous engagement with English, whether through international school systems, media, or professional interactions, showed higher

language proficiency. The analysis of oral speech performance in relation to the factor of AoA and length of exposure (LoE), showed that early acquirers' oral speech was relatively more like the target language in terms of accentedness, and with higher comprehensibility ratings, indicating that earlier and longer exposure contributes to better attainment of oral language skills. The highly significant negative correlation between AoA and the accentedness measure suggests that early exposure reduces the degree of foreign-accented speech of an L2 learner, contributing to higher nativelikeness of L2 oral production. Additionally, the positive correlation between length of exposure to rich input and oral speech proficiency ensures the cumulative benefits of extended interaction with the target language. However, the significant difference between accentedness and comprehensibility may indicate a weak relationship between both measures, where nativelike accent does not necessarily reflect in an oral speech discourse that is easier to understand.

In summary, the findings highlight the importance of Age of Acquisition (AoA) and Length of Exposure (LoE) in determining L2 lexical knowledge and oral proficiency in adult learners. Early exposure to L2 generally leads to a larger vocabulary and more nativelike speech, although the significance of the differences between early childhood and late childhood acquirers is not boldly pronounced. The results suggest that both the timing of L2 onset and the quality of sustained linguistic input are both significantly important, with AoA slightly more influential in shaping linguistic outcomes within the context and specifics of this study.

5. Chapter Five: Discussion

This study intended to explore part of the effects of the age of L2 acquisition within the context of the Arabic-English language pair. The study was concerned with learners who had acquired English mainly in an instructional setting, with chances of exposure to rich linguistic input, yet with limited experience in a native community or an immersive acquisition setting. The study attempted to contribute to the body of findings present in literature with regards to addressing two main research questions:

1) *How does early bilingualism affect English lexical knowledge compared to late bilingualism for adult Arabic speakers learning English as a second language?*

2) *How effectively does the age of acquisition (AoA) predict oral proficiency in English for adult Arabic speakers learning English as a second language?*

Guided by previous literature, the study addressed the effects of AoA cross-sectionally using a multidomain approach owing to the complexity of the bilingual phenomena and to its high variability in form among L2 learners; especially with the well-established notion that some language subskills are more sensitive to age effects compared to others.

The following sections reflect on the findings' interpretation and demonstrate how they link or deviate from different scholarly work in that domain. In addition to furnishing the possible practical and educational implications of those findings. This chapter is also concerned

with the limitations of the study and the suggested directions for further research, if more generalizable findings and a broader view of the effects are aimed at.

5.1. Summary and Interpretation of the Findings

To explore AoA effects on Lexical attainment and oral speech, the linguistic biographies of 42 Egyptian Arabic speaking adults who are learners of English as L2 were analyzed. The study attempted to control for the variations among participants in terms of the educational background, the age at the time of testing, the exposure to rich L2 input, the instructional mode of acquisition, being at an intermediate level of proficiency or above, and the considerable current use of English as L2 for different purposes. The AoA variable was compared to the length of exposure to rich input (LoE) as a key confounding factor to the effects of AoA.

5.1.1. Lexical Knowledge and Age of Acquisition. The study findings with regards to lexical attainment have shown a highly significant negative correlation to the age factor. Elaboratively, aural receptive lexical attainment could be strongly influenced and mediated by the age of first consistent exposure to the language, where the earlier the AoA, the broader the lexical knowledge of a learner could be as an adult, and vice versa. Despite this being an intuitive finding, it may not per se offer evidence to the presence of a maturational constraint or a limited window for language acquisition, yet it is a finding that opens the door for further questions within the context of the CPH, owing to the lower predictive power of the factor of LoE for vocabulary size in this study.

Another interesting finding that pertains to the vocabulary size is the score variation between two groups of participants who both fall under the cut-off age

suggested by the CPH position in literature (i.e.: less than or equal to 12 years old). Although the difference in the mean value of scores between the early childhood acquirers (four to six years) and the late childhood acquirers (seven to12 years) was found to be statistically insignificant (p-value = 0.06 > 0.05), there is still an observable difference supported by two things, the noteworthy borderline p-value which is slightly above the 0.05 threshold, and the regression analysis suggesting a linear relationship between the age factor and the scores. Which might hold an implied probability of finding a higher significance if the sample sizes were larger.

The above results do partially align with the findings of Hellman (2011), which is one of the key studies guiding the current research in approaching age effects on vocabulary knowledge, but in a naturalistic acquisition context, as it also measured different aspects of lexical proficiency including the depth of vocabulary knowledge (i.e.: how far a bilingual knows about a word), and the vocabulary size (i.e.: how many words a bilingual knows), using PPVT-4 vocabulary test from Pearson assessments for evaluating receptive aural vocabulary knowledge. Hellman's study came down to the conclusion that the lexical domain is one of the least affected by the age factor, and that ultimate attainment of L2 lexicon could be highly successful in the case of adult L2 onset, especially on the written measures and depth of word knowledge; however, there was a significant difference in adult non-native acquirers compared to monolingual native speakers, the difference was primarily due to the lower scores achieved in the PPVT-4 aural vocabulary size measure. Hellman argues that the average native speaker's vocabulary size is not large enough to make it impossible for a non-

native to acquire a comparable range, however states “This is not to debate that some aspects of the L2 lexis may be age constrained, particularly those that are dependent on aural processing, processing speed, or mental statistical calculations, namely lexical decision tasks, collocations, multiword units, idioms, and colloquialisms.” Emphasizing that there are areas of the lexicon that could still set a late bilingual apart from a native speaker, and native like lexical attainment is not that common among adult late acquirers.

Spadaro (2013) also interestingly provided evidence to the presence of a maturational constraint on the acquisition of L2 lexicon. Even more interestingly, coming down to suggesting the age of six as the cut-off point for peak sensitivity to acquiring second language vocabulary with focus on lexical and collocational measures, which is somewhat congruent with the results obtained by the current study. Spadaro based this conclusion on her interpretation of the test battery results she used for comparing a group of early childhood acquirers (below six years of age) to a group of late childhood acquirers (from seven to 12 years of age) to a group of late acquirers (13 years of age or above), where the seven to 12 acquirers performed similarly to the 13+ group. An important mechanism that might be explanatory to the early acquisition advantage observed here, which Spadaro refers to as well, is what Ellis (1995) demonstrates about a very important feature of the lexicon, that a word is represented in the learner’s mind initially as phonological strings, which requires the ability of the learner to be aware of a language’s phonology and syllabic structures, the repetition of those phonological strings makes them available afterwards in the long term memory,

hence, automatized and acquired successfully. This interface, linking the phonological domain, which is known to be the most sensitive to age effects, to vocabulary acquisition may offer logical explanation to the sensitivity of aural receptive lexical attainment to the age effect as well, which may apparently reflect in a relatively narrower or broader vocabulary size based on the AoA.

In light of previous literature, the findings of the current study could be quite interesting, especially with its focus on classroom foreign language learners, which is a cohort that is relatively underrepresented in age related SLA research. In addition to its focus on the Arabic-English language pair that is scarcely researched as well with regards to age effects.

5.1.2. Oral Proficiency and Age of Acquisition. Investigating the age effects on the attainment of L2 oral proficiency was carried out qualitatively based on the judgements of native experienced raters. The raters evaluated the degree to which oral production is either target like or non-target like. The criteria used to evaluate oral speech were concerned with two global measures which are accentedness (i.e.: the lack or presence of foreign accent), and comprehensibility (i.e.: how easy or difficult it is to understand the speaker). In addition to a number of local measures including pronunciation, fluency, vocabulary, and grammar.

The results revealed the very high significance of earlier language acquisition in mediating a more target like accent compared to the role of rich input quantity (LoE), with an effect size of 26% to 12% respectively, despite LoE being a significant factor itself. As for comprehensibility ratings, they were interestingly higher than the other two

measures, suggesting the relatively weak contribution of foreign accentedness in how difficult a speaker is understood. Comprehensibility ratings were also significantly higher than those of local measures, which could be due to the lower scores of the pronunciation qualities (i.e.: segmentals) compared to the vocabulary and grammar sub-measures. However, comprehensibility was slightly more affected by the AoA compared to the LoE, with effect sizes of 20% and 17% respectively.

Local measures at large were found to be significantly impacted by both, the AoA and LoE with the length of exposure to rich input having a higher predictive power with an effect size of 26%, while the AoA effect size was 22%, based on the regression models showing a decline in ratings with older ages and an increase in ratings with longer exposure to rich content.

Saito et al (2015) suggested that AoA is a stronger predictor for oral proficiency with regards to segmental and prosodic qualities. But the findings for local speech measures in this study could rather be interpreted as an interaction between both variables of AoA and LoE mediating the form of attainment observed in the study participants, since the local measures were evaluated statistically as one unit. With consideration to the possible effects of speech rate and lexicogrammar on raters' judgements, as two sub-measures that might not be as sensitive to age effects as other domains, the stronger predictability of LoE for local speech measures could be explained in alignment with Saito's findings as well, where he referred to the key role of extensive exposure to L2 input in realizing an optimal level of speech rate and a proper use of lexicogrammar, regardless of the age of L2 onset.

Like lexical attainment, another important finding is the advantage early childhood acquirers seem to have over late childhood acquirers, despite them both falling under the offset age of 12 based on the agreement of many enthusiasts for the critical period hypothesis. Although some researchers explain this as a domain specific closure of several maturational windows (Granena & Long, 2013), this could also be addressed with further investigation to determine whether this decline is in fact a result of a maturational constraint that is domain specific, or it is a gradual decline resulting from the competition of two language systems in the learner's mind, as L1 becomes more established and almost complete by the age of six to seven years old (S. A. Montrul, 2008).

Although the AoA factor was found to show considerable predictive power to most of the features investigated in the study, it is important to note that the above results cannot definitely nor absolutely support the CPH position over the CAH position, yet it highlights the significant role of the age factor without eliminating the possibility of ultimate attainment of late L2 acquirers across the different linguistic subskills.

5.2. Implications for Language Learning

The role of age effects in L2 acquisition is one of the drivers of educational policies and decisions. In the United States for example, explaining the age factor effects from the CPH point of view contributed to decision making with regards to how early immigrant children should be introduced to English and when foreign languages should be taught in school (Hakuta et al., 2003). The idea that " the younger, the better" has been promoting the decisions of educators,

where policy makers usually push for foreign language learning in elementary school stage across different school systems worldwide. Some European school systems experimented with introducing foreign language education in grades 1 or 2, however, enrollment in foreign language classes as early as 8 years old to 14 years old, has shown no additional benefit over enrolling from the age of 11 to 14 (Caldwell-Harris, 2023). De wilde et al.,(2020) explains this as a result of how the language is taught in the school setting, emphasizing that successful acquisition is usually reported in children who relied on rich and interactive input outside the classroom.

As for the current study, the findings are in line with this aforementioned understanding of De wilde et al. The role of AoA is in fact very important and is might be capable of leading to a more successful attainment later in life but this is only achieved through an orchestration of several important factors, including the exposure and accessibility to rich L2 input. An understanding as such is particularly important not only for policy making on the most convenient age to introduce foreign language, but age related L2 educational decisions should also encompass how the foreign language is taught in the classroom, and whether ample chances for interactivity and extensive exposure to rich input are provided.

Ioup (1994), also emphasizes the importance of enough exposure to L2 at school for successful L2 attainment, where the long hours of exposure at school on both the academic and social counts greatly impact the final outcomes, and that the lack of exposure due to irregular attendance or the domination of a different language in the community could lead to compromised attainment.

The above literature aligns with this study findings, in the sense that AoA is a very important factor to consider while introducing language learning frameworks and designing school systems, yet exposure to input should go hand in hand with it to realize successful attainment. It is also worth noting that a comprehensive understanding of the age factor views age as an “organizational factor” in L2 learning since early exposure itself triggers and enables other social and attitudinal factors that could promote the growth and development of L2 proficiency (Caldwell-Harris, 2023).

5.3. Study Limitations and Future Research

This is a cross-sectional study, so despite adopting a rigorous data collection tool such as the LEAP-Q questionnaire, then following up with an additional layer of interviews for validation, an important limitation to the study is that the information about linguistic biographies is mainly self-reported, which is one of the major challenges encountering research in the domain of age related effects, which makes longitudinal studies in the domain a sensible direction through which a more complete yet accurate picture of the role of age in language acquisition could be painted.

Another key challenge is the limited sample size, and although this was compensated for through ensuring the convenience of statistical analysis tools used, and through ensuring proper data cleaning, handling, and categorization, the generalizability of the findings should only be approached with caution and in light of previous findings already existing in the literature. The study also separately built regression models for investigating the correlation the age and the input variables with different L2 subskills, however, the interaction between both variables was not possible to be captured in the study owing to the small sample size. Where

future research could consider building multiple regression models in order to capture an interaction among different variables.

The study was concerned with exploring the age effects on the lexical domain, however only one feature of the lexicon was studied, which is the vocabulary size, it is yet important for a clearer vision for understanding lexical attainment in relation to age of acquisition is to complement the current view with vocabulary knowledge depth and to go beyond the receptive aural knowledge of words. In addition, the consideration of participants with an age of onset that is below the age of 3 as simultaneous acquirers, and participants above the age of 12, or 15 as late acquirers would definitely contribute to a more complete and elaborate view of age effects.

An important methodical challenge as well was the familiarity of the oral speech raters with the native Arabic speaking learners, which might have caused a tendency towards higher ratings for comprehensibility, which might be compensated for in future research if judgements of inexperienced native speakers were used along with the ratings of experienced raters.

Conclusively, future research may consider longitudinal design to better capture the dynamic nature of L2 acquisition over time. Additionally, expanding the sample to include learners from different linguistic and cultural backgrounds would enhance the generalizability of the findings. Further investigation into the interaction between AoA, LoE, and other factors, such as motivation and language learning strategies, would also provide a more comprehensive understanding of the determinants of L2 proficiency.

5.4. Conclusion

This study has attempted to shed light on the complex interplay between the age of acquisition (AoA) and the development of lexical attainment and oral proficiency in English as a second language among adult native Arabic speakers in Egypt. Through a mixed-methods approach, the research explored how early and late childhood acquisition could impact language performance, particularly focusing on the comparative advantages of early sequential versus late sequential bilinguals.

The findings of this study suggest that while early bilingualism does offer certain advantages, particularly in lexical knowledge, and global speech qualities, especially accentedness, the age of acquisition is not the sole determinant of proficiency. Exposure to rich linguistic input over time contributes significantly to building a learners' capabilities in both lexical richness and oral proficiency.

Additionally, the study's results underscore the importance of considering individual linguistic biographies and the quality of language input when assessing second language proficiency. While early exposure provides a foundation, the quality and continuity of language learning experiences play a crucial role in the attainment of more target-like proficiency, even in adult learners.

In conclusion, this research contributes to the ongoing debate about the influence of AoA on second language acquisition by highlighting the strong predictive power of AoA and the advantage it could offer to early learners specially before the age of six years old. However, the potential for late learners to achieve high levels of proficiency should not be eliminated given the significant contribution of long exposure to L2 quality input. The study's insights are

valuable for educators and policymakers in designing language education programs that cater to the diverse linguistic backgrounds and learning timelines of students, ensuring that language learning remains an attainable goal to L2 learners.

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Appendix A: Adapted LEAP-Q questionnaire:

https://drive.google.com/file/d/1anRC0_GIWpHKZFmB7oxnWK6B4oiDPCZc/view?usp=sharing

Appendix B: Semi-structured interview questions:

Linguistic Background and AoA:

1. When have you started acquiring English as a second language on regular basis?
2. Which languages have you been exposed to during childhood? At which age did you start learning each language?
3. How many years have you been learning English?
4. How have you started acquiring English as a second language? In a school setting or in a native community?
5. In which school system have you been learning English, how was it taught at school?
6. If you have been using English in a native community, when was that? And for how many years? Could you describe your daily interactions using English in that community?
7. How do you think the age at which you started learning English as a second language has influenced your language abilities and proficiency?

Order of Bilingualism:

8. What was the order of learning each of your languages? Which language do you consider to be your native mother tongue?
9. How comfortable are you using each of the languages you speak?
10. How do you think the order in which you learned the languages you speak has impacted your overall language development?

Language use patterns, motivation, and learning strategies:

11. How do you practice/develop your English skills in your day-to-day interactions?
12. How many hours do you currently spend practicing/using English on daily or weekly basis?
13. Can you describe your current typical English language use patterns in various contexts (e.g., home, work, social settings)?
14. What strategies do you use to help you maintain your English proficiency? Are any specific challenges you face using English? If so, how do you overcome those challenges?
15. What motivated you to learn and continue using English as a second language? How have your attitudes toward language learning evolved over time?
16. How does exposure to cultural content such as movies, music or social media, or interactions with speakers of the language, contribute to your language development?

L2 end state:

17. How would you describe your current level of proficiency in your second language? In what ways do you feel that your language abilities have developed or changed over the years?
18. Do you think the LEAP-Q questionnaire accurately captures the factors influencing your current proficiency in English? Are there other factors you believe to have influenced it?

Appendix C: Saito et al 2015 oral proficiency assessment measures

Table 1. Summary of the linguistic predictors for human raters' phonological, temporal, lexical, and grammatical judgment of L2 speech in Saito et al. (in press)

Rater judgment measures	Linguistic predictors
Audio Measures	
Segmentals	Number of vowel and consonant errors
Word stress	Number of word stress errors
Intonation	Number of intonation errors
Speech rate	Mean length of run, number of unfilled pauses, and articulation rate
Transcript Measures	
Lexical appropriateness	Number of lexical errors
Lexical richness	Type frequency and token frequency
Grammatical accuracy	Number of grammatical errors
Grammatical complexity	Subordinate clause ratio

Appendix D: Oral speech assessment 9-point scale form:

https://docs.google.com/forms/d/e/1FAIpQLSe2F9ObGsGF97HDEu2ZcWrrMy1lRVtKRvvB742Ikid92v09Hw/viewform?usp=sharing

Appendix E: Oral speech assessment criteria shared with raters:

https://drive.google.com/file/d/1kAzTi9CGBC85dUbyapN9gZoO2NZ1XAXO/view?usp=sharing

Appendix F: IRB Approval Letter

THE AMERICAN UNIVERSITY IN CAIRO
INSTITUTIONAL REVIEW BOARD

Case# 2023-2024-094

To: Mona Kamar
Nihal Nagi
Sara Tarek

From: **Heba Kotb**
Chair of the IRB
Date 3/1/2024

Re: IRB approval

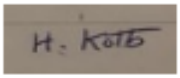
This is to inform you that I reviewed your revised research proposal entitled

The effect of age of acquisition on the development of lexical attainment and oral proficiency of English as L2 in adult native Arabic Speakers.

It required consultation with the IRB under the "expedited" category. Your proposal used appropriate procedures to minimize risks to human subjects and that adequate provision was made for confidentiality and data anonymity of participantsin any published record. I believe you will also make adequate provision for obtaining informed consent of the participants. This approval letter was issued under the assumption that you have not started data collection for your research project. Any data collected before receiving this letter could not be used since this is a violation of the IRB policy.

Please note that IRB approval does not automatically ensure approval by CAPMAS, an Egyptian government agency responsible for approving some types of off-campus research. CAPMAS issues are handled at AUC by the office of the University Counsellor. The IRB is not in a position to offer any opinion on CAPMAS issues, and takes no responsibility for obtaining CAPMAS approval.
This approval is valid for only one year. In case you have not finished data collection within a year, you need to apply for an extension.

Thank you and good luck.



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