Appendix no.1 to the Order No. 4.2024

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DOCTORAL SCHOOL

DISCIPLINE: LINGUISTICS

MA. Blerta Krasniqi, PhD. Candidate

Disertation: ***"Predispositions of dyslexia and the neurolinguistics aspect of preschool age children in the Republic of Kosovo and Poland"***

Supervisor: Dr. Hab. Marzena Błasiak – Tytuła, prof. UKEN

Associate supervisor: Prof. Ass. Dr. Sc. Muljaim Kaqka

Kraków, 2025

Załącznik nr 1 do Zarządzenie nr 4.2024

Dyrektora Szkoły Doktorskiej

UNIWERSYTET KOMISJI EDUKACJI NARODOWEJ

W KRAKOWIE

SZKOŁA DOKTORSKA

DYSCYPLINA: JĘZYKOZNAWSTWO

MA. Blerta Krasniqi, PhD. Candidate

Tytuł Rozprawy: „Predyspozycje dysleksji i aspekt neurolingwistyczny dzieci w wieku przedszkolnym w Republice Kosowa i Polsce”

Promotor: Dr. Hab. Marzena Błasiak – Tytuła, prof. UKEN

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Kraków, 2025

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Acknowledgments (ENG)

I would like to express my gratitude to the UKEN Doctoral School for providing the academic structure that made this work possible. My sincere thanks go to the Director of the School, Dr. Hab. prof. UKEN Władysław Marek Kolasa, for his leadership, and to the wonderful staff in the office, whose patience, helpfulness, and professionalism made every step smoother.

I would also like to acknowledge my supervisors, Dr. Hab. Marzena Błasiak-Tytuła, prof. UKEN, and Prof. Ass. Dr. Sc. Muljaim Kacka. I am grateful for their time, guidance, and for fulfilling their supervisory roles during my PhD journey. Their oversight helped ensure the completion of this work, and I appreciate their contribution to the academic process.

To my family—there are no words strong enough to capture what your love and support have meant to me. You believed in me when I needed it most, carried me through moments of doubt, and reminded me of who I am when things felt overwhelming. Your strength, kindness, and constant encouragement have been my greatest source of motivation. I share this achievement with you, and I dedicate it to you — **MOM and DAD**.

And finally, to myself. Thank you for enduring, for showing up every day, even when it was hard. For not giving up. For believing in the value of this work and the worth of your own voice. This journey has tested me deeply, and I am proud of the person I've become through it.

Podziękowania (PL)

Chciałbym wyrazić wdzięczność Szkole Doktorskiej UKEN za zapewnienie struktury akademickiej, która umożliwiła tę pracę. Serdeczne podziękowania kieruję do Dyrektora Szkoły, Dr. Hab. prof. UKEN Władysław Marek Kolasa, za jego przywództwo, a także do wspaniałych pracowników biura, których cierpliwość, pomoc i profesjonalizm ułatwiały każdy krok.

Chciałbym również podziękować moim promotorom, Dr. Hab. Marzena Błasiak-Tytuła, prof. UKEN, oraz Prof. Ass. Dr. Sc Muljaim Kacka. Jestem im wdzięczny za poświęcony czas, wskazówki i pełnienie ról nadzorczych podczas mojej podróży doktorskiej. Ich nadzór pomógł zapewnić ukończenie tej pracy i doceniam ich wkład w proces akademicki.

Mojej rodzinie - nie ma wystarczająco mocnych słów, aby uchwycić, co znaczy dla mnie wasza miłość i wsparcie. Wierzyliście we mnie, gdy najbardziej tego potrzebowałem, nieśliście mnie w chwilach zwątpienia i przypominaliście mi, kim jestem, gdy wszystko wydawało się przytłaczające. Twoja siła, życzliwość i ciągła zachęta były moim największym źródłem motywacji. Dzielę się z wami tym osiągnięciem i dedykuję je wam - **MAMIE I TACIE**.

I wreszcie, sobie. Dziękuję za wytrwałość. Za pojawianie się każdego dnia, nawet gdy było ciężko. Za niepoddawanie się. Za wiarę w wartość tej pracy i wartość własnego głosu. Ta podróż wystawiła mnie na ciężką próbę i jestem dumna z tego, jaką osobą się dzięki niej stałam.

Falenderime (ALB)

Dëshiroj të shpreh mirënjohjen time për Shkollën Doktorale të UKEN për mbështetjen institucionale dhe akademike që e bëri të mundur realizimin e këtij punimi. Falënderime të sinqerta për Drejtorin e Shkollës, Dr. Hab. prof. UKEN Władysław Marek Kolasa, për udhëheqjen e tij, si dhe stafit të mrekullueshëm të zyrës, për durimin, ndihmën dhe profesionalizmin që e bënë çdo hap më të lehtë.

Gjithashtu, dua të shpreh mirënjohjen time për mentorët, Dr. Hab. Marzena Błasiak-Tytuła, prof. UKEN, dhe Prof. Ass. Dr. Sc. Muljaim Kacka. Jam mirënjohës për kohën dhe udhëzimet e tyre, dhe për përmbushjen e rolit të tyre mbikëqyrës gjatë rrugëtimit tim doktoral. Mbikëqyrja e tyre ndihmoi në përfundimin e këtij punimi dhe e vlerësoj kontributin e tyre në procesin akademik.

Për familjen time — nuk ka fjalë të mjaftueshme për të përshkruar se sa shumë vlerë ka dashuria dhe mbështetja juaj për mua. Më qëndruat pranë në momentet më të vështira, më ngritët kur u lodha dhe më kujtuat vlerat e mia kur gjithçka dukej e paqartë. Falë jush, gjeta forcën për të vazhduar. Kjo arritje është po aq e juaja sa edhe e imja, dhe me gjithë zemër i'a kushtoj **MAMIT dhe BABAIT**.

Dhe në fund, vetes sime. Faleminderit…që u paraqite çdo ditë, edhe kur ishte e vështirë, që nuk u dorëzove, që besove në vlerën e kësaj pune dhe në fuqinë e zërit tënd. Ky rrugëtim më ka testuar thellë, dhe jam krenare për njeriun që jam bërë përmes tij.

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ABSTRACT (ENG)

This study investigates early predispositions of dyslexia in preschool-aged children from the Republic of Kosovo and Poland, focusing on the potential cultural and environmental influences on dyslexia. The research spans two phases, evaluating the same cohort of children at two different stages. In the first phase, 88 children aged 4 and 5 were assessed using a battery of 12 subtests designed to measure dyslexia indicators. Significant group differences were found in language skills. In comprehension, Kosovar children scored higher than Polish peers in both phases ($t(72.46) = -4.77$, $p < .001$, $d = 1.04$; $t(57.13) = -4.70$, $p < .001$, $d = 1.03$). Phase 1 phonological skills also favored Kosovar children ($t(86) = -3.91$, $p < .001$, $d = 0.84$), while differences in phase 2 were non-significant. Copying skills differed in phase 1 only ($t(86) = -2.81$, $p = .006$, $d = .60$). In storytelling tasks, Kosovar children produced significantly more words in phase 1 (Picture 1: $t(86) = -2.85$, $p = .005$, $d = 0.61$; Picture 2: $t(86) = -4.08$, $p < .001$, $d = .87$) and in phase 2 (Picture 2: $t(58.53) = -3.00$, $p = .004$, $d = .66$). Correlational analyses showed moderate associations between comprehension phase 1 and comprehension phase 2 ($r = .39$, $p < .001$), and with copying phase 1 ($r = .30$, $p < .01$). Phonological skills exhibited weak or non-significant correlations. When analyzed by country, Polish children showed a significant negative correlation between comprehension and phonological skills in phase 2 ($r = -.37$, $p < .05$), while Kosovar children showed a significant positive correlation between comprehension phases ($r = .35$, $p < .05$). Fisher's Z transformation confirmed that the difference in correlation strength between countries was statistically significant ($Z = -2.95$, $p = .003$). Regression analysis revealed that only comprehension at age 4–5 significantly predicted comprehension at age 6–7 ($\beta = .32$, $t = 2.97$, $p = .004$; $R^2adj = .16$). Neither phonological nor copying skills significantly predicted outcomes in later phases ($p > .05$). These results support the hypothesis that early comprehension abilities are a reliable predictor of later language development and highlight the need for culturally sensitive early screening tools. The findings contribute valuable data for improving early intervention strategies and standardizing speech therapy diagnostics in diverse linguistic settings.

Key words: predispositions of dyslexia, dyslexia, Kosovo, Poland, speech therapy

STRESZCZENIE (PL)

Niniejsze badanie dotyczy wczesnych predyspozycji do dysleksji u dzieci w wieku przedszkolnym z Republiki Kosowa i Polski, koncentrując się na potencjalnych wpływach kulturowych i środowiskowych na dysleksję. Badanie obejmuje dwie fazy, oceniając tę samą kohortę dzieci na dwóch różnych etapach. W pierwszej fazie 88 dzieci w wieku 4 i 5 lat zostało ocenionych za pomocą baterii 12 podtestów zaprojektowanych do pomiaru wskaźników dysleksji. Stwierdzono znaczące różnice między grupami w zakresie umiejętności językowych. W zakresie rozumienia kosowskie dzieci uzyskały wyższe wyniki niż polscy rówieśnicy w obu fazach ($t(72.46) = -4.77$, $p < .001$, $d = 1.04$; $t(57.13) = -4.70$, $p < .001$, $d = 1.03$). Umiejętności fonologiczne w fazie 1 również faworyzowały dzieci z Kosowa ($t(86) = -3.91$, $p < .001$, $d = .84$), podczas gdy różnice w fazie 2 były nieistotne. Umiejętności kopiowania różniły się tylko w fazie 1 ($t(86) = -2.81$, $p = .006$, $d = .60$). W zadaniach polegających na opowiadaniu historii kosowskie dzieci produkowały istotnie więcej słów w fazie 1 (Obrazek 1: $t(86) = -2,85$, $p = .005$, $d = .61$; Obrazek 2: $t(86) = -4.08$, $p < .001$, $d = .87$) i w fazie 2 (Obrazek 2: $t(58.53) = -3.00$, $p = .004$, $d = .66$). Analizy korelacyjne wykazały umiarkowane powiązania między fazą rozumienia 1 i fazą rozumienia 2 ($r = .39$, $p < .001$) oraz z fazą kopiowania 1 ($r = .30$, $p < .01$). Umiejętności fonologiczne wykazywały słabe lub nieistotne korelacje. Analizując według kraju, polskie dzieci wykazały istotną ujemną korelację między rozumieniem a umiejętnościami fonologicznymi w fazie 2 ($r = -.37$, $p < .05$), podczas gdy dzieci z Kosowa wykazały istotną dodatnią korelację między fazami rozumienia ($r = .35$, $p < .05$). Transformacja Z Fishera potwierdziła, że różnica w sile korelacji między krajami była statystycznie istotna ($Z = -2.95$, $p = .003$). Analiza regresji wykazała, że tylko rozumienie w wieku 4-5 lat istotnie przewidywało rozumienie w wieku 6-7 lat ($\beta = .32$, $t = 2,97$, $p = .004$; $R^2adj = .16$). Ani umiejętności fonologiczne, ani umiejętności kopiowania nie prognozowały znacząco wyników w późniejszych fazach ($p > .05$). Wyniki te potwierdzają hipotezę, że wczesne zdolności rozumienia są wiarygodnym predyktorem późniejszego rozwoju językowego i podkreślają potrzebę stosowania wrażliwych kulturowo narzędzi do wczesnych badań przesiewowych. Wyniki te dostarczają cennych danych dla poprawy strategii wczesnej interwencji i standaryzacji diagnostyki logopedycznej w różnych środowiskach językowych.

Słowa kluczowe: predyspozycje do dysleksji, dysleksja, Kosowo, Polska, logopedia

ABSTRAKTI (ALB)

Ky studim synon të identifikojë predispozitat e hershme për disleksi tek fëmijët e moshës parashkollore në Republikën e Kosovës dhe Polonisë, duke analizuar ndikimin e faktorëve kulturorë dhe mjedisorë në zhvillimin e aftësive gjuhësore. Hulumtimi është zhvilluar në dy faza, duke përfshirë një numër të pjesëmarrësëve prej 88 fëmijësh (mosha 4–5 vjeç në fazën e parë), të cilët u vlerësuan me një instrument vlerësimi bateri prej 12 nën-testeve për të matur tregues të hershëm të disleksisë. Rezultatet treguan se fëmijët kosovarë kishin performancë më të lartë në aftësitë e kuptueshmërisë në të dy fazat ($t(72.46) = -4.77$, $p < .001$, $d = 1.04$; $t(57.13) = -4.70$, $p < .001$, $d = 1.03$), si dhe në aftësitë fonologjike dhe të kopjimit në fazën e parë. Në detyrat e tregimit të historive, fëmijët kosovarë përdorën ndjeshëm më shumë fjalë në tre nga katër situatat eksperimentale ($p < .01$). Analizat korrelative zbuluan lidhje të moderuara midis kuptimit në dy fazat ($r = .39$, $p < .001$) dhe midis kuptimit dhe kopjimit në fazën e parë ($r = .30$, $p < .01$). Në analizën e ndarë sipas vendit, vetëm fëmijët kosovarë treguan lidhje pozitive të qëndrueshme ndërmjet fazave të kuptueshmërisë ($r = .35$, $p < .05$), ndërsa te fëmijët polak u vu re një korrelacion negativ midis kuptimit dhe fonologjisë në fazën 2 ($r = -.37$, $p < .05$). Transformimi Fisher Z konfirmoi se këto dallime ndërmjet grupeve ishin statistikisht të rëndësishme ($Z = -2.95$, $p = .003$). Analizat e regresionit treguan se vetëm kuptimi në moshën 4–5 parashikon ndjeshëm performancën në kuptueshmëri në moshën 6–7 ($\beta = .32$, $t = 2.97$, $p = .004$; $R^2adj = .16$), ndërkohë që aftësitë fonologjike dhe të kopjimit nuk kishin fuqi parashikuese. Gjetjet theksojnë rëndësinë e vlerësimit të hershëm të kuptimit si tregues për rrezikun e disleksisë dhe mbështesin zhvillimin e instrumenteve të standardizuara të vlerësimit logopedik të ndjeshme ndaj konteksteve kulturore dhe gjuhësore.

Fjalë kyçe: predispozitat e disleksisë, disleksia, Kosova, Polonia, logopedi

1. INTRODUCTION

We live in a society where reading is a fundamental skill, crucial for academic achievement and active participation in everyday life. Consequently, difficulties in reading can have negative effects not only on individuals but also on society as a whole. Reading is often described through *The Simple View of Reading*, which frames it as the combination of decoding and comprehension: Reading = decoding × (listening) comprehension (Gough & Tunmer, 1986). This model highlights that successful reading requires both accurate word decoding and strong comprehension skills. Therefore, children may face reading challenges either due to weaknesses in decoding, broader language difficulties such as limited vocabulary, or a combination of both. When decoding difficulties occur despite otherwise typical development, this condition is typically identified as developmental dyslexia (hereafter dyslexia). Dyslexia is a widespread learning disorder, affecting an estimated 3–7% of the population (Bishop & Snowling, 2004; Snowling & Melby-Lervåg, 2016). Since the term dyslexia was first coined by the German ophthalmologist, Rudolf Berlin, in 1887, many terms have been used to describe the difficulties that a significant proportion of people encounter in trying to decode text. Early terms included congenital word blindness (Hinshelwood 1907), visual agnosia for words, and word blindness (Orton 1925). Recorded instances of individuals with dyslexia have been documented as far back as the 17th century (Grigorenko et al., 2020). The earliest cases primarily involved acquired dyslexia, which usually pertains to adults who previously acquired reading skills but lost them following a stroke or traumatic brain injury, despite their overall cognitive functions being intact. Later observations described children with evident signs of developmental dyslexia who struggled to learn to read, even though they demonstrated proficiency in mathematics and showed no signs of significant brain injury (Wagner et al., 2020). More recently, terms commonly used include specific reading difficulties, specific learning difficulties, learning disability, specific reading retardation, unexpected reading difficulty, reading disorder, reading disability, and specific reading disability. Dyslexia has become one of the most widely employed terms to describe reading (decoding) and spelling problems. While this term has long been prevalent in the UK, its use has proliferated across the world, particularly in the United States where dyslexia advocacy and legislation have flourished (Gabriel 2019; Ward-Lonergan & Duthie, 2018).

Dyslexia has a strong genetic basis, but its heritability is significantly shaped by factors such as the home literacy environment and educational experiences. In early childhood, about 50% of the variation in reading ability can be attributed to genetics. However, as children grow

older and receive more consistent instruction, genetic influence becomes more pronounced, with heritability estimates rising to around 80% in older children (Olson et al., 2014). Environmental factors—such as teacher quality, socioeconomic status, and parents' reading ability—also contribute to differences in reading skills (Friend et al., 2009; Petrill et al., 2006). While several genes have been linked to dyslexia, each contributes only a small effect, and the condition is inherited through a complex, polygenic process (Grigorenko et al., 2020). The occurrence of Developmental Dyslexia (DD) is frequently noted to be higher among males compared to females, typically at a ratio of 2:1 (Chan et al., 2007; DeFries & Alarcón, 1996; Farrag et al., 1988; Katusic, 2001). This difference is often attributed to ascertainment or referral biases (Finucci & Childs, 1981; Vogel, 1990). However, the argument becomes challenging to support with the continuous increase in sample sizes from unselected populations. A single study conducted with four independent epidemiological samples, comprising 989, 895, 5,752, and 2,163 individuals, observed prevalence rates ranging from 18.5% to 24.6% in boys and 8.3% to 13% in girls. Additionally, a large-scale prospective study in the US involving 32,223 children (16,080 boys and 16,143 girls) noted that twice as many boys were affected compared to girls (Flannery et al., 2000). Furthermore, a study examining reading abilities in nearly 200,000 children across 43 different countries revealed that girl's consistently outperformed boys on reading tests in every country examined (Chiu & McBridge-Chang, 2006). But, on the other side, few studies report similar problems in learning a foreign language (L2), though some problems associated with dyslexia affect the learning of foreign languages: weakness in phonological awareness, poor working memory, auditory discrimination, auditory sequencing, rapid automatised naming, and confusion over syntax (Crombie, 1997, 2000; Krasowicz-Kupis, 2008).

Specific learning disabilities encompass conditions such as dyslexia (difficulty with reading), dysgraphia (difficulty with writing), and dyscalculia (difficulty with mathematics). While nonverbal learning disability (NVLD) is not formally classified as a specific learning disability in the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision* (DSM-IV-TR), it involves challenges in areas like social interaction, nonverbal reasoning, visuospatial processing, motor coordination, reading comprehension, and math. Individuals with NVLD often show relative strengths in verbal abilities and may read fluently and accurately. Similarly, although autism spectrum disorder (ASD) is not considered a specific learning disability, it can significantly impact learning. Individuals with ASD typically face challenges in verbal and nonverbal communication, social relationships, motor skills, and may respond atypically to sensory stimuli (APA, 2000). The prevailing explanation of dyslexia

today is that it stems from challenges with decoding in reading (Snowling & Hulme, 2012). However, it's important to note that dyslexia is not regarded as a distinct medical syndrome (Elliot & Grigorenko, 2014). Children may encounter difficulties in reading due to issues with decoding or broader language challenges, such as a limited vocabulary, or a combination of both. When children face unexpected hurdles specifically in decoding, it's typically termed as developmental dyslexia or simply dyslexia. A person diagnosed with dyslexia during childhood usually continues to experience dyslexia throughout their lifetime (Hatcher et al., 2002; Pammer, 2014). These individuals encounter challenges in acquiring reading and related cognitive abilities, which often persist into adulthood. Consequently, they are prone to developing secondary emotional and behavioral issues linked to educational setbacks and may later face unemployment, leading to subsequent psychological, economic, and social difficulties (Gerber, 2011; Watson & Boman, 2005).

The importance of the ability to read as a required skill throughout and beyond the academic domain and its use as a traditional criterion of initial school achievement (Chapman & Tunmer, 2003) highlights the far-reaching consequences reading difficulties could entail for how children with dyslexia perceive themselves. As indicated by Burden's (2008) review on dyslexia in relation to several aspects of self-perception including self-efficacy, self-concept and self-esteem, most of the self-perception research to date has focused on children or adolescents with "learning disabilities". The term "learning disability" encompasses a set of various disabilities (e.g. mathematics, reading, writing) identified within the education system but not necessarily based on a clinical diagnosis, thus making the comparative replicability of research findings across studies somewhat questionable. In dyslexia, children experience delays in mastering word decoding and achieving fluency, as well as difficulties in applying their reading skills to unfamiliar words. It's widely recognized that dyslexia stems from challenges in phonological representation, as suggested by various studies (e.g., Shankweiler et al., 1979; Snowling & Hulme, 1994). This hypothesis originates from historical clinical observations, beginning with Orton (1937) and continued by Bannatyne (1974), who identified issues with auditory sequencing, discrimination, and linking auditory symbols with visual sequences.

Numerous other developmental and psychiatric conditions frequently coexist with dyslexia, posing additional risks to the health and academic performance of affected children. Approximately 20% to 40% of children diagnosed with attention-deficit/hyperactivity disorder (ADHD) also have dyslexia (Germanò et al., 2010), while those with autism spectrum disorder (ASD) are at an elevated likelihood of experiencing dyslexia as well (Åsberg et el., 2010).

Additionally, behavioral disorders such as conduct disorders and oppositional defiant disorders are linked to dyslexia (Burke et el., 2002). A significant proportion, up to 85%, of children with dyspraxia (developmental coordination disorder) exhibit dyslexia (Pauc, 2005), and children with dyscalculia (math learning disorder) (Moll et al., 2019) and dysgraphia (writing learning disorder) (Döhla & Heim, 2016) are more prone to dyslexia compared to those without these conditions. Recognizing dyslexia within pediatric practice is crucial for determining the most suitable interventions for these multiple concurrent disorders.

As children advance through the education system, reading becomes the primary means of accessing and understanding content, underscoring the critical importance of promptly identifying and intervening for children with dyslexia. Research indicates that when early intervention in reading is provided to begin readers at risk, a significant majority, ranging from 56% to 92%, can attain average reading skills (Torgesen, 2004). However, many children are diagnosed with dyslexia long after they exhibit evident struggles with early literacy milestones (Torgesen, 2002). There is evidence that significant numbers of dyslexics
are represented in populations of runaway homeless street youths (79), adolescent suicide victims (80) and juvenile offenders (81). It is important that we recognize these difficulties early and make an attempt to eliminate them or reduce their severity (Siegel, 2006). Presently, dyslexia is typically diagnosed toward the end of second grade or the beginning of third grade, often much later, after prolonged difficulties in learning to read and falling behind academically compared to peers. This delayed recognition, known as the "dyslexia paradox," overlooks the optimal intervention window, which is during the heightened brain plasticity period in kindergarten and first grade (Fox et al., 2010). This gap between the earliest possible identification and the timing of actual identification and treatment undermines effective intervention, with significant implications for the child's academic progress and socio-emotional well-being. It's noteworthy that children in reading ability at the 10th percentile may learn as many words in a year as a child at the 90th percentile reads in just a few days (Cunningham & Stanovich, 1998).

Children who are vulnerable to experiencing challenges with reading can be pinpointed during kindergarten (at the age of five), and support programs can be initiated. According to research conducted by Lesaux and Siegel (2003), children flagged as at-risk for reading difficulties in kindergarten, irrespective of their primary language, showed improvement through intervention programs conducted in the classroom. These programs focused on enhancing phonological awareness, vocabulary, and reading techniques. It's crucial to acknowledge that behavioral challenges in school might indicate dyslexia. Any indication of

reading difficulties, even in the early stages of a child's schooling, should be taken seriously and thoroughly examined. The common assumption that the issue will resolve itself over time is generally invalid. Research suggests that early identification and intervention can mitigate or prevent the development of severe reading difficulties. Any academic struggles or behavioral issues should be promptly addressed. Instances of school avoidance or physical complaints specifically on school days could signal a potential learning disability (Siegel, 2003).

Some children diagnosed with dyslexia also exhibit symptoms that align with Developmental Language Disorder (DLD), a condition characterized by ongoing difficulties in expressing and/or understanding language (Bishop et al., 2017). Although DLD is typically viewed as a distinct communication disorder separate from learning disabilities, it significantly increases the likelihood of dyslexia. Research by McArthur et al. (2000) demonstrated that around 40% of children facing specific reading challenges (dyslexia) also struggle with significant language impairments. Conversely, children entering school with DLD face a heightened risk of encountering literacy difficulties (Bishop & Adams, 1990). Essentially, the boundaries between dyslexia and language disorders are often blurred: it's common for children with dyslexia to experience language issues, with some even meeting clinical criteria for DLD (Catts et al., 2005; Snowling et al., 2019). These language difficulties are frequently underdiagnosed but are likely to impact the effectiveness of intervention strategies (Adlof & Hogan, 2019).

According to Snowling et al., (2020), the term dyslexia accurately describe children who struggle with learning to read and write. Even after achieving a basic level of reading and spelling proficiency, difficulties with reading fluency often persist. Dyslexia is considered a dimensional disorder, lacking a clear-cut distinction from poor reading skills. However, this does not diminish its impact as a handicap. If learning challenges and fluency issues persist, it's important to use the term dyslexia to signal the necessity for intervention. Additionally, it's crucial to acknowledge the need for assessments to identify any accompanying problems, which may require separate management but do not define dyslexia. The imperative for intervention is evident: children with poor reading skills face heightened risks of emotional and behavioral difficulties. Furthermore, longitudinal studies highlight that literacy problems endure into adulthood, leading to lower educational achievements, increased rates of unskilled employment, and sometimes periods of joblessness (e.g., Maughan et al., 2020). However, since some individuals with dyslexia can compensate for their difficulties, dyslexia only become disabling if they cannot cope with literacy demands even with appropriate support in place. As mentioned, Dyslexia is a lifelong disorder that affects reading and spelling abilities

(Beaton, 2004; Lyon, 2003) but also brings repeated challenges in both educational and professional contexts. Because reading and writing difficulties often persist into adulthood (Bogdanowicz et al., 2013; Elbro & Jensen, 2005; Everatt, 1997; Hatcher et al., 2002; Shessel & Reiff, 1999), they can have a negative impact on life satisfaction and overall well-being. At the same time, however, making use of personal resources and receiving support from significant others or institutions may serve as protective factors, enabling individuals to better cope with challenges and alleviating the harmful effects of long-term stress.

Recognition of dyslexia within the education system and society has evolved over time, particularly with the abandonment of the IQ-discrepancy definition. While uncertainties remain, there's a comprehensive understanding of how reading develops and the most effective teaching methods (Castles et al., 2018), with clear policy implications (Seidenberg, 2017). Despite concerted efforts, some children will still struggle with reading. Achieving optimal outcomes for these children necessitates embracing the multifaceted nature of dyslexia and its complexities; failing to do so would be negligent and arguably morally indefensible. Due to the inherent challenges and delays in diagnosing and treating dyslexia, we advocate for a shift towards prevention as a more effective approach. This approach mirrors strategies long employed in healthcare. Preventive medicine aims to forestall the onset of a disease by either preventing its occurrence altogether (primary prevention) or mitigating its consequences once it has begun (secondary prevention), rather than solely focusing on treatment (Clark, 1974). Examples of preventive medicine include initiatives targeting heart disease, diabetes, and cancer. For instance, in the case of heart disease, screening often commences early in life to assess risk factors such as family medical history, hypertension, and cholesterol levels. Upon identification of risk factors, medical and/or behavioral interventions are recommended to mitigate risk. Not only have these preventive efforts demonstrated improved health outcomes, but they have also proven to be more cost-effective (Heller et al., 2017; Pharoah & Hollingworth, 1996).

Most research on dyslexia has concentrated on phonological difficulties, which create significant challenges in decoding and, in turn, hinder the development of fluent reading and reading comprehension. However, dyslexia is also associated with other underlying factors that differentiate affected readers from their typically developing peers. One such factor is working memory deficits (Knoop-van Campen et al., 2018; McLoughlin et al., 1994). A few studies have provided evidence that individuals with dyslexia often experience impairments in working memory, and that these deficits can contribute independently to reading comprehension difficulties - beyond the phonological coding problems typically observed (Berninger et al.,

2008; Smith-Spark & Fisk, 2007). Overall, in the journey to address dyslexia, early identification and treatment stand as crucial waypoints. Recognizing this pressing need, efforts to enhance early identification mechanisms have gained momentum in recent years. Screening tools and assessments, tailored to pinpoint dyslexia's subtle yet significant markers, have emerged as valuable assets in the diagnostic arsenal. By facilitating early detection, these tools empower educators, parents, and healthcare professionals to intervene swiftly and decisively, thereby stemming the tide of academic setbacks and emotional turmoil that often accompany undiagnosed dyslexia. However, early identification alone is insufficient without concurrent emphasis on treatment and support. If dyslexia remains undetected in its early stages, children persist in their struggles with reading, potentially missing crucial opportunities for instructional, intervention, and remedial support. These educational setbacks can cascade into further learning difficulties, including challenges with memory, organization, attention, and motivation (Chapman & Tunmer, 2019), ultimately impacting economic opportunities throughout their lives (Unesco, 2019). Effective interventions, grounded in evidence-based practices and tailored to individual needs, constitute the cornerstone of dyslexia management. From structured literacy programs to assistive technologies and targeted interventions addressing underlying cognitive processes, the treatment landscape for dyslexia is multifaceted and dynamic, offering hope and tangible pathways to success for individuals navigating the challenges of dyslexia.

Studies show that language plays a crucial role in literacy acquisition, and English and Polish differ considerably in this respect. In alphabetic languages, the degree of orthographic transparency influences the difficulty of tasks measuring phonological awareness (Geva & Siegel, 2000). The deeper the orthography, the more challenging it becomes to read both words and nonwords (Seymour et al., 2003). English is characterized by a deep, non-transparent orthography—especially when compared to languages such as Finnish, Italian, or Spanish (Erickson & Sachse, 2010; Pagliuca et al., 2008) - and is less transparent than semi-transparent Polish (Miles, 2000). As a result, acquiring English reading skills can be particularly demanding, largely due to its irregular pronunciation rules (Caravolaset al., 2013). In Poland, formal instruction in the first language begins in Grade 1, when children are seven years old, following a mandatory one-year reception class. Reading is taught using an analytic-synthetic approach (Gruszczyk-Kolczyńska, 2013), in which children initially learn individual letters and syllables before combining them into simple words. English as a second language is compulsory from the first year of primary school, although it is often introduced earlier in

kindergartens. Furthermore, students must sit external written and/or oral examinations in a foreign language, most frequently English (www.cke.pl).

Based on the findings from Ransy and Swanson (2003), reading comprehension in adults with childhood dyslexia (CD) is influenced not only by phonological processing but also by several other cognitive factors. Adults with CD are unlikely to achieve efficient comprehension of connected text if they experience severe phonological or rapid naming deficits, since these are tied to weaknesses in word recognition. It may be that a basic threshold of word recognition ability is required for fluent reading under time constraints, and that participants in the present sample had already surpassed this threshold. Even so, the development of reading comprehension in this group seems to depend not only on lingering difficulties with word recognition but also on additional deficits in vocabulary, working memory, and listening comprehension. One of the most influential frameworks for understanding reading is the *Simple View of Reading* proposed by Gough and Tunmer (1986), which defines reading comprehension (RC) as the product of decoding (D) and linguistic comprehension (LC), expressed as RC = D × LC. Based on this model, they identified three types of reading disorders—dyslexia, hyperlexia, and so-called "garden variety" poor reading—each leading to poor reading comprehension but for different underlying reasons. In dyslexia, difficulties in comprehension are considered a direct result of impaired decoding, itself linked to weak phonological skills (Bishop & Snowling, 2004; Vellutino et al., 2004). By contrast, in developmental language disorders, comprehension deficits stem from broader language weaknesses (Bishop & Snowling, 2004; Nation et al., 2004). Importantly, these disorders frequently co-occur (Adlof et al., 2017; Bishop et al., 2009; Catts et al., 2005), and children with both dyslexia and developmental language disorders tend to face more severe comprehension challenges than those with only one of these conditions (Catts et al., 2005; Snowling et al., 2020).

Understanding the early indicators and predispositions of dyslexia in preschool children is essential for timely identification and intervention. By exploring genetic, cognitive, environmental, and developmental factors, this thesis aims to shed light on how dyslexia may manifest before formal schooling begins. Early recognition of at-risk children not only improves their long-term academic outcomes but also reduces the emotional and psychological impact often associated with undiagnosed learning difficulties. The following chapters will review the current literature, examine the key predispositional factors, and highlight the importance of early screening and support strategies in preschool settings.

2. LITERATURE REVIEW

2.1. Learning Disabilities

According to Kavale & Forness (2012), the term *learning disability (LD)* has traditionally been associated with the idea of unexpected underachievement—referring to students who struggle with listening, speaking, reading, writing, or math skills despite having the ability and opportunity to learn. This gap between potential and performance has historically been linked to inherent neurobiological factors. As a result, it is understood that students with LD need specialized instruction in order to reach academic levels that align with their cognitive abilities, typically measured by IQ tests. The historical narrative surrounding learning disabilities has been shaped by exclusionary practices. Early accounts illustrate how researchers focused on individuals who faced unexpected learning challenges, yet lacked sensory disabilities, setting them apart from those with intellectual disabilities (Danforth, 2009). Consequently, the term "learning disabilities" came to specifically refer to students who exhibited a failure to learn unexpectedly, as they were not intellectually disabled and had received what was considered an "adequate" education. This notion of unexpected failure is deeply embedded in the concept of learning disabilities (Fletcher et al., 2004). The concept of learning disabilities is facing challenges as traditional understandings prove insufficient for the scientific community's needs. Apart from research on reading, the field struggles with more questions than answers. Lack of consensus on definition and methodology has led research to rely heavily on personal experiences and intuition, with terms like "proprietary insight" highlighting the difficulty in reaching scientific agreement. Different labels for similar observations reflect professional biases and hinder progress in understanding learning disabilities (Dicman, 2005).

Learning disabilities (LDs) are almost twice as common in children with chronic illnesses compared to healthy children. Around 5% of school-aged children worldwide are affected by LDs, and in the United States, data from the National Survey of Children's Health indicate a lifetime prevalence of 10% (Al-Mahrezi et al., 2016). Various risk factors contribute to the development of LDs, including a family history of LDs, poverty, premature birth, prenatal alcohol exposure, traumatic brain injury (TBI), and the presence of other neurodevelopmental disorders (Snowling et al., 2003). The most prevalent form of LD is dyslexia, which accounts for at least 80% of cases. LDs are frequently comorbid with other conditions such as oppositional defiant disorder, attention deficit hyperactivity disorder,

anxiety, and obsessive-compulsive disorder (Kohli et al., 2018). The United States Office of Education (USOE, 1977) defined a specific learning disability as a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, which may manifest itself in an imperfect ability to listen, speak, read, write, spell, or do mathematical calculations. The term includes such conditions as perceptual handicaps, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia. Such terms do not include children who have learning difficulties that are primarily the result of visual, hearing, or motor handicaps, of mental retardation, of emotional disturbance, or of environmental, cultural, or economic disadvantage. Learning disabilities are relatively common in children. For example, one study found that 12.97% of rural primary school children with an IQ of 90 or above demonstrated poor academic performance (Agarwal et al., 1991). Research on the prevalence of learning disabilities in India has reported rates ranging between 3–10% among school-aged children. In a study conducted in Chandigarh, 1.58% of students aged 12 to 18 years were identified with specific learning disabilities; however, this lower rate was likely due to the absence of standardized assessments in local languages (Arun et al., 2013). In contrast, data from the United States indicate a lifetime prevalence of 9.7% for learning disabilities among children. Overall, learning disabilities are recognized as a significant health and educational concern in children who otherwise develop typically (Altarac & Saroha, 2007).

According to AAP et al., 1998, concerns about learning disabilities have grown both personally and publicly in recent years. One of the most significant challenges within this area is the difficulty in reading and comprehension, which can greatly hinder a child’s ability to learn and may lead to lasting educational, social, and economic consequences. The desire of families to support children with dyslexia and other learning disabilities has contributed to the rise of various diagnostic and treatment approaches - many of which remain controversial or lack solid scientific backing. Experts in education, psychology, and medicine generally agree that individuals with learning disabilities should: (1) undergo early, thorough evaluations across educational, psychological, and medical domains; (2) receive targeted educational support alongside suitable psychological and medical interventions; and (3) avoid unproven methods such as eye exercises, colored filters, or tinted lenses, which lack scientific evidence of effectiveness. There exist various agreed-upon concepts concerning the identification, comprehension, and definition of students with Specific Learning Disabilities (SLD). One established approach, known as the exclusionary or 'discrepancy' approach, aims to eliminate numerous potential reasons for students' academic struggles, including hearing and vision impairments, intellectual challenges, environmental factors, economic and socio-cultural

disadvantages, emotional issues, and familial background (Dickman, 2005; Hallahan & Mercer, 2002; Lyon, 1996; Turkington & Harris, 2003). The concept of 'discrepancy' refers to the gap between achievement and intelligence, colloquially known as the 'wait-to-fail' approach. This approach is criticized for its passive nature, waiting until student's experience failure before investigating the underlying causes actively (Hardy & Woodcock, 2014).

In the relevant literature, specific difficulties associated with Specific Learning Disabilities (SLD) are recognized. These challenges encompass language (receptive or expressive), reading (basic comprehension), writing (sentence structure, spelling), mathematics (calculation, reasoning), physical actions (fine/gross motor skills), cognition (information processing, memory), social interactions (misinterpretation, social isolation), attention (short attention span, distractibility), and organization (scheduling, timing) (Smith & Adams, 2006; Turkington & Harris, 2003). Students with learning disabilities (LD) are prone to facing various challenges in science education due to their inherent characteristics, as well as additional issues that could be secondary or tertiary in nature. The primary characteristics represent the fundamental challenges associated with LD, while secondary and tertiary issues arise from ineffective coping mechanisms in response to environmental demands stemming from these primary challenges (Brigham et al., 2011). Identifying and understanding these conditions is complex, as they may not exist in isolation and often overlap. Within the Special Education: A Guide for Educators (Ministry of Education, 2001), Ontario defines SLD in a more discursive and expansionary fashion. "Specifically, SLD is: A learning disorder evident in both academic and social situations that involves one or more of the processes necessary for the proper use of spoken language or the symbols of communication, and that is (a) characterized by a condition that is not primarily the result of: Impairment of vision; Impairment of hearing; Physical disability; Developmental disability; Primary emotional disturbance; Cultural difference;

b) Results in a significant discrepancy between academic achievement and assessed intellectual ability, with deficits in one or more of the following: Receptive language (listening, reading); Language processing (thinking, conceptualizing, integrating); Expressive language (talking, spelling, writing); Mathematical computations; and c) May be associated with one or more conditions diagnosed as: A perceptual handicap; A brain injury; Minimal brain dysfunction; Dyslexia; Developmental aphasia" (Ministry of Education, 2001, p. A19).

In contrast, the state of New South Wales (NSW) opts for a broader classification, using the term 'learning difficulties' as an overarching umbrella instead of distinguishing between learning difficulties and learning disabilities. This disparity is partly attributed to the NSW government's preference for a non-labelling approach to learning difficulties, potentially

influenced by budgetary considerations. Current legislation in NSW links the identification and categorization of students to the provision of funding for relevant services and resources. The Every *Student Every School* (2012) policy, released by the Department of Education and Community in NSW, acknowledges and allocates funding to students with disabilities, encompassing intellectual, physical, hearing, vision, mental health, and autism conditions. However, this classification does not explicitly acknowledge students with Specific Learning Disabilities (SLD). Instead, those with SLD fall under a broader 'additional needs' category, which includes challenges related to dyslexia, reading or communication delays, and attention deficit hyperactivity disorder (ADHD). The term 'disabilities' is used in a general sense and does not explicitly recognize students with SLD. The policy acknowledges that schools and teachers grapple with students having diverse learning and support needs, yet many of these needs remain unfunded as they don't meet the more general disability criteria outlined in the policy: "S*chools and teachers are increasingly challenged by students who may present with additional learning and support needs but who do not meet the existing disability criteria for targeted services"* (NSWDEC, 2012, p. 5). Learning disabilities (LD) affect 2%-10% of the population (Diagnostic and Statistical Manual-4th edition; DSM-IV, 1994). Johnson and Blalock (1987) discovered that adults who have learning disabilities (LD) encounter challenges related to their self-concept and social acceptance. Likewise, several other studies have observed negative self-concept among students with LD (Write & Stimmel, 1984), deficiencies in interpersonal skills (La Greca, 1987), and fragile ego structures (Gaddes, 1985). Additional research has identified various personality shortcomings in children with LD, including a higher tendency toward an external locus of control (Bendel et al., 1980; Hallahan et al., 1978; Tarnowski & Nay, 1989), elevated anxiety levels, withdrawal, depression, low self-esteem, increased rejection by peers, and fewer social skills (as discussed in the review by Gregg et al., 1992). Consequently, it appears that learning disabilities have a lasting impact on the personalities of both children and adults affected by them throughout their lives. According to federal law, learning disabilities (LD) are not viewed as a single condition but rather as a broad category within special education. This category includes difficulties in one or more of seven areas: listening, speaking, basic reading skills (such as decoding and word recognition), reading comprehension, arithmetic calculation, mathematical reasoning, and written expression. These difficulties often appear together and may also be associated with emotional, social, or behavioral challenges, including attention disorders. However, such accompanying conditions cannot be considered the primary cause of the learning disability (Waber, 2017). So, learning disability is not a single disorder, but is a general category of special education composed of

disabilities in any of seven specific areas: (1) receptive language (listening), (2) expressive language (speaking), (3) basic reading skills, (4) reading comprehension, (5) written expression, (6) mathematics calculation, and (7) mathematical reasoning. These separate types of learning disabilities frequently co-occur with one another and also with certain social skill deficits and emotional or behavioral disorders such as attention deficit disorder. LD is not synonymous with reading disability or dyslexia although it is frequently misinterpreted as such (Lyon 1989; Lyon 1995). Common learning disabilities: (1) Dyslexia – a language-based disability in which a person has trouble understanding written words. It may also be referred to as reading disability or reading disorder. (2) Dyscalculia – a mathematical disability in which a person has a difficult time solving arithmetic problems and grasping math concepts. (3) Dysgraphia – a writing disability in which a person finds it hard to form letters or write within a defined space. (4) Auditory and Visual Processing Disorder – sensory disabilities in which a person has difficulty understanding language despite normal hearing and vision. (5) Nonverbal Learning Disabilities – a neurological disorder which originates in the right hemisphere of the brain, causing problems with visual-spatial, intuitive, organizational, evaluative and holistic processing functions. In recent years attention has been given to bring awareness among parents and teachers (Shilpa, 2000).

Learning Disabilities, as defined by the National Joint Committee on Learning Disabilities in 1988 (Hammill, 1993), encompass a diverse range of conditions affecting abilities such as listening, speaking, reading, writing, reasoning, or mathematics. These difficulties are believed to arise from dysfunction in the central nervous system and are not caused by sensory impairments, intellectual disabilities, severe emotional disturbances, cultural disparities, or inadequate or unsuitable instruction, although they may coexist with these conditions. While individuals with Learning Disabilities may also experience challenges in self-regulation and social perception and interaction, these factors alone do not qualify as learning disabilities According to the existing literature, there are three distinct categories of gifted/learning-disabled students (Brody & Mills, 1997; Gunderson et al., 1987). The field of learning disabilities emerged primarily from a social and educational need and currently remains a diagnostic practice that is more rooted in clinical practice, law, and policy than in science. Advocates for children with learning disabilities have successfully negotiated a special education category as a means to educational protection at the same time that the schools have seen an increase in the identification of LD (Moats & Lyon 1993). Epidemiological studies of Learning Disability are also fraught with difficulties ranging from the very definition of Learning Disability, identification and assessment, to socio-cultural factors unique to India,

and its implications in a pluralistic society being immense and cannot be easily dealt with (Karanth, 2002); where each type of Learning Disability needs to be individually addressed instead of being addressed under the broader umbrella term 'Learning Disability'. Furthermore, learning disabilities have been seen as a sociopolitical construct designed to distinguish white, middle-class children from other special education categories, with less stigma compared to intellectual disabilities. In the early days of this category, the majority of students with learning disabilities were white (Sleeter, 1986). However, in the present context, students of color are disproportionately overrepresented in the learning disabilities category, a complex situation influenced by teachers' racial biases and systemic issues like inadequate funding and a shortage of qualified teachers in schools serving low-income families (Harry & Klingner, 2014).

The first group comprises gifted students with subtle learning disabilities who typically excel in elementary school and participate in gifted programs. However, as their coursework becomes more reliant on their specific area of disability, they may encounter learning difficulties and periods of underachievement. Due to their above-average performance in elementary school, these students are often not identified as learning disabled. The second type consists of students identified as learning disabled, yet they also possess gifted abilities. These individuals have significant learning disabilities but may demonstrate exceptional aptitudes in one or more academic or intellectual domains. Despite their gifted potential, they are seldom officially recognized as gifted. The third category includes gifted/learning-disabled students who remain unidentified as either learning disabled or gifted. These students possess disabilities that mask their giftedness and talents that conceal their learning disabilities. Consequently, they may appear average to their teachers and are less likely to be referred for psychoeducational evaluation. As a result, the discrepancy between their intellectual abilities and academic performance goes unnoticed. Although they may perform at grade level on most tasks, their learning disability hampers their ability to achieve at the superior level (Hammill, 1993).

The most prevalent way of understanding learning disabilities is typically through a medical model, which views the difference solely within the individual and aims to identify individual deficits and provide remedial measures. However, an alternative perspective known as the social model of disability offers a different framework. According to this model, disability is framed as society's failure to accommodate a diverse range of individuals, rather than a specific impairment of an individual (Shakespeare, 2006; Linton, 1998). In the social model, biological or physical differences are considered impairments, while disability arises from the interaction between the individual and the environment. A learning disability is

recognized by medical and mental health professionals as a neurobiological disorder of cognitive and/or language processing caused by atypical brain functioning. A learning disability may present academically in the areas of word decoding or identification, reading comprehension, calculation, mathematical reasoning, spelling, and/or written expression. Frequently, a learning disability is associated with atypical functioning in the area of spoken language, as well. Additionally, social relationships and/or emotional functioning may be adversely affected because the individual's cognitive processing deficits cause him or her to make mistakes in thinking or behaving and/or to misunderstand the behavior of others (Rourke, 1995; Tsatsanis et al., 1997).

According to Fletcher et al., (2007) and Gabrieli (2009), there is consensus among contemporary researchers and practitioners that Learning Disabilities (LDs) are brain-based and have a heritable component. However, accurately measuring brain dysfunction and heritability in LDs has proven challenging. Nevertheless, individuals with LDs clearly demonstrate differences in brain function compared to typically developing individuals and those with different types of LDs, such as reading or math LDs. Pennington (2009) and Plomin and Kovas (2005) provide strong evidence supporting the partial genetic origins of LDs. However, the effects of individual genes are small, and the mode of inheritance aligns with a multifactorial model similar to that observed in other developmental disorders like Attention-Deficit/Hyperactivity Disorder (ADHD). This parallel is further supported by Willcutt & Pennington, et al., (2010).

A learning disability is a lifelong condition where children with learning disabilities perform more poorly in school and they are less likely to obtain a high school diploma. In adulthood, learning disabilities can have an adverse effect upon occupational functioning. Early identification of neuropsychological strengths and limitations can facilitate educational, vocational, and treatment planning. Appropriate evaluation should be provided in every case (Silver et. al., 2008). Children with Specific Learning Disabilities (SpLD) often struggle to attain academic grades aligned with their intelligence. Recognizable indicators of this lifelong condition include frequent spelling errors, messy or unreadable handwriting with deficient sequencing, and difficulty in accurately performing basic mathematical calculations. Early identification of SpLD is crucial to prevent chronic academic underachievement and the associated emotional consequences, such as low self-esteem and behavioral issues. Unfortunately, children with SpLD may face rejection by their peers and may be vulnerable to engaging in substance abuse and delinquent behavior (Shapiro & Gallico, 1993).

According to Keogh (1992) numerous tests and surveys document the behaviors and skills expected of children at specific ages. Prominent and widely utilized methods include the Gesell Developmental Schedules (Gesell & Amatruda, 1947), the Bayley Scales of Infant Development (Bayley, 1969), and the Minnesota Child Development Inventory (Ireton & Thwing, 1974). These tools provide systematic ways to describe the developmental status of children at particular points in time. However, it is crucial to recognize that within each age group, there is a broad range of individual differences and various growth patterns. Observing any preschool class vividly demonstrates the variations among preschoolers in physical size, motor skills, language abilities, and social competencies. Some children may be "typical" in most developmental areas, others may be advanced or delayed in all areas, and still others may exhibit uneven skill patterns. Key considerations from a developmental perspective include the significance of these differences as predictors of future developmental issues and their stability and continuity over time.

Chermak et. al., (1989) conducted a study comparing adults with Learning Disabilities (LDs) to a control group without LDs. The researchers observed that the group with LDs exhibited poorer word identification in noisy conditions compared to the control group. Either groups faced challenges when the target words were masked by speech spectrum noise or competing linguistic strings. However, the decline in performance due to masking was more pronounced in the adults with LDs than in the control group. The literature on the speech perception abilities of children with language, learning, and reading disorders is diffuse in terms of the specific participant inclusion criteria applied across studies; however, a common finding of this research is that a subset of the children with impairments, regardless of the specific diagnostic category, show speech perception deficits relative to their peers without impairments (e.g., Bradlow et al., 1999; Elliott et. al., 1989; Kraus et al., 1996; Mody et al., 1997; Reed, 1989; Stark & Heinz, 1996; Sussman, 1993; Tallal & Piercy, 1974).

To identify a learning disability, it is essential to document a difference between a student's intellectual ability and their academic achievement. For instance, intellectually gifted students may have higher cognitive abilities, resulting in academic achievements that are not as low as those of students with average intellectual abilities. However, both groups could still qualify for services as learning disabled. Students with superior cognitive abilities who have learning disabilities might only perform slightly below grade level in their specific area of disability, whereas other students with learning disabilities may be significantly behind in their academic performance. These distinctions in performance are due to their qualitative differences, as noted by Winner (2000). According to McCloskey and Rapp (2017) the

evaluation of learning disorders (LDs) starts with ruling out other potential diagnoses, followed by adherence to the Diagnostic and Statistical Manual of Mental Disorders (DSM) guidelines. The evaluation should include the patient's development, medical, familial, and educational histories. According to the DSM-5, LDs are neurodevelopmental disorders that affect learning in three academic domains: reading, writing, and mathematics. Diagnosis requires meeting specific criteria: Criterion A involves difficulties in processing and applying skills, evidenced by symptoms like disturbances in reading, writing, or math for at least six months. Criterion B specifies that academic skills are significantly lower than expected, leading to dysfunction. Criterion C states that difficulties begin during the school-age years, and Criterion D excludes explanations related to neurological, developmental, or sensory disorders.

States vary considerably in the IQ and achievement criteria used to designate a child as LD, but virtually all states use discrepancy in their definition and/or criteria, with the use of an IQ test to establish "aptitude" being equally common (Frankenberger & Fronzaglio, 1991; Mercer, Jordan, Alsop, & Mercer, 1996). Discrepancy is the sole inclusionary criterion, while all other criteria are exclusionary, indicating what LD is not. At the time, there was little research validating classifications of LD based on IQ discrepancy, but researchers, practitioners, and the public commonly assume that IQ discrepancy is a marker for a specific type of LD that is unexpected and categorically distinct from other forms of underachievement (Kavale & Forness, 2000; Mercer et al., 1996; Stanovich, 1991). These beliefs are rooted in the common observation of unexpected underachievement in children who appear bright and capable. According to Moats & Lyon (1996) children with severe reading disabilities may need a more extended and intensive intervention compared to those with milder deficits. However, regardless of the severity, delayed identification and intervention make remediation more challenging and hinder the children's progress. Even children with subtle linguistic and reading difficulties require the guidance of well-trained teachers who understand the connections between language and reading development. Unfortunately, there is a scarcity of such trained teachers due to the lack of programs offering this specific training. Signs associated with Specific Learning Disabilities (SLD) typically do not appear suddenly during primary school (Coleman, Buysse, & Neitzel, 2006). Instead, children at risk of SLD may display preliminary symptoms in earlier stages of development. These early symptoms can manifest in areas like reading, speaking, motor skills, and predictive abilities (Smith, 1994). Deficiencies in regulating learning methods, knowledge, visual analysis skills, and other related abilities can also serve as indicators of SLD.

The diagnosis of learning disabilities is often determined when children begin to exhibit academic difficulties in school, and the average age when children receive learning disabilities assessments is 9 years (Shaywitz, 1998). Signs related to SLD are generally not considered as symptoms that appear suddenly in primary school (Coleman et al., 2006). Children at risk of having SLD may exhibit some preliminary symptoms in earlier periods. The symptoms that may be observed in early childhood can be seen in areas such as reading, speaking, motor skills, and predicting skills (Smith, 1994). In addition, deficiencies in SLD, such as the regulation of learning methods, knowledge, and visual analysis skills, and in some other skills that may be associated with SLD are also indicators of SLD. As the development of academic skills is not at the forefront in early childhood, the degree of inadequacy in the developmental areas with the potential to predict academic failure can be observed rather than academic failure itself (Smith, 1994). It is important to recognize those possible delays in the developmental areas and start intervening early.

A family history of learning disabilities should keep parents, teachers, and physicians alert to this possibility. A history of delay or difficulty in developing speech and language, learning rhymes, or recognizing letters and sound/symbol connections may be an early indication of dyslexia. Parents or teachers may detect early signs of learning difficulties in preschool-aged children; however, in most cases, learning disabilities are not discovered until children experience academic difficulties in elementary school. The child may have difficulty with reading, spelling, handwriting, remembering words, or performing mathematical computation. Because remediation is more effective during the early years, prompt diagnosis is important (Shaywitz 1998; Klein & Shaywitz 2005; Torgesen 1998; Vellutino et al., 2004; Foorman et al., 2003; Schatschneider & Torgesen 2004; Shaywitz & Shaywitz 2002). The effect that dyslexia may be different for each person and depends on the severity of the condition and the effectiveness and timeliness of instruction or remediation (AAPSO et al., 2009).

Being a life-long disability and observed as significant unexpected scholastic under-achievements, academic capabilities and experiences, Learning Disability may vary in severity across individuals, depending upon the degree in which it affects an individual. Eventually it hampers or slows down an individual’s capacity to interact with the demands of the environment that they are part of and their own strengths and needs, demanding an unusually high level of efforts and support to maintain the performance; and about 7% of children and adolescents are found to experience a substantive learning deficit in at least one area of mathematics before graduating from high school (Barbaresi et. al, 2005). Depending on the

type of difficulty and the related symptoms evident in a learner with Learning Disability, the disability may be classified into Dyslexia (’Word Blindness’ or ’Reading disorder’ leading to difficulty in reading, writing, and spelling), Dyscalculia (difficulty in computation, Math, concepts of time and money), Dysgraphia (difficulty in written expression leading to illegible handwriting, spelling, and composition), Dyspraxia (difficulty in fine motor skills and coordination), Auditory Processing disorder (difficulty in Interpreting auditory information affecting language development and reading), Visual Processing disorder (difficulty in interpreting visual information affecting reading, writing, and math). When accompanied with other related disorders like Attention Deficit Hyperactivity Disorder (ADHD), the level of concentration and focus in learners as well gets affected, who as a result exhibit over-activity, get easily distracted and tend to be impulsive. Difficulty in sitting still, losing interest quickly, handling complexity, adaption and flexibility, attending to and remembering differentiation, judgment, symbolic thought perception of the patterns and rhythms of forms in knowledge and reflection are areas affected that probably define the abilities of individuals with Learning Disabilities (Crealock, et al., 1993).

Around 80% of individuals with learning disabilities are affected by dyslexia. In literature, the terms "reading disability" and "dyslexia" are often used interchangeably. Dyslexia is a fundamental reading disorder caused by abnormal processing of written language in the brain.It is marked by difficulties in accurate or fluent recognition of sight words, as well as problems with spelling and decoding. These struggles are typically unexpected when compared to the individual's other cognitive abilities. Dyslexia has a strong genetic component.While it is frequently inherited, it can also occur without a known family history. Dyslexia varies in severity, can persist throughout life, is found across cultures, and appears to affect boys more than girls. It affects individuals across the full range of intelligence and can be diagnosed early or only later, when higher-level reading and writing skills are needed. Some individuals with dyslexia are highly intelligent and may excel in areas such as math, science, the arts, or even writing. It is important to distinguish dyslexia from secondary reading problems caused by hearing or vision impairments, intellectual disabilities, or lack of educational opportunities. Early reading challenges can also result from poor instruction or limited experience. Identifying and addressing these factors is crucial (Lyon, 1998; Shaywitz, 2003; Vellutino et al,. 2004; DeFries & Alarcón, 1996; Shaywitz et al., 1999; Torgesen, 1998).

Learning disabilities can resemble other neurodevelopmental or sensorimotor disorders. It's crucial to differentiate LDs from conditions like intellectual disability, hearing or vision impairments, and ADHD, which can also impact speaking, listening, reading,

reasoning, writing, and math skills. Environmental factors such as chronic truancy, domestic violence, abuse, or caregivers' behavioral health issues should also be considered. Additionally, different types of learning disabilities may present similarly and mimic one another (Mayes et al., 2018; Kronenberger et al., 2003). According to studies (Handler & Fierson, 2028; Spencer et al., 2014), diagnosing and treating children with learning disabilities requires ongoing collaboration from a multidisciplinary team, including educators, educational specialists, psychologists, physicians, and speech, occupational, and physical therapists. Speech therapists can address underlying language difficulties often linked to dyslexia, while occupational and physical therapists treat motor, balance, and sensory-processing issues that may accompany learning disabilities. Clinical psychologists assist with social challenges, and educational therapists support children with learning disabilities. Continuous monitoring of academic performance and behavior is essential, especially for children with behavioral concerns, and remedial programs are available for reading and writing difficulties. Specific educational strategies include improving phonological awareness for children with dyslexia, enhancing hand-eye coordination for those with dysgraphia, and practicing number syntax for children with dyscalculia.

Children with learning disabilities are at higher risk for poor academic performance, which can impact their social and career paths. Persistent academic struggles can lead to a negative self-image, contributing to difficulties in social relationships and potentially depression. Behavioral issues may also arise, as children with LDs may resist authority or demands. These challenges can foster an aversion to school, leading to increased absenteeism or truancy (Spencer et al., 2014). Thus, the importance of early intervention for children at risk for learning disabilities is further illustrated by their potentially pervasive effects on development. While those with learning disabilities constitute a heterogeneous and diverse population with varied outcomes, adverse consequences of learning disabilities can persist across the lifespan and extend beyond academic skill acquisition to more complex developmental tasks (National Research Center on Learning Disabilities [NRCLD], 2002). During childhood, individuals with learning disabilities face a complicated and challenging task of integrating their disability into an emerging self-concept. Children who have difficulty with this task and employ immature strategies such as denial or disavowal can become harsh self-critics. These children thus have an increased lifetime risk for a broad range of psychiatric disorders (Esser et al., 1990), and particularly depressive disorders and Post-traumatic Stress Disorder (McNulty, 2003). Because of inconsistent criteria and methods, there is no clear agreement on how the severity of learning difficulties (LD) relates to behavioral and emotional

problems. For example, Miller et al. (2005) found that children with the most severe reading difficulties did not show more internalizing symptoms than those with milder reading issues. In contrast, Wu et al. (2014) reported that lower math achievement was linked to externalizing, but not internalizing, symptoms. They also observed differences in math anxiety across children classified as having math difficulties (<10th percentile), low achievement (11th–24th percentile), or typical performance (>40th percentile), concluding that even nonclinical math challenges are connected to attention problems and math anxiety. Further inconsistencies appear when using the same cutoff point: Arnold et al. (2005) found no differences between students below the 18th percentile and their typically developing peers, while Goldston et al. (2007) did. Together, these mixed findings highlight a concern: if research or assessments rely solely on categorical cutoffs, the emotional well-being challenges of students with less severe academic difficulties may be overlooked or underestimated.

Population-based studies indicate that girls are more likely to experience somatic complaints, depression, and anxiety, whereas boys are more prone to oppositional defiant disorder, conduct disorder, and ADHD (Altemus et al., 2014; Martel, 2013). However, findings on gender differences in behavioral-emotional problems among individuals with learning difficulties (LD) are less consistent. Some studies report higher levels of depressive symptoms in girls (Heath & Ross, 2000; Martínez & Semrud-Clikeman, 2004), while others either do not differentiate results by gender or fail to identify differences (Maag & Reid, 2006; Nelson & Harwood, 2011, 2010). Few studies have examined gender effects across different types of LD.

Research focusing on reading difficulties (RD) suggests that girls with RD are more likely to experience internalizing problems such as anxiety and depression (Nelson & Gregg, 2012; Willcutt & Pennington, 2000). In contrast, boys with RD are often reported to show more externalizing behaviors compared to girls and controls (Heiervang et al., 2001; Willcutt & Pennington, 2000). Yet, Carroll et al. (2005) found higher rates of self-reported depression among boys with RD, challenging this pattern. Findings concerning math difficulties (MD) are similarly inconsistent. Wu et al. (2014) observed a stronger link between math achievement and externalizing behaviors among girls, whereas Graefen et al. (2015) found boys scored higher on internalizing problem scales. Overall, the evidence does not allow for firm conclusions about the interaction between gender and LD type, highlighting the need for further research exploring gender effects on behavioral-emotional problems across different forms of LD.

The identification of learning disabilities (LD) in the United States has long been a matter of debate, particularly regarding the methods used to determine eligibility for special

education services. Since the 1970s, schools have largely relied on the IQ–achievement discrepancy model, which defines LD as a marked gap between a child's intellectual potential and actual academic achievement (Ysseldyke et al., 1983). This method, however, has been widely criticized because reliable discrepancies often do not emerge until later elementary school years, effectively delaying intervention—hence its description as a "wait-to-fail" model (Hallahan et al., 2015; Kavale, 2005; Pullen & Mercer, 2009; Shaywitz & Shaywitz, 2009). In response, policymakers and researchers have promoted the Response to Intervention (RTI) framework as an alternative. RTI is organized into a three-tiered system: Tier 1 involves evidence-based classroom instruction, Tier 2 provides more intensive small-group support, and Tier 3 refers students for special education when progress remains insufficient (Pullen & Hallahan, 2015). While RTI is widely seen as more proactive and theoretically sound, its success depends heavily on consistent implementation and the quality of Tier 1 teaching. Challenges such as students cycling between Tiers 1 and 2 without progressing to Tier 3 have raised concerns about delays in proper identification (O'Connor & Sanchez, 2011; O'Connor et al., 2013). Nevertheless, RTI is increasingly regarded as the dominant approach (Fuchs & Fuchs, 2006; McKenzie, 2014; Berkley et al., 2009).

Epidemiological patterns further reflect these shifts in policy. The prevalence of LD among children aged 6–17 rose from roughly 2–3% in the 1970s to 5.59% by 2001, before declining to 4.39% in 2011. Scholars attribute this decrease, at least in part, to the gradual replacement of discrepancy-based identification with RTI (Cortiella, 2009). Gender differences are also evident, with boys identified at a rate three times higher than girls. While some argue this is linked to biological vulnerabilities, others suggest referral bias may play a role, as teachers are more likely to refer boys who also exhibit disruptive behaviors (Clarizio & Phillips, 1986; Leinhardt et al., 1982; Shaywitz et al., 1990).

Educational responses are guided by federal mandates such as the Individuals with Disabilities Education Act (IDEA) and the Americans with Disabilities Act (ADA)**,** though implementation is left to individual states. The central tool in school-based practice is the Individualized Education Program (IEP), which outlines specific goals, methods, and accommodations. Effective instruction for students with LD is expected to be explicit, systematic, and intensive, while incorporating corrective feedback and reinforcement (Mercer & Pullen, 2009; Carnine et al., 2006; Brosvic et al., 2006; Chard et al., 2012; Wanzek et al., 2006). Secondary school programs emphasize either functional skills (e.g., work readiness, money management) or preparation for post-secondary education, while Section 504 of the

Rehabilitation Act ensures reasonable accommodations at the college level (Deshler et al., 2001; Rojewski & Gregg, 2011).

Finally, long-term outcomes show progress but also persistent challenges. Dropout rates for students with LD remain around 25%, significantly higher than peers, though graduation rates have improved since the 1990s (Cortiella, 2009). Adults who adapt most successfully often share traits such as perseverance, realistic self-assessment, goal-setting, strong social networks, and a sense of self-determination (Bear et al., 2006; Lindstrom & Benz, 2002; Raskind et al., 2011).

2.2.Norms of development

Children grow and develop within a socially intricate, ecological environment where both mothers and fathers play a significant role in shaping their growth and well-being (Carbera et al., 2014). According to Yogman et al., 2018, children must acquire a range of skills to foster optimal development and cope with toxic stress. Studies show that age-appropriate play with parents and peers provides a unique opportunity to enhance social-emotional, cognitive, language, and self-regulation abilities, all of which contribute to the development of executive function and a prosocial mindset. Additionally, play helps establish the secure, stable, and nurturing relationships with caregivers that are essential for children's well-being and growth. Positive youth development (PYD) emphasizes strengthening the abilities of young people, creating supportive and engaging environments, and fostering mutually beneficial interactions between youth and their contexts (Larson, 2000; Lerner et al., 2009; Snyder & Flay, 2012). Interventions based on the Positive Youth Development framework should therefore go beyond merely focusing on problems and instead address protective and risk factors in family, peer, school, and community settings that influence the successful achievement of youth developmental milestones (Catalano et al., 2002).While individuals with learning disabilities (LD) have been present in our educational system since its establishment, acknowledging and identifying the specific learning needs associated with LD, now recognized as a global condition (Gersons-Wolfensberger & Ruijssenaars, 1997), is a relatively recent development. Growth in identification of individuals for special education is of concern to educators and policymakers largely because special education services are costlier than general education (Chambers et. al., 2002). The cost per student for special education is nearly twice that for general education ($12,000 per special education student compared with $6,500 for a general education student). Furthermore, much of the burden for funding special education comes from

state and local education agencies (Vaughn & Fuchs, 2003). Thus, accurate determination of which students qualify for special education is critical. According to WHO (2006), evaluating the growth of children holds crucial importance in tracking their health, spotting deviations from the norm, and gauging the efficacy of interventions. The timely identification of insufficient growth during early stages is particularly vital due to its connection with negative outcomes such as impaired cognition and academic performance, lower adult earnings, reduced productivity, and, if accompanied by excessive weight gain in later childhood, an elevated risk of nutrition-related chronic ailments (Victoria, 2008).

Children's timely attainment of developmental milestones is an important indicator of the extent to which early neurodevelopment is progressing typically (Bishop et al., 2016; Johnson et al., 2015; Mayes & Calhoun, 2003). Developmental milestones are commonly incorporated into pediatric screening questionnaires, which are widely recommended on the basis of evidence supporting their accuracy in detecting developmental delays (Duby et al., 2006). Moreover, evidence also supports the validity of individual milestones as markers of developmental status. Consistent with recent evidence that early childhood is a critical developmental period for long-term health and productivity (Campbell et al., 2014; Shonkoff et al., 2012). A significant number of counseling professionals face challenges in devising appropriate intervention programs for students with disabilities, primarily due to a limited grasp of approaches (e.g., attitudes, values, beliefs) and insufficient skills to cater to the unique needs of this demographic (Glenn, 1998). In the absence of adequate knowledge and comprehension regarding the needs and characteristics of specific groups of students with disabilities, school counselors may struggle to effectively contribute to their academic, career, and personal/social development. Recent research has delved into the social and emotional needs of academically talented students with learning disabilities, revealing distinctive traits related to persistence and individual interests. This body of research suggests that academically talented students with learning disabilities often exhibit lower academic self-efficacy compared to their peers without learning disabilities (Baum & Owen, 1988).

According to documented research (Lightfoot et al., 2013; WHO, 2006), motor, language, and cognitive development adhere to specific schedules that are comparable across different cultures. Cross-sectional studies have demonstrated that delayed or atypical motor or language development often coincide with certain cognitive deficits, and vice versa (Nelson et al., 2006; Piek et al., 2004). Therefore, the link between developmental milestones and later intelligence can be interpreted in two ways: one possibility is that it reflects the influence of common factors on both early development and later adult intelligence, as well as

developmental trajectories. Alternatively, it might indicate an independent effect of the age at which developmental milestones are achieved on later cognitive development and adult intelligence (Flensborg-Madsen, 2017). Based on Scharf et al., (2016), developmental milestones are a set of goals or markers that a child is expected to achieve during maturation. They are categorized into 5 domains: gross motor, fine motor, language, cognitive, and social-emotional and behavioral. Understanding and identifying the developmental milestones can help the provider more adeptly recognize delayed development, facilitating earlier interventions and improving outcomes and these milestones are like bellowed listed:

Six months: Stranger anxiety; Rolls over; begins to say consonants while babbling; brings things to mouth.

Nine months: Separation anxiety; 'stands' on hands and feet, sits without support, crawls, pincer grasp; understands “no,” points with a finger, says “mama” or “baba;” plays “peek-a-boo.”

Twelve months: Puts out arm or leg when dressed, cries when familiar people leave; stands well; responds to simple commands, makes gestures, puts things in a cup and removes them, bangs things together.

Eighteen months: Engages in pretend play, kisses/hugs familiar people, walks alone, walks up steps, eats with utensils, says several individual words, points to one body part, scribbles with crayon, marker, or pen.

Two years: Begins playing with other children, parallel play; stands on tiptoes, kicks a ball, throws a ball overhand; two to four-word sentences, points to things in a book, strangers can understand 50% of language; stacks four or more blocks, follows two-step instructions.

Three years: Dresses/undresses self, copies others, takes turns; walks up and downstairs with one foot per stair, runs easily; strangers can understand 75% of language; stacks six or more blocks, turns pages in a book, pushes buttons and turns knobs.

Four years: Likes to play with others, more imaginative play; hops on one foot, can stand on one foot for two seconds, cuts with scissors; can recite a poem or sing songs, understands basic grammar; identifies some colors and numbers, draws a person with two to four body parts.

Five years: Differentiates between real and pretend, wants to be like friends; can stand on one foot for 10 seconds, can somersault; easily understood by others, tells stories, uses future tense; counts to 10, draws a person with six body parts, prints some letters and numbers (Scharf et al., 2016).

Children with delays qualify for Early Intervention, which are programs that can help the child catch up to development typical for their age. These interventions may include speech therapy, physical therapy, and occupational therapy. The earlier delays are identified and addressed, the more positive the prognosis (Garg & Dworkin, 2011; Lipkin et al., 2015)

Once a delay in development is identified, the clinician must try and find the etiology for the delay. A child with a speech delay may have an underlying hearing problem, whereas, children with visual problems may have delays in motor development. Genetic and metabolic conditions can also precipitate developmental delays, often global in nature. Children with cerebral palsy will also present with global delays. A thorough workup should include hearing screening, thyroid function testing, lead testing, and a microarray (Weitzman & Wegnar, 2015).

Research shows that parents with poor knowledge of child development tend to overestimate their children's rate of development, leading to inappropriate expectations, impatience, and intolerance (Cowen, 2001; Twentyman & Plotkin. 1982). Parents who have a history of child abuse or neglect also demonstrate low levels of knowledge in child development and become frustrated when their children do not meet their expectations (Plotkin. 1982; Azar & Rohrbeck 1986). Effective parenting relies on parents' understanding of child development and having accurate expectations for their children's behavior, which is associated with better child outcomes (Stevens, 1984; Dichtelmiller et al., 1992; Hunt & Paraskevopoulos, 1980). Positive and effective parenting techniques are essential for children's healthy emotional and social development (Reiner et al., 2004; Riesch et al., 2006).

On the other hand, ineffective parenting techniques, such as inconsistent or harsh discipline, can increase the risk of conduct problems in children (Gardner et al., 2006; Gardner et al., 2003). Additionally, a lack of warm and positive relationships with adults or inadequate adult supervision can lead to social or behavioral problems in children (Gardner et al., 2006). These behavior, social, and conduct problems can have significant secondary consequences, including school exclusion, delinquency, mental illness, partner violence, and poor literacy (Gardner et al., 2006; Fergusson et al., 2004; Rydelius, 1988). The overall impact of these secondary outcomes has resulted in increased costs for governments in education, social services, and the justice system. Children with behavior problems are estimated to cost the system ten times more than children without behavior problems (Scott et al., 2001). In conclusion, knowledge of child development plays a crucial role in effective parenting and optimal child development (Stevens, 1984).

2.3.Language development

Communication refers to the exchange of information through a system of socially recognized symbols and behaviors. While humans also communicate using gestures, posture, and facial expressions, most communication depends on expressing ideas through spoken or written language. Spoken messages are received by listeners via hearing. Language itself is a socially shared, rule-based system of symbols used to represent ideas about the world. It involves semantics (shared understanding of word meanings), morphology (rules for modifying words, such as adding "s" to form plurals), and syntax (rules governing word order). Pragmatics, or the social use of language, includes complex conventions such as using eye contact, interpreting verbal and nonverbal cues together, phrasing requests politely, and maintaining conversational flow. Language disorders occur when an individual experiences challenges with expressive language (conveying thoughts and ideas), receptive language (understanding others), or pragmatic language (appropriate social use of language) (Shark & Hillenbrand, 2008; ASHA, 2008).

Language development is a fundamental skill for all children, crucial for their participation in daily activities, as well as their social, emotional, and educational success (Boyle et al., 1994; Conti-Ramsden et al., 2016; Roulstone et al., 2011). Milestones in language development should reflect the core aspects of language, including speech, language, and communication, which are interconnected. Speech refers to the production of sounds, with children typically beginning to babble at around 6 months, and speech sound development continuing until about 7 years old. Language involves understanding and producing words, sentences, and ideas, with the first words generally emerging around 12 months and vocabulary increasing thereafter. Grammar development begins when children start combining two words, usually around their second birthday, followed by the development of more complex grammar elements, such as syntax and morphology. Communication includes both verbal and nonverbal language used in interactions, which is essential for language development. However, it remains unclear whether milestones in speech, language, and communication reflect the same underlying construct of language development. Children show considerable variability in the timing and rate of vocabulary and grammar development, such as the mean length of utterance, the proportion of verbs in vocabulary, and the use of irregular nouns and verbs. Due to these variations, it is challenging to define a standard pattern of language development that applies to all children (Jiang et al ., 2018; Kuhl, 2004; Bates et al., 1996; Fenson et al., 1994).

The acquisition of language and speech seems deceptively simple. Young children learn their mother tongue rapidly and effortlessly, from babbling at 6 months of age to full sentences

by the age of 3 years, and follow the same developmental path regardless of culture (Kuhl, 2004). Environmental events, like neglect, abuse, or inadequate interactions with caregivers, as well as biological causes such as genetically transmitted disabilities, trauma, toxins, infections, poor nutrition, drug exposure, anoxia, or asphyxia at birth, and low birth weight, can put children at risk of developing communication disorders (Lerner et al., 1998; McCormick, 1994; Wetherby, 1998). Difficulties with language can arise from various underlying issues, such as intellectual disabilities, pervasive developmental disorders like autism, physical disabilities, hearing impairment, environmental deprivation, neurological disorders, or a combination of these factors (Bishop, 1997; Chapman, 2000; Goorhuis & Schaerlaekens, 2000; Hall, 1997; Pinker, 1994; Tomblin, 1996; Whitehurst & Fischel, 1994).

In the first five years of life, children progress through significant prespeech, speech, and language milestones. From birth to three months, infants respond to sounds by startling, quieting, or smiling at familiar voices, and may alter sucking behavior in response to auditory stimuli. They begin cooing to show pleasure, use distinct cries to signal needs, and smile at familiar faces. Between four and eight months, they localize sounds, notice changes in tone of voice, attend to music, and become aware of sound-making toys. Their vocal skills expand to include clear vowel sounds, babbling with consonants such as *b*, *p*, and *m*, imitating adult sounds, and using their voice to express excitement or displeasure. By seven to fourteen months, infants discriminate speech sounds in their native language, recognize familiar words, follow simple requests, and enjoy social games like peek-a-boo. They add consonant sounds such as *k*, *g*, *t*, and *d*, babble in short sequences, and may use one or two true words like “mama” or “bye-bye.” From one to two years, children understand body parts, follow simple commands, answer basic questions, listen to stories, and point to pictures in books. Their vocabulary grows steadily, reaching at least ten words by 18 months, and they begin combining words into two-word phrases or questions. Speech is simplified by dropping syllables or sounds, but a wide range of consonants emerges, with girls often slightly more advanced. Between two and three years, children follow two-part instructions, identify body parts, and can be understood by caregivers most of the time. They use two- to three-word phrases, have words for almost everything, and use speech both for requests and attention, though occasional repetitions at the start of phrases may occur. By age’s three to four, children can answer basic “wh” questions, learn vocabulary and sentence structures through conversations and reading, and are understood by most unfamiliar listeners. They describe events away from home, speak fluently in longer sentences of four or more words, and usually no longer repeat syllables. From four to five years, they listen attentively to stories, answer questions about them, and comprehend most

spoken language at home, preschool, and school. Their speech is clear, using detailed sentences and storytelling that remains on topic. By this stage, they communicate easily with both peers and adults, produce most sounds accurately (though *th, ch, r, l, s,* and *z* may still be developing), and consistently apply grammar rules consistent with their family or regional dialect (ASHA, 2008; Kuhl & Meltzoff, 1996; Owens 2006; Luinge et al., 2006; Sebastián-Gallés 2007).

Learning language is one of the key developmental tasks facing children in the preschool years. Human infants have evolutionarily adapted nervous systems that enable them to attend to and perceive the acoustic and temporal characteristics of spoken language. Soon after birth, infants can discriminate all the sound contrasts languages of the world use, even those which are not present in their home language (Kuhl and Meltzoff 1997; McMurray and Aslin 2005). Infants start using communicative gestures, such as pointing, showing, and offering interesting objects to others (Behne et al., 2012; Fusaro et al., 2012; Tomasello et al., 2007). During this stage, they also exhibit the initial signs of language comprehension. Infants respond to their own name (Tincoff and Jusczyk, 1999) and begin to associate words with objects (Bernhardt et al., 2007; Gogate and Hollich, 2010; Masur et al., 2013), especially within specific contexts, like when an adult says "duck" during bath time while playing with a toy duck. In typically developing children, language comprehension generally comes before language production.

The significance of language in human behavior makes it unsurprising that language difficulties can have repercussions in other aspects of children's lives. Research indicates that language impairments are connected to challenges in acquiring literacy skills, memory development, and general nonverbal abilities, persisting from middle childhood to adolescence and beyond (Conti-Ramsden and Durkin, 2007; St Clair et al., 2010). Exposure to language during the first year of life plays a crucial role in the infant's ability to recognize and respond to the speech sounds of their home language or languages in multilingual families (Krentz and Corina, 2008). Throughout this phase, the infant's speech sounds gradually emerge, leading to babbling as they develop longer sequences of sounds that mirror the intonation patterns of the adult language (Locke, 1989; Majorano and D'Odorico, 2011; Papoušek and Papoušek, 1989; Saaristo-Helin et al., 2011). According to Schulte-Körne (2010), the ability to spell develops in stages. Initially, children spell phonetically, such as writing "foto" instead of "photo" or "boks" instead of "box". It generally takes about a year for children to learn all sound-letter associations, but children with spelling disorders might need up to two years. The next stage involves orthographically correct writing, addressing aspects like the proper use of capital and lowercase letters, suffixes (e.g., "asked" instead of "askt"), and correct spelling of word roots

(e.g., "happen" instead of "hapen" because the first vowel is short). By the end of the fourth year of school in Germany (around age 10), most children have mastered basic correct spelling. However, children with spelling disorders continue to struggle with accurate spelling into adulthood.

Language represents a multifaceted system that encompasses various dimensions or components necessary for effective communication. These components include phonology (sound system), lexicon (vocabulary), semantics (meaning), grammar (structure), pragmatics (communicative functions and conventions), and discourse (integration of utterances into longer conversations or narratives). Moreover, language is a dynamic system, with its different components working in harmony and undergoing changes during development. Evidence shows a strong correlation between early lexical development and grammatical development in typically developing children (Bassano et al., 2004; Bates and Goodman, 1997; Dionne et al., 2003; Szagun et al., 2006). Additionally, research involving children with language difficulties suggests that problems in one language dimension can have cascading effects on other components. For instance, delays in lexical acquisition can impact the development of grammar in late talkers and children with Specific Language Impairment (SLI) (Conti-Ramsden and Jones, 1997; Moyle et al., 2007). Language acquisition appears to happen effortlessly as the brain matures. The developmental milestones of language can be observed through behavior and are as follows: In the first days after birth, infants can distinguish different phonemes and recognize the prosody (sentence melody) of their native language compared to other languages. By 9 months, they have acquired the inventory of phonemes and specific stress patterns of their mother tongue (Jusczyk, 1997). At around 11 to 13 months, children begin to comprehend first words and produce their initial words. By 16 months, they have a vocabulary of about 50 to 75 words, and between 18 and 24 months, there is a notable vocabulary spurt (Bates and Goodman, 1999). During the second and third years of life, children continuously acquire syntactic structures, starting with two-word utterances around 18 to 24 months and progressing to longer sentences later on. Basic knowledge of syntactic word order constraints is evident around 2.5 years of age (Höhle et al., 2001).

According to Bates et al., (2002) by the age of four, most children have successfully grasped the fundamental structures of their native language. Alongside this linguistic achievement, they also demonstrate a range of cognitive and social accomplishments that seem essential for effective language learning. This rapid development results in highly sophisticated 4-year-olds. Remarkably, some children as young as three can utilize their newfound linguistic abilities to engage in discussions about complex topics such as life after death and the existence

or nonexistence of God. The universal occurrence of this phenomenon across all normal children and cultures leads to the intriguing notion that language is ingrained in our biological heritage, relying on the unique characteristics of the human brain.

Moreover, children facing language difficulties are at risk of experiencing less favorable developmental and educational outcomes. Evidence shows that these children encounter greater difficulties in social interaction compared to their typical peers (Durkin and Conti-Ramsden, 2007). As a result, they become more susceptible to academic struggles, social exclusion, behavioral and emotional problems, and bullying (Conti-Ramsden et al., 2009; St Clair et al., 2011). The complexity of the language system is often only detected when examined developmentally and realized when language development derails. The way in which language development can be impaired is multifaceted. It can manifest itself in the inability to acquire phonological, semantic, and syntactic information (specific language impairment [SLI]) (Levy and Schaeffer, 2003), or grammatical aspects selectively (grammatical-SLI) (Van der Lely, 2005), the inability to read (Dyslexia) (Shaywitz et al., 1990), or to understand others (autism) (Baron-Cohen et al., 1985, 1997).

Earlier research has identified a connection between developmental dyslexia and language acquisition deficiencies (Catts et al., 2001; Gallagher et al., 2000; Scarborough, 1991). Several prospective studies have investigated the relationship between language acquisition and dyslexia. In a groundbreaking study with children at risk of developing dyslexia, Scarborough (1990, 1991) found that 65% of the sample children were classified as dyslexic by the age of 8 years. By 30 months, these children exhibited a more limited range of syntactic devices and made more speech production errors. At 36 and 42 months, the dyslexic children showed less developed vocabulary skills compared to controls, and their syntactic difficulties persisted. Scarborough concluded that phonological awareness skills did not significantly contribute to the variance in reading outcomes, whereas syntactic skills emerged as a distinct predictor of reading disability. Consistent research findings indicate that dyslexia seldom occurs in isolation. Around half of children diagnosed with dyslexia also exhibit symptoms of a language disorder (Adlof & Hogan, 2018). Additionally, children with dyslexia are susceptible to experiencing adverse mental health outcomes, such as depression and anxiety (Grills-Taquechel et al., 2012; Hendren et al., 2018; Mammarella et al., 2016; Mugnaini et al., 2009; Nelson & Harwood, 2011). Dyslexia has also been linked to conduct disorders and oppositional defiant disorders (Burke et al., 2002), and a substantial portion—ranging from 20% to 40%—of children diagnosed with ADHD also present with dyslexia (Germanò et al., 2010). Moreover, children diagnosed with autism spectrum disorder exhibit a higher

prevalence of dyslexia compared to their peers (Åsberg et al., 2010). Similarly, those diagnosed with dyspraxia, a developmental coordination disorder, face an elevated risk of dyslexia, with up to 85% of children with dyspraxia also being diagnosed with dyslexia (Pauc, 2005). Collectively, dyslexia and its associated conditions manifest in a range of symptoms and challenges.

2.4.Dyslexia

Dyslexia is a neurobiological and developmental learning disability that is primarily language-based. It impacts a person's capacity to learn reading, both in terms of accuracy and fluency, as well as the development of spelling skills. The core challenge for individuals with dyslexia lies in connecting spoken language with the printed word due to deficits in the phonological aspect of language. This difficulty in accurately and fluently decoding words can have repercussions on reading comprehension and vocabulary development (Kim et al., 2014; Snowling, 2019). When dyslexia is identified as a specific learning disability, it exhibits two key characteristics. Firstly, individuals with specific learning disabilities have weaknesses in specific processes rather than showing generalized weaknesses in overall language or cognitive functioning (Grigorenko et al., 2020). In the case of dyslexia, a common processing weakness is a deficit in phonological processing, which involves using speech-based coding when processing oral or written language (Wagner & Torgesen, 1987). Secondly, the reading problem is unexpected (Fletcher et al., 2019). Historically, the recognition of dyslexia in adult's dates back to the latter part of the nineteenth century, while developmental dyslexia in children was initially documented in 1896 (Morgan 1896). The foundation of our comprehension regarding the neural mechanisms of reading traces its origins as far back as 1891 when Dejerine (1891) proposed that a specific segment of the posterior brain region, encompassing the angular gyrus and supramarginal gyrus in the inferior parietal lobule, as well as the posterior aspect of the superior temporal gyrus, holds paramount importance for reading. Furthermore, it was delineated another posterior brain area, situated more ventrally in the occipito-temporal region, as essential for the reading process.

According to Snowling (2012) dyslexia is a neurodevelopmental disorder believed to have a genetic basis, and it is generally accepted that more boys than girls are affected (though the gender ratio may be higher in referred samples). Although the precise causes of dyslexia are still unknown, morphological and brain imaging investigations have revealed abnormalities in how the brains of those who have the condition develop and work. Dyslexia is not a result

of a lack of intelligence or disinterest to study; with the right teaching strategies, dyslexic students may learn well. People of all ages and intellectual abilities can develop dyslexia (Muktamath et al., 2023). Children with learning disabilities experience a lower quality of life compared to typically developing children, with the severity of the disability being positively correlated to a poorer quality of life (Karande & Venkataraman, 2012). The health-related quality of life for children with dyslexia is significantly impacted, affecting various aspects of social psychology (such as role limitations and emotional problems) and physical health (including somatic function and general health perception). These impacts are reflected in difficulties with social interactions, low peer acceptance, poor self-awareness, increased negative emotions, behavior problems, and a higher rate of juvenile delinquency (Karande et al., 2008; Smolik & Málková, 2011; Furnes & Samuelson, 2011). Studies have shown that learning disabilities contribute significantly to juvenile delinquency (Einat & Einat, 2007; Kumagami & Kumagami, 2014). Children with dyslexia often have negative feelings about their self-image, peer and family relationships, and social interactions. They struggle with social skills due to low self-esteem or external pressures and face challenges with social adaptation and behavior. The prevalence of anxiety and depression in children with dyslexia is higher than in typically developing children, and they tend to exhibit more negative behaviors, a higher suicide rate, and an increase in antisocial conduct (Karande & Venkataraman, 2013).

The primary characteristic of dyslexia is difficulty with word decoding, which, in turn, impacts spelling ability and the development of reading fluency. Dyslexia tends to persist throughout a person's life, and the outcomes in adulthood can vary widely. While some individuals with dyslexia manage to pursue higher education, others may leave school with minimal qualifications. Many adults with dyslexia report issues such as slow reading, spelling problems, and challenges with written expression. Moreover, difficulties with working memory, attention, and organization are frequently mentioned by those with dyslexia. As a specific learning disability that is neurobiological in origin, dyslexia is characterized by difficulties with accurate and fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction (Lyon et al., 2003; Callens & Brysbaert 2020). Children with dyslexia face challenges in developing word decoding skills and fluency, as well as difficulties in generalizing their reading abilities to unfamiliar words. The cognitive roots of dyslexia are firmly associated with issues in phonological representation. These difficulties in phonological processing contribute to the struggles dyslexic individuals experience in acquiring and

applying reading skills (Shankweiler et al., 1979; Snowling & Hulme, 1994). Dyslexia is the outcome of multiple risk factors. Research has shown that dyslexia has a complex genetic basis. The prevalence of dyslexia is higher in those children who have a family history of dyslexia (Thompson et al., 2015).

Although it hasn't been studied extensively, children with dyslexia often struggle to recognize speech in noisy environments, though the severity of this difficulty can vary widely (Nittrouer et al., 2018; Van Hirtum et al., 2019; Ziegler et al., 2009). These challenges are particularly noticeable when identifying consonants, with most errors related to the place of articulation (Frey et al., 2019; Ziegler et al., 2009). Interestingly, no research so far has explored how a co-occurring Speech Sound Disorder (SSD) might contribute to this variability. SSD, according to the DSM-5, is a persistent difficulty producing speech sounds that interferes with intelligibility or communication, without being caused by physical, neurological, or hearing problems (American Psychiatric Association, 2013). It usually appears in preschool years and can increase a child's linguistic vulnerability, including in relation to dyslexia (Adlof & Hogan, 2018; Delage & Durrleman, 2018; Preston et al., 2013). In multifactorial models of dyslexia, SSD is considered one of several early predictors, alongside language impairments and family history (Hayiou-Thomas et al., 2017; Peterson et al., 2009). The overlap between SSD and dyslexia may stem from a shared deficit in phonological awareness - children with SSD struggle to recognize and manipulate phonemes, while children with dyslexia have difficulty linking these sounds to written letters (Johnson et al., 2011; Melby-Lervåg et al., 2012). Mari et al. (2020) found that children with dyslexia who do not have a co-occurring Speech Sound Disorder (SSD) exhibit normal speech recognition abilities, both in quiet and in noisy environments.

Systematic reviews and empirical studies have extended these findings, identifying a range of environmental risk factors associated with developmental dyslexia. These include maternal behaviors during pregnancy, such as smoking, as well as child-specific factors like birth weight, parental age at childbirth, and early parental educational exposure (Mascheretti et al., 2013a, 2013b; Becker et al., 2017). Evidence from Chinese cohorts additionally suggests that lower levels of active learning in early childhood may increase the risk of dyslexia (Sun et al., 2013). The impact of environmental risk factors is not confined to early childhood; prenatal and perinatal conditions also play a critical role in shaping later reading ability (Becker et al., 2017). For instance, several studies have demonstrated a negative association between maternal cigarette smoking during pregnancy and children's subsequent language, reading, spelling, and mathematical skills (Batstra et al., 2003; Fried, Watkinson & Siegel, 1997). Beyond prenatal

influences, research has also pointed to broader familial and sociodemographic factors. Children born to younger parents, particularly mothers under 30, and to mothers with lower educational attainment, are more likely to develop dyslexia and experience educational disadvantages (Melekian, 1990; Fergusson & Lynskey, 1993; Fergusson & Woodward, 1999). Family structure and stability further shape cognitive and learning trajectories, with parental separation linked to poorer preliteracy skills in early childhood and diminished academic achievement during adolescence (O'Connor et al., 2000; De Fries et al., 1994; Jee et al., 2008). Additional environmental stressors, including family history of neuropsychiatric disorders, maternal infections, complicated deliveries, preterm birth, and neonatal complications such as asphyxia or hyperbilirubinemia, have also been associated with persistent difficulties in reading, writing, and mathematics (Hokkanen et al.,2014; Duncan et al., 1994). Collectively, these findings underscore the multifactorial nature of dyslexia, highlighting the interplay between socioeconomic, familial, prenatal, and perinatal factors in shaping early literacy development.

Dyslexia has an estimated prevalence ranging from 5% to 17% of school-aged children (Peterson & Pennington, 2012 & Shaywitz, 1990). The challenges in phonological processing, or recognizing single language sounds and single word decoding (Shaywitz & Shaywitz, 2003 & Lyon et al., 2003) cause these skills to come less naturally in children with dyslexia, and they subsequently develop challenges with reading, spelling, writing, and vocabulary acquisition (Shaywitz & Shaywitz, 2003; Thomson et al., 2015; Vellutino, 2004). The degree of difficulty is variable; however, it is more than expected for an individual's cognitive level and age, persists despite appropriate reading instruction, and has a chronic course (Bruck, 1992). While most research on dyslexia has concentrated on the phonological challenges that significantly hinder decoding and, consequently, the development of proficient reading and reading comprehension, other underlying factors also differentiate dyslexic readers from typically developing ones. One such factor is working memory deficits (Knoop-van Campen et al., 2018; McLoughlin et al., 1994). Numerous studies have confirmed that dyslexic readers often experience working memory deficits, which can independently contribute to reading comprehension difficulties, separate from the issues they face with phonological coding (Berninger et al., 2008; Smith-Spark & Fisk, 2007).From a clinical perspective, the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) lists four criteria that must be met to diagnose a specific learning disability, which includes dyslexia. They are as follows: (a) persistent difficulties (i.e., for 6 months or more) in reading, such as inaccurate or slow and effortful reading; (b) skills must be well below average for the person's age and interfere with

academic achievement or daily life; (c) difficulties that begin during the school-age years even though some people may not have significant problems until adulthood; and (d) difficulties are not better explained by another disorder (APA, 2013).

Subgroups of dyslexia cannot be defined based on etiology, nor are there specific spelling errors unique to dyslexia. Instead, the errors can be linked to various stages of development. Approximately 40% to 60% of children and adolescents with dyslexia face psychological challenges, a rate significantly higher than the general prevalence of psychological disorders, which ranges from 5% to 18% according to the German Health Interview and Examination Survey for Children and Adolescents (KiGGS), depending on diagnostic criteria and symptoms used for classification. Children with dyslexia often experience more negative thoughts, depression, somber moods, and school-related anxiety, starting as early as primary school. They frequently feel excluded, disapproved of by teachers, and rejected. Adolescents with dyslexia have rates of suicidal thoughts and attempts three times higher than their non-dyslexic peers. Additionally, the prevalence of depressive disorders is twice as high, and anxiety disorders are up to three times more common in adolescents with dyslexia. Among primary school children, attention deficit hyperactivity disorder (ADHD) is the most common concurrent disorder, affecting about 20% (Daniel et al., 2006; Goldston et al., 2007; Mugnaini et el., 2009).

It is widely believed that early interventions can benefit all children at high risk of neurobehavioral impairments, although the evidence supporting this claim is inconsistent (Herskind et al., 2014; Spittel et al., 2015). While the definition of early intervention varies in research and clinical practice, it is generally described as “multidisciplinary services provided to children from birth to 5 years of age to promote child health and well-being, support emerging skills, minimize developmental delays, address existing or potential disabilities, prevent functional decline, and encourage adaptive parenting and overall family well-being” (Shonkoff & Meidels, 2000). Therefore, earlier such children are diagnosed, the more time there is for systematic and effective intervention (Hulme & Snowling, 2009; Shaywitz, 2003). On the other hand, according to Miciak & Fletsher (2020), from an educational standpoint, the criteria for identifying dyslexia can significantly differ among various schools and countries. Within the realm of education research, there is generally a consensus supporting a model of identification that views dyslexia as a construct not tied to any singular criterion, but rather a combination of criteria. One such proposed model introduces three criteria, though it does not inherently distinguish dyslexia from other specific reading-based learning disabilities. This three-pronged approach encompasses: (a) diminished performance in reading, particularly in

accurate or fluent word reading and spelling; (b) inadequate response to effective instructional methods, including multi-tiered support systems; and (c) exclusion of other factors (like intellectual disability or attention-deficit/hyperactivity disorder) that necessitate further evaluation. Years of failure to read can lead to reduced self-esteem, depression, and other psychological and clinical implications (Valas, 1999). Furthermore, targeted interventions are most effective when administered in kindergarten and first grade (Torgesen, 2000).

Dyslexia has become a significant concern, impacting the cognitive, personality, and mental health development of school-age children. Children with dyslexia often experience low academic performance, emotional instability, and feelings of inferiority due to a lack of understanding from parents, teachers, classmates, and peers. If these challenges persist, they may develop anxiety and depression, negatively affecting their physical and mental well-being. While several studies have shown the positive effects of literacy intervention programs on improving learning outcomes for children with dyslexia (Tam & Leung, 2019; Tilanus et al., 2019), dyslexia is influenced by multiple factors. Therefore, interventions focused solely on linguistic-literacy improvement may not be sufficient. It is crucial to understand the behavioral and personality traits of children with dyslexia and explore the factors that contribute to the condition. Thus, early detection and timely intervention play a crucial role in achieving a favorable prognosis and mitigating the 'dyslexia paradox.' Medical professionals working with children hold a vital responsibility in this regard. Being well-informed about this condition, they should focus on identifying risk factors and early indicators. During routine assessments of children, it is advisable to incorporate dyslexia screening by gathering a comprehensive history of speech and language development, exploring any initial challenges with naming (letters, objects, or colors), and assessing familiarity with nursery rhymes. Additionally, allowing the child to engage in free writing and observing spelling errors is important. Dyslexia is characterized by three key features: inaccurate reading involving distortions, omissions, and word or part-of-word substitutions; poor spelling with inaccurate letter orientation; and slow, laborious reading (Thambirajah, 2010).

Recognizing the crucial significance of early identification and intervention, coupled with the numerous unfavorable outcomes that can be averted or lessened, it becomes evident that there exists substantial therapeutic potential in identifying risk factors for dyslexia in children at an early stage. The home literacy environment emerges as a reliable predictor for the early development of reading skills. With its high heritability, a family history of dyslexia stands out as a significant risk factor. Additionally, considering the robust association between dyslexia and language disorders, deficient speech development can also be regarded as an early

predictor (Adlof & Hogan, 2018). Non-verbal intelligence is considered an indicator of identification and diagnosis of dyslexia. Reading achievement and intelligence quotient (IQ) discrepancy models have been used historically to diagnose dyslexia. Surprisingly, some new studies have shown stronger genetic association between reading difficulties and higher IQ (Wadsworth et al., 2010). There is also a suggestion that a higher IQ can serve as a protective factor for dyslexia, which can be effectively addressed through remediation. Working memory, responsible for storing and actively processing ongoing information, is recognized as a modest yet significant predictor of reading capabilities. Considering the potential comorbidity of dyslexia with other neuro-developmental disorders such as ADHD, ADD, OCD, dyspraxia, and Tourette syndrome, it becomes crucial to systematically assess for dyslexic features in children with neurodevelopmental disorders (Scarborough, 1998; Pauc, 2005).

Similarly, Wagner et al., (2020) present a hybrid model incorporating a constellation of criteria for identifying dyslexia, with an increased emphasis on the unanticipated nature of the reading challenges. Their framework comprises four dyslexia criteria: (a) unexpected difficulty in phonological decoding of nonsense words (inaccurate application of sound–letter associations when reading nonsense words); (b) unforeseen struggles with sight word reading (such as difficulty reading common words for a student's age, which should be recognized without sounding out letters); (c) poor response to effective instruction, including multi-tiered support systems; and (d) higher listening comprehension compared to reading comprehension. The commonalities among the aforementioned identification models involve subpar achievement in reading (specifically decoding) and limited response to effective instruction. However, Wagner et al.'s (Wagner et al., 2020) model introduces an element of unpredictability (like unexpected impairment in sight word reading), aligning with existing dyslexia definitions and receiving support from other researchers (APA, 2013; Erbeli et al., 2018).

It is well recognized that children with preschool language impairment are at high risk of developing reading difficulties (Bishop & Snowling, 2004) and that children at family risk of dyslexia who go on to have significant reading difficulties are likely to have a history of oral language difficulties (e.g. Scarborough, 1990; Snowling et al., 2003). Impairments in motor skills are also frequent in children with dyslexia (Kaplan et al., 1998), although the evidence for an association between motor difficulties and specific reading difficulties in the school years is not strong (Rochelle et al., 2008). The occurrence of motor deficits in children with language impairment, on the other hand, is well documented (Hill, 2001) and Bishop (2002) found shared genetic liability for impairments on speeded motor tasks and tasks requiring

speech production, suggesting that the genes that put a child at risk of speech/language difficulties may also affect motor development.

Neglected dyslexia can significantly affect different facets of children's lives, including communication, education, career, and mental well-being. The consequences of untreated dyslexia are apparent in the form of compromised academic performance. Prolonged struggles in academics and a sense of diminished self-esteem can elevate the likelihood of anxiety and depression (Mamarella et al., 2014). Children with dyslexia exhibit a reduced likelihood of finishing school and pursuing higher education. Dyslexic adolescents demonstrate elevated levels of aggression, externalizing behavior, and delinquency compared to their peers with typical reading abilities. Additionally, they face an increased risk of involvement with the juvenile justice system, with approximately 28-45% of incarcerated youth having a learning disability (Jimerson et al., 2000; Heiervang et al., 2001; Mallet et al., 2011). Children diagnosed with dyslexia often encounter additional psycho-social challenges, including diminished self-esteem, anxiety, and depression. They also face an elevated risk of suicide (Arnold et al., 2005; Chapman et al., 2000; McArthur et al., 2020; Morgan et al., 2012). Furthermore, they may be more prone to developing behavioral issues, engaging in delinquent behavior, and, in some cases, experiencing incarceration (Baker & Ireland, 2007; Grigorenko, 2006).

The etiology and pathogenesis of dyslexia have not yet been clearly determined. At present, three views dominate explanations of dyslexia: A visual-attentional view, a phonological view, and a multifactor view (Pennington, 2006). Scholars have found that children with dyslexia may be related to genetic, brain injury, brain dysplasia, malnutrition, and so on (Rüsseler et al., 2017; Wallace & Stevenson, 2014). Children with dyslexia lag behind normal children in visual cognition and sequential motor skills (Marchand-Krynski et al., 2018), and children’s learning motivation is also an important cause of dyslexia (Mammarella et al., 2009). External factors, including school, family environment, parenting education and reading environment, living environment, and others may also influence children reading skills. Children’s living and learning environment has produced significant effect on their learning skills (Rodriguez & Tamis-LeMonda, 2011). Incomplete family, disharmonious family relationships, family dysfunction, and too harsh parental rearing patterns may cause children anxiety or resist in learning (Karande et al., 2008). Dyslexia exhibits both familial and hereditary traits, as noted by Pennington and Gilger (1996) further they revealed that affected individuals' siblings show a roughly 40 percent prevalence, while among parents, the prevalence varies from 27 to 49 percent, offering opportunities for early detection in siblings and delayed but beneficial identification in adults (ennington & Gilger 1996). Research into

dyslexia has identified genetic markers on chromosomes 2, 3, 6, 15, and 18, based on replicated linkage studies (Fisher and DeFries 2002).

When examining how genetic and environmental influences shape literacy development, gene–environment correlations play a crucial role. These correlations refer to the way in which parental genes indirectly affect a child through the environment they create (Plomin, DeFries, & Loehlin, 1977; Scarr & McCartney, 1983). For example, a parent's genetic profile contributes to the child's genetic risk for dyslexia and also influences the type of literacy environment the parent provides - potentially one that is less conducive to reading. This scenario is described as a passive gene–environment correlation (passive rGE), and it helps explain why parental reading habits account for a small but meaningful amount of variation in the reading abilities of children with a familial risk of dyslexia, beyond the child's individual cognitive abilities (Carroll et al, 2014).

Two other forms of gene–environment correlation are also important. An evocative rGE occurs when children with a genetic predisposition to dyslexia elicit less literacy-related input from their parents compared to peers without such risk. An active rGE describes a situation in which children with a heritable vulnerability to dyslexia are more likely to choose environments that provide limited exposure to printed materials. Another potentially related risk factor for dyslexia is preschool language impairment. Research has shown that many children with a family history of dyslexia also experience early language delays or difficulties (Bishop & Snowling, 2004; Scarborough, 1990). Additionally, late talkers are often reported to have parents with background reading problems (Duff et al., 2015).

2.5.Risk Factors: Genetics

The functional characterization of genes associated with dyslexia and the identification of some common features led to theories about the neurobiology of the condition. Notably, 'knockdown' experiments in rats indicated a potential role for these genes in neuronal migration (Galaburda et al., 2006). This finding supported the theory that dyslexia could result from defective neuronal migration, as originally proposed by the Galaburda–Geschwind hypothesis (Galaburda & Kemper, 1979; Hymphreys et al., 1990). The neuronal migration hypothesis remained influential until it was questioned by 'knockout' mouse models for certain candidate genes (e.g., KIAA0319), which did not show the expected cortical abnormalities (see Guidi et al., 2018 for a full review). Further analysis of the cellular functions of these genes revealed an unexpected role in cilia, the sensory organelles that mediate various functions, including the reception of extracellular stimuli (Kere, 2014; Paracchini et al., 2016). Transcriptomic analysis

showed that dyslexia-related genes are upregulated in ciliated tissues (Ivliev, 2012). Both knockdown and knockout models provided evidence for the involvement of KIAA0319, DCDC2, and DYX1C1 in cilia formation and regulation of cilia length. Mutations in DYX1C1 and DCDC2 have been linked to primary ciliary dyskinesia and nephronophthisis-related ciliopathies, causing severe organ dysfunction due to defective cilia, but not dyslexia. As a result, while research on these genes has revealed interesting neurodevelopmental mechanisms, they cannot be directly associated with dyslexia (Diaz et al., 2022; Tarkar et al., 2013; Schueler et al., 2015).

LaBuda, (1988) suggest that the reading difficulties observed in twins with reading disabilities stem from several influences. They attribute 40% of these limitations to genetic factors, 35% to shared environmental influences such as socioeconomic status, parental literacy, and educational approach, and 25% to unique environmental circumstances. Notably, specific genes implicated in dyslexia include DCDC2 (doublecortin domain-containing protein 2) and KIAA0319, with DYX1-9 (dyslexia susceptibility 1–9) and ROBO1 (roundabout 1) also recognized as relevant (Schumacher et al., 2007). The risk of having dyslexia in first-degree relatives who have this reading and spelling disorder exceeds that in the general population (Pennington & Olson, 2015). Studies have shown that young children with a family history of dyslexia have reduced activation in neural correlates of phonological processing before reading onset compared to those without family history of dyslexia (Raschle, 2012). However, dyslexia should not be considered as a pure genetic component, but as a multifactorial developmental disorder (Mascheretti et al., 2017 & Van Bergen 2014). Following the initial descriptions of developmental dyslexia by Pringle-Morgan (1896) and Kerr (1897), the medical community quickly observed that dyslexia tends to occur within families. Various reports documenting familial clustering of dyslexia were published shortly thereafter, (Hinshelwood, 1907, 1911). These early accounts established the understanding that dyslexia has a hereditary component and tends to aggregate within certain family lineages. Compelling evidence indicates the heritability of reading difficulties; children with a family member experiencing reading challenges are more prone to developing similar difficulties compared to those without a family history (Pennington & Lefly, 2001; Scarborough, 1990; Snowling et al., 2003; Thompson et al., 2015). Among children with a first-degree relative facing reading difficulty, 40%–66% are likely to encounter similar challenges, contrasting with 6%–14% of those without a family history of reading difficulties (Catts, 2017; Pennington & Lefly, 2001; Scarborough, 1990; Snowling et al., 2003).

Over the past decade or so, advances in molecular technologies have enabled researchers to begin pinpointing potential genetic risk factors implicated in human neurodevelopmental disorders (Graham & Fisher, 2013). There are many possible causes of dyslexia and genes play a role in at least some of their (DeFries et al., 1987). The pursuit of identifying genes associated with dyslexia is strongly supported by compelling reasons. Extensive previous research, including familial clustering and twin studies, has provided substantial evidence indicating a significant genetic contribution to dyslexia. This is evident from the considerable proportion of variation in reading abilities that can be attributed to genetic factors, with estimates of heritability ranging from 0.4 to 0.8 (Schumacher et al., 2007). The ability to uncover the molecular foundation of a disorder relies not only on the genomic techniques at hand but also on the approaches employed to identify and understand the specific characteristics of the condition (Grigorenko, 2001).

In 1950, Hallgren conducted a comprehensive genetic epidemiological study involving a large sample of families to investigate the mode of transmission of dyslexia. The study revealed that dyslexia followed an autosomal dominant pattern, indicating the potential presence of a dominant gene on nonsex chromosomes. Hallgren's (1950) monograph also shed light on several characteristics of dyslexia, which have recently been reaffirmed. Firstly, the commonly cited male predominance in dyslexia (3-4 M: F) is primarily a result of selection bias. When examining relatives of individuals identified as probands, the sex ratio is nearly equal at around 1.5 M: F. Whether or not sex has an influence on heritability is controversial. Although the results of a US American twin study (Colorado Twin Study) showed similar heritability between the sexes (Hawke 2006; Wadsworth 2000) where Harlaar et al., 2005 found a higher heritability for boys in a UK sample (London Twins Early Development Study). Evidence from family and twin studies shows that dyslexia is a highly heritable disorder, and up to 75% of the phenotypic variance can be explained by genetic factors (Fisher et al., 2001 & de Kovel, 2004). Factors such as age and sex can moderate heritability estimates from twin studies. Regarding age, in contrast to ADHD, where the heritability attenuates across adolescence and adulthood (Bergen et, al., 2007), genetic influences on dyslexia remain stable across adolescence and early adulthood (Hawke et al., 2006). Moreover, research has shown that the same genetic influences are manifested in childhood and early adulthood (Hawke et al., 2006). That means that the emergence of genetic factors, which would exert unique effects at different time points from childhood to adolescence and early adulthood, is less likely. The presence of hereditary dyslexia has been a subject of suspicion for a long time, and comprehensive studies on its causes have verified a significant genetic influence, which is

believed to account for at least 50% of the overall variation (Decker & Bender 1988; Olsen et al., 1989).

The genetic basis of dyslexia, a neurobiological reading disability, has been the subject of study for over four decades. Recent advancements in genetic research have significantly improved our understanding of dyslexia. Both twin studies and molecular genetic investigations have converged on the idea that dyslexia represent the lower end of the distribution of reading abilities in the general population. However, there is an ongoing debate regarding the precise diagnostic criteria and the establishment of a definitive categorical threshold for dyslexia. This highlights the remaining challenges in unequivocally defining dyslexia within the field of genetics. Nonetheless, having a categorical definition of dyslexia remains valuable, particularly in facilitating large sample sizes required for genome-wide association studies (GWAS) (Erbeli et. al., 2021).

Although certain neurobiological and genetic connections exist, dyslexia remain primarily a clinical diagnosis, lacking definite biochemical or neuroimaging indicators, and no single test can establish it (Lyon, 2003; Shaywitz, 2007). Diagnosis hinges on historical data, observational insights, and psychological evaluations. This diagnosis becomes pertinent when an unexpected and differential delay between an individual's reading proficiency and their overall cognitive capacities arises, alongside challenges in phonological processing (Shaywitz & Shaywitz 2003). While children with dyslexia can eventually acquire reading skills, the process often demands greater effort (Lyon, 2003), resulting in comparatively lower overall reading achievements than their non-dyslexic counterparts (Lyon, 2003; Shaywitz, 2007). Timely characterization of children's reading abilities and early diagnosis of dyslexia are imperative, as targeted reading remediation through early intervention can lead to improved reading outcomes (Shaywitz & Shaywitz 2003; Shaywitz et al., 2007). Moreover, considering the heightened risk of academic underachievement, school failure, and internalizing issues (such as anxiety and depression) among children and adolescents with dyslexia, appropriate interventions have the potential to forestall these subsequent adverse consequences (Lyon 2003; Shaywitz 2007).

According to Dilnot et al., (2016) children with a familial predisposition to dyslexia face a higher accumulation of vulnerabilities compared to those without such a familial background. However, the influence of family risk alone on preparedness for learning is not as robustly linked as other contextual elements and child-health factors, and it loses its explanatory power in outcomes once the impacts of these additional factors are considered. It is thus more appropriate to perceive family risk of dyslexia not merely as a representation of

genetic susceptibility but as a reflection of the intricate interplay between genes and the environment. The presence of a nurturing literary environment at home emerges as a significant predictor of reading readiness, in conjunction with child well-being, and also holds predictive value for attention and behavior, interwoven with family stressors. These findings underscore the public health imperative of prioritizing early childhood, which offers optimal prospects for children's educational trajectories. Furthermore, they imply the potential of interventions aimed at assisting parents in cultivating a stimulating home literacy milieu to support their children's emergent reading abilities.

Genome-wide association studies (GWASs) (Uffelman et al., 2021) are considered the gold standard for identifying genetic factors linked to complex traits like dyslexia. These studies analyze numerous single-nucleotide polymorphisms (SNPs) spread throughout the genome. The success of GWASs largely depends on the size of the sample used. Large enough sample sizes can be achieved through international collaborations or by utilizing resources like the UK Biobank, which provides access to genomic data and hundreds of phenotypes from half a million individuals (Bycroft et al., 2018). A GWAS conducted on NeuroDys samples compared 2,274 dyslexia cases with 6,272 controls, finding that 20-25% of dyslexia susceptibility could be explained by common genetic variants. The largest case-control GWAS, involving 51,800 cases and over 1 million controls, relied on self-reported dyslexia diagnoses. This study identified 42 significant associations, with 17 being specific to dyslexia, and half of the associations were replicated in independent cohorts. It found strong genetic correlations between dyslexia and reading abilities, as well as ADHD, but no correlation with neuroanatomical measures related to language. Additionally, reliable polygenic risk scores (PRSs) for dyslexia were generated, explaining up to 6% of the variance in reading outcomes (Erbeli et al., 2021). Polygenic risk scores (PRSs) combine the effects of multiple genetic markers (SNPs) to predict an individual’s risk for a trait or disorder. For reliability, PRSs must be derived from large GWASs. While their primary goal is to assign risk scores, PRSs can also be used to explore whether genes associated with one trait influence other phenotypes. PRSs for various neurodevelopmental traits have been tested for their relationship with dyslexia and reading abilities (Wraj et al., 2018).

2.6.Assessing Dyslexia / Diagnosis

As noted by Roitsch & Watson (2019), identifying individuals with dyslexia can be difficult because IQ tests and language abilities are not always reliable indicators of the disorder. The most reliable sign that a student may have dyslexia is difficulty in learning to read. Early identification of children at risk for reading difficulties is crucial for timely and effective intervention. Since dyslexia is a specific learning disability in word reading and spelling, often linked to impairments in verbal working memory, it is essential to assess word reading (both real and pseudo words), spelling, and working memory to identify individuals with dyslexia. Historically, dyslexia has commonly been identified through either discrepancy criteria or cut-off point criteria (Snowling, 2012). Discrepancy criteria suggest that children with dyslexia exhibit reading skills below the anticipated level based on their performance on non-verbal IQ measures. Presently, the predominant understanding of dyslexia attributes its origin to challenges in the decoding aspect of reading (Snowling & Hulme, 2012), emphasizing that dyslexia is not a distinct medical syndrome (Elliot & Grigorenko, 2014). Consequently, individuals with dyslexia lack a specific ability profile, posing challenges in establishing a definitive cut-off point for diagnosis (Andresen & Monsrud, 2021). While much of the research on dyslexia emphasizes phonological challenges that significantly hinder decoding and the development of fluent reading, which in turn affects reading comprehension, other factors also set dyslexic readers apart from their typically developing peers. One such factor is working memory deficits (Knoop-van Campen et al., 2018; McLoughlin et al., 1994). Studies suggest that individuals with dyslexia experience working memory impairments, which may independently contribute to difficulties in reading comprehension, beyond their challenges with phonological coding (Berninger et al., 2008; Smith-Spark & Fisk, 2007).

One of the most known and recognized definition of dyslexia is provided by Lyon et al. (2003):

“Dyslexia is a specific learning disability that is neurobiological in origin. It is characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction. (Lyon et al., 2003, p. 2)”. According to this definition, diagnosis requires that these difficulties are surprising given the individual's cognitive abilities, although intelligence measures are not explicitly mentioned. Shaywitz (2003) suggested that unexpectedness can be assessed by comparing reading age with

chronological age or by evaluating reading ability against educational and professional attainment levels. While much of the research on dyslexia has focused on phonological difficulties affecting decoding and reading comprehension, other factors, such as working memory deficits, also distinguish individuals with dyslexia from typically developing readers. Studies have shown that working memory deficits in dyslexic readers can independently contribute to difficulties in reading comprehension, separate from issues with phonological coding (Berninger et al., 2008; Smith-Spark & Fisk, 2007; Knoop-van Campen et al., 2018; McLoughlin et al., 1994).

According to Muktamath (2023), diagnosing dyslexia can be a complex process, involving multiple steps for parents, educators, doctors, and other professionals working with struggling students. Parents often initiate the process when they notice their child facing difficulties, inquiring about the possibility of dyslexia. However, school personnel, despite recognizing red flags, cannot diagnose dyslexia, necessitating the involvement of qualified specialists such as clinical psychologists, neuropsychologists, speech-language pathologists, educational diagnosticians, academic learning centers, or trained medical experts. The diagnostic process involves a comprehensive evaluation, considering case history, casual observations, conversations, and standardized measures. Key areas assessed include decoding, reading fluency, reading comprehension, spelling, writing, and phonological processing skills like phonological awareness, phonological memory, or rapid automatic naming. In EU, dyslexia is diagnosed in different ways, mostly without specific dyslexic instruments. For example, In Bulgaria, all children in primary school are theoretically screened by a speech therapist at the beginning of the school year, but there is no standardized test for dyslexia; specialists instead rely on various cognitive assessments, such as IQ tests (Wechsler, Raven), as well as tests of memory, attention, and other skills, while judgments on reading, writing, and math abilities are left to professional discretion, with diagnoses carried out by psychologists, speech therapists, child neurologists, and other specialists. In the Czech Republic, only psychologists and special educators from psycho-pedagogical or special pedagogical centers are authorized to make a diagnosis, while parents, teachers, and pediatricians cannot; when a learning disability is suspected, teachers investigate areas such as reading, writing, spelling, counting, focus, and speech before referral. In England, assessments and diagnoses are conducted by educational psychologists or teachers with postgraduate training in dyslexia and a practicing certificate. In Switzerland, there is no legislation or standardized diagnostic protocol for learning difficulties; diagnosis and support largely depend on collaboration between schools, families, and speech therapy services, which are framed more in an

educational than clinical context, with diagnoses made by neuropsychiatrists in cooperation with speech therapists, psychologists, and motor psychotherapists under the National Health Service. In Turkey, diagnosis is restricted to state or university hospitals, where psychologists and psychiatrists are responsible; when a classroom teacher suspect's dyslexia, the child is referred to a government-run rehabilitation center that employs adapted tests such as WISC-R or Stanford-Binet (Cappa & Giulivi, 2012).

Wechsler Scales, designed for assessing preschoolers, children, and adults, include separate tests for verbal and non-verbal or performance skills (Wechsler, 1974). The verbal tests measure vocabulary, verbal concepts, general knowledge, and mental arithmetic, while the performance tests involve practical tasks such as assembling blocks or puzzles to create patterns or objects; these tasks are timed to assess processing speed. Scores from these tests typically yield Verbal IQ, Performance IQ, and Full-Scale IQ. Children with average or above-average Full-Scale IQ, but who struggle with reading and spelling despite lacking obvious neurological or sensory impairments and having adequate educational opportunities, may be identified as dyslexic. This corresponds to the concept of 'Specific Dyslexia' as described in the Word Blind Centre (Naidoo, 1972). Expanding this category beyond the discrepancy definition allows for a broader classification.

Performance on Rapid Automatized Naming (RAN) tests also differentiates between good readers and those with dyslexia (Snowling & Melby-Lervåg, 2016; Thompson et al., 2015). RAN is assessed by asking participants to quickly name arrays of familiar items such as letters, digits, colors, and objects. Research has demonstrated that RAN is a predictor of early reading skills (Lervåg et al., 2009). In the field of educational psychology, there are two significant international categorization systems: The World Health Organization's International Classification of Diseases (ICD) and the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders (DSM). In the DSM-5 (2013), dyslexia is referred to as a reading disorder (dyslexia) and is grouped with mathematical disorders and disorders of written expression under the broader diagnosis of Specific Learning Disorder, which is part of Neurodevelopmental Disorders. In ICD-11, the term used is developmental learning disorder with impairment in reading (ICD-11: 6A03.0). Despite the terminology changes in ICD-11 and DSM-5, dyslexia remains widely used as a diagnosis in Norway, where this study was conducted. The Norwegian Dyslexia Association (Dysleksi Norge, 2017) notes that educational psychologists and educational-psychological services (EPS) often use more operational definitions from sources like Lyon et al. (2003), the International Dyslexia Association (2003), the British Dyslexia Association (2008), or the ROSE report (2009), rather

than those from ICD or DSM. In Norway, students diagnosed with dyslexia are entitled to remedial software, such as computers with spell-checking applications, making dyslexia a "popular" diagnosis compared to other general academic problems. However, obtaining a dyslexia diagnosis typically requires assessment from an EPS. Since dyslexia is not directly observable, it must be identified through observable traits. Therefore, having nationally agreed-upon operational definitions of dyslexia is crucial so that all EPSs use consistent criteria and assessment tools that measure the specific skills and features included in the definition. However, due to the lack of clear diagnostic criteria, the definition of dyslexia has changed several times over the years (Snowling & Melby-Lervåg, 2016).

The diagnosis of dyslexia typically occurs when children encounter significant challenges in learning and advancing their reading skills, usually after commencing formal education and receiving sufficient reading instruction. However, research examining the behavioral traits of preschool children later diagnosed with dyslexia during their school years indicates that the primary predictors of dyslexia are closely linked to language skills (Hulme and Snowling, 2016; Snowling and Melby-Lervåg, 2016; van Viersen et al., 2017). Predictors such as speech delay, language disorder, speech sound disorder, difficulties in phonological processing skills, and a family history of dyslexia hold considerable importance in identifying dyslexia (Flax et al., 2008; Puolakanaho et al., 2007). The inclusion of language and speech skills among these predictors underscores the significance of recognizing language issues during the preschool period and monitoring children with language difficulties as they may be at risk for dyslexia (Yilmaz, 2021).

According to Gryz, 2015, in Poland the critical periods for diagnosing the risk of dyslexia and implementing effective interventions are at ages 7 and 8. It is essential to identify dyslexia symptoms and reading difficulties early. Screening tests, such as the Scale of the Risk for Dyslexia (SRD-7), should be conducted after the first school year, and reading assessments are needed at the end of the year. Useful tools include the "Darek" reading test for kindergartens, "Testy czytania dla sześciolatków," and "Dom Marka" reading aloud test. The "Test Dekodowania" (Szczerbiński & Pelc-Pękala, 2007) provides a broader assessment, including phonological skills. If symptoms of moderate or high dyslexia risk persist despite intervention, a re-evaluation at ages 8-9 is recommended. This diagnosis should involve a team of psychologists and pedagogues. Early diagnosis using tools like the "Test Dekodowania" helps identify reading difficulties and their causes, enabling targeted support. The aim is to provide regular training to address reading issues and reduce dyslexia risk. According to

Poland's education reform, dyslexia diagnosis should be completed by the end of primary school and remain valid throughout a student's education.

2.7.Early identification of dyslexia: the need and the importance

Identifying students at risk for dyslexia at an early stage has remained a persistent challenge in education. Despite significant advances in research on the nature, causes, diagnosis, and treatment of this learning difficulty, many educators still struggle to detect its early indicators. As a result, children at risk of reading difficulties may go unnoticed. Early detection is crucial, as it enables timely interventions that can prevent a cycle of academic failure, diminished self-worth, and reduced motivation (Shaywitz & Shaywitz, 2005; Kirby et al., 2010; Snowling, 2013; Hulme et al., 2015). Educational support and nurturing care offer chances to mitigate the potential negative outcomes in one's future. The connection between a top-notch preschool experience and later life results has been established causally, and this connection is further emphasized later on. It is worth noting that the pre-school setting has recently shown a positive correlation with subsequent academic achievements. The Effective Pre-school Primary and Secondary Education (EPPSE) project in England delved into the impact of pre-school experiences on later outcomes (Sammons et al., 2014). Effective intervention for children at risk of dyslexia and early reading difficulties relies on early action (Fletcher et al., 2019). Studies indicate that when risks are recognized in kindergarten (KG), Grade 1 (G1), or Grade 2 (G2), the likelihood of difficulties can decrease significantly with high-quality, intensive instruction (Mathes et al., 2005; Torgesen, 2000). However, if identification and intervention begin later, such as in Grade 3, it often requires more intervention time to catch up compared to interventions started in earlier grades (Connor et al., 2013; Lovett et al., 2017). Adolescents identified with reading difficulties tend to have poorer outcomes (Vaughn et al., 2010). Accurate identification of risk is essential for successful early intervention implementation.

The groundbreaking longitudinal research on the familial risk of dyslexia was conducted by Scarborough (1990, 1991). She studied 32 children diagnosed with familial risk (FR) and a control group from ages 2 to 8. Scarborough then retrospectively analyzed three groups: children with FR and dyslexia, children with FR but no dyslexia, and the control group (no risk). Assessments were made when the children were 3, 5, and 8 years old. At age 8, 65% of the children had a positive prognosis. The retrospective analysis of their early behavior

revealed significant developmental differences: at age 3, they exhibited poor vocabulary, grammar issues, and difficulty with speech production; by age 5, they had lower letter knowledge, weaker phonological awareness, and a smaller active vocabulary; and by age 8, they had developed full symptoms of dyslexia (Krasowicz-Kupis et al., 2014).

Intervening early with children who are at risk of dyslexia has been shown to be far more effective than waiting until after a formal diagnosis is made. This is often described as the "dyslexia paradox," meaning that by the time difficulties become severe enough for a diagnosis, the optimal window for intervention has already passed (Ozernov-Palchik & Gaab, 2016). For this reason, monitoring and supporting children's language skills in the preschool years is critical. Even after diagnosis, however, interventions are most successful when they go beyond teaching reading skills alone and instead combine reading and language instruction in a systematic, individualized, and comprehensive way (Snowling & Hulme, 2012; Grigorenko et al., 2020). Because dyslexia is a language-based reading disorder that often co-occurs with speech and language difficulties, speech and language therapists (SLTs) play a central role in its assessment and treatment. In Turkey, the National Core Education Program for Speech and Language Therapy (2016) specifies that SLTs should be trained to carry out functional assessments, differential diagnosis, and evidence-based interventions for dyslexia. Their role is broad, including prevention by supporting children's early literacy, identifying those at risk, assessing reading skills, conducting interventions, reporting results, and providing guidance to families and teachers (ASHA, 2001). Despite this, studies suggest that SLTs do not always receive sufficient training in reading and written language disorders. Research in Turkey, for example, found that while SLTs generally understood the characteristics of dyslexia, many had not taken specific courses on the subject and some held misconceptions that could negatively influence practice (Seçkin Yılmaz, 2019). A similar pattern was observed in the United States, where SLTs who graduated earlier reported limited formal training and had to learn about written language disorders during practice, while those with more knowledge also expressed greater confidence in working with affected children (Blood, Mamett, Gordon, & Blood, 2010). As Moats (2009) emphasizes, the knowledge and competence of professionals are key to successful interventions, meaning that better preparation and training for SLTs is crucial for improving outcomes for children with dyslexia.

Currently, the most extensively studied approach for early identification is the Response to Intervention (RTI) framework, as outlined by Fuchs and Fuchs (2006) and Fuchs et al., (2002). RTI employs a multi-tiered system of instruction and assessment to determine which children require additional support in reading. Generally, it comprises three tiers of

instruction, with the first tier delivering evidence-based initial reading instruction to all students in regular classrooms. Regular monitoring of children's progress occurs using relevant curriculum assessments. Successful response to instruction is defined by achieving predetermined progress or meeting specific standards on a designated assessment task. The initial stage of identification focuses on the functional consequences of reading difficulties rather than their root causes. Children not meeting predetermined criteria progress to the second tier of instruction, where they receive additional support, potentially involving more explicit or frequent instruction in smaller groups. Their progress continues to be regularly monitored, and if they persistently fall short of required standards, they may be referred for in-depth assessment and/or special education services tailored to their specific needs. A notable advantage of this approach is that it avoids the "waiting to fail" scenario (Fletcher et al., 2004; Fuchs & Fuchs, 2006). Monitoring children's progress begins right from the start of reading instruction, enabling early identification and intervention to address any issues promptly.

As children advance through school, reading becomes the main method for learning content. Therefore, it is crucial to identify children with dyslexia early and provide prompt intervention. Intensive early reading intervention enables 56% to 92% of at-risk beginning readers to reach average reading levels (Torgesen, 2002). However, many children are diagnosed with dyslexia only after they show significant preliteracy difficulties (Torgesen, 2002b). Typically, dyslexia is diagnosed at the end of second grade or the beginning of third grade, after children have struggled with reading for an extended period and fallen behind academically (Wanzek & Caughnm, 2007). This "wait-to-fail" approach misses the optimal intervention window during early brain plasticity in kindergarten and first grade (Wanzek & Caughnm, 2007; Fox et al., 2010). This discrepancy, known as the “dyslexia paradox” (Ozernov-Palchik & Gaab, 2016), between early identification and delayed treatment can hinder effective intervention and have significant academic and socioemotional impacts. Children in the 10th percentile for reading ability might read as many words in a year as those in the 90th percentile read in a few days (Cunningham & Stanovich, 1998).

Beyond academic challenges, delayed diagnosis of dyslexia can severely affect children's mental health. They might be seen as lazy or unintelligent, leading to low self-esteem, anxiety, and depression (Mugnaini, 2009). Additionally, children with learning disorders are less likely to finish high school (Jimerson et al., 2000), pursue higher education (Dougherty, 2003), and are at a higher risk of involvement with the juvenile justice system, with 28% to 45% of incarcerated youth (Gaab, 2019) and 20% to 30% of incarcerated adults (IDA, 2017) having learning disorders. Adults with learning disorders are also more likely to

be unemployed and earn significantly less than the national average (Cortilla, 2009). Early diagnosis and intervention can prevent or reduce these negative outcomes, highlighting the importance of identifying dyslexia risk early in pediatric care (Sanfilipo et al., 2020).

A group of researchers elucidated the delayed diagnosis of dyslexia through an illustrative example, which is delineated below: “Ben, a second-grade student, has consistently shown enthusiasm for school, and his teachers have consistently recognized him as bright and engaged in the classroom. While he has enjoyed being read to at home, there has been a noticeable resistance to reading independently or aloud during assigned "home reading time" since late kindergarten. Concerned about this resistance, his parents have discussed the issue with his teachers, who, despite noting Ben's reading skills lagging behind peers, haven't been overly alarmed due to his active participation in class. Between the ages of 3 and 6, Ben received speech-language therapy for a speech sound disorder that significantly impacted his speech intelligibility. By age 6, most error patterns had been remediated, except for /r/ in all positions of words, leading to his discharge from therapy. However, in second grade, Ben's reluctance to engage in reading activities both at school and at home has become increasingly concerning. A recent referral for a special education evaluation aimed to explore the possibility of a reading disability. The evaluation results revealed that while Ben possesses strong oral language comprehension and expression skills, he struggles with weak phonological awareness and significant difficulties in decoding words. The special education team has identified characteristics consistent with a learning disability and is now recommending intensive instruction to address and improve Ben's deficient word-reading skills” (Cabbage et al., 2018, p. 1).

This authentic case serves as a typical occurrence observed in numerous educational settings. The process of identifying dyslexia, often labeled as a specific learning disability within school contexts, frequently requires 2–3 years of a child struggling with reading instruction before intervention. Ben, the subject of this example, displayed early risk factors, such as a speech sound disorder, predisposing him to reading difficulties well before encountering challenges in the classroom. Individuals with dyslexia face enduring educational and socio-emotional consequences, including diminished self-esteem and a negative perception of social and academic competence (Polychroni et al., 2006; Snowling wt al., 2007; Terras et al., 2009). As a result, enhancing the early identification of children with dyslexia has been a longstanding objective for educators and researchers. This article underscores the crucial role speech-language pathologists (SLPs) can play in advancing early identification due to their

proficiency in speech and language, as well as their interactions with children prior to formal reading instruction.

Regrettably, there is evidence indicating that children with initial difficulties in reading, when commencing their education, tend to lag behind their peers for years or experience an exacerbated decline, a phenomenon known as the Matthew effect (Ferrer et al., 2015; Stanovich, 1986). This likely attributes to the fact that struggling readers may have limited exposure to written text, impeding the development of fluency and automaticity, and restricting access to more sophisticated vocabulary and grammar. Consequently, their reading comprehension and ability to glean knowledge from written material are diminished (Cunningham & Stanovich, 1998; Mol & Bus, 2011).

According to Colenbrande (2018), early identification of reading difficulties is complex and challenging, but essential if we are to optimize outcomes for children with reading difficulties. While there is evidence suggesting that children who receive early intervention during their initial years of schooling exhibit better long-term outcomes compared to those who commence intervention later (e.g., Dion et al., 2010; Scanlon et al., 2005), it is crucial to consistently monitor children's progress throughout their academic journey. In certain instances, especially concerning more narrowly defined skills like letter–sound correspondence knowledge, early intervention may "inoculate" children, enabling them to catch up with their peers. However, it is important to note that the initial gains achieved through early intervention might diminish over time (Tymms et al., 2017). Furthermore, for individuals with pronounced weaknesses in word reading ability or at the highest risk levels, short-term intervention alone is unlikely to suffice.

Detecting early indicators of dyslexia is crucial because, currently, the earliest diagnosis typically occurs around the second or third year of school. By this time, children have already grappled with reading difficulties for several years, struggling with both technical aspects and fluency. Identifying signs of dyslexia at an early stage allows the development of tailored tasks and training programs for children before they commence formal education. This early intervention provides children with a better chance to begin their school journey on equal footing with their peers, enabling them to focus on learning rather than expending all their efforts on mastering basic learning tools within the school environment. The pursuit of early precursors is feasible due to the familial aggregation of dyslexia. Research findings consistently reveal a direct correlation, indicating that 35–50% of children with at least one parent affected by dyslexia are also likely to develop dyslexia (Pennington, 1995). Timely identification and suitable intervention play a pivotal role in enabling individuals with dyslexia to manage their

challenges effectively. Without proper interventions, the likelihood of individuals with dyslexia successfully continuing their education diminishes (Grigorenko, 2006). The repercussions of dyslexia-related difficulties extend beyond the individual's academic life, impacting their professional and adult life as well (APA, 2013; Mortimore and Crozier, 2006).

2.8.The speech therapist's Impact on Children with Dyslexia

A diagnosis of dyslexia is usually established once children begin formal schooling and display persistent difficulties in acquiring and improving reading skills. However, research examining the preschool behavioural characteristics of children later diagnosed with dyslexia has highlighted several early indicators. Studies consistently demonstrate that the most important predictors of dyslexia are closely related to language development (Hulme & Snowling, 2016; Snowling & Melby-Lervåg, 2016; van Viersen et al., 2017). Early signs such as speech delay, language impairment, speech sound disorder, and weaknesses in phonological processing, as well as a family history of dyslexia, are significant risk factors (Flax et al., 2008; Puolakanaho et al., 2007). The central role of language and speech skills in these predictors underlines the importance of identifying language difficulties in the preschool period and monitoring children with such challenges, as they represent a population at heightened risk for developing dyslexia. The speech-language pathologist has an important role throughout the entire process of school learning, not only when the developmental disorder is already in place. Children at risk for reading disorders should be a major concern of speech-language therapists in order to create favorable conditions for improving language skills and cognitive abilities, consequently an adequate school performance (Varanda et al., 2015). Clinical interventions of reading disorders by speech-language therapists are highly recommended by scientific-based evidence (Ebert & Scott, 2016). Intervention should encompass decoding and coding at the word level to improve reading and spelling accuracy, fluency and prosody, as well. Some studies that aimed at characterizing dyslexia in adults show that cognitive and linguistics deficits persist in adulthood, however they have different manifestations (Callens et al., 2012). The most commonly altered components of reading skills in adults with dyslexia are reading fluency and reading accuracy (Everatt, 1997). Considering these specific characteristics in adults, a reading specialist should participate in the counseling for intervention and adaptations during high school and continuing education text comprehension and writing (Schwanenflugel et al., 2004).

Since 2001, it has been the position of the American Speech-Language-Hearing Association (ASHA) that SLPs play a “critical and direct role in the development of literacy for children and adolescents with communication disorders”. This role includes the identification of children who are at risk for reading and writing problems, such as dyslexia. As outlined in ASHA’s position statement, “the connections between spoken and written language are well established and spoken language provides the foundation for the development of reading and writing” (ASHA, 2001, p.1). According to Nurseitova and Shayakhmetova (2023), better results can be achieved if various specialists are involved, for example, speech therapists, as well as teachers of native and foreign languages. The educational process at school is based on the concept that children learn to read quickly and understand the essence of the text they read. Therefore, the quality of the student's understanding of assignments, as well as various control and independent work, depends on how well the reading skill is developed. Conversely, another study (Yilmaz, 2021) found that while most speech-language therapy candidates correctly answered the majority of the questionnaire items, incorrect or incomplete knowledge about dyslexia was still common. A significant portion of the candidates were unaware of the specific language and speech difficulties experienced by individuals with dyslexia. To ensure that children at risk for dyslexia during the preschool years are identified and receive early intervention, and that school-aged children diagnosed with dyslexia have access to effective, evidence-based interventions, undergraduate programs for speech-language therapists should include both theoretical and practical courses on dyslexia. The study also showed that candidates who had taken a course on dyslexia demonstrated higher levels of dyslexia-related knowledge, highlighting the importance of incorporating such courses into undergraduate curricula.

Reading and writing interventions are commonly managed by special education teachers and school specialists. However, due to their expertise in language disorders, ASHA emphasizes that speech-language pathologists (SLPs) should also play a key role in this process. As such, SLPs have a broad range of responsibilities, including participation in evaluation, decision-making, and providing interventions to address reading and writing needs (ASHA, 2001, 2010). Given that dyslexia is characterized by a fundamental impairment in phonology (Stanovich & Siegel, 1994; Vellutino et al., 2004), it can be inferred that individuals with dyslexia may exhibit errors in speech production, a skill heavily reliant on phonology. The connection between dyslexia and spoken language has been a topic of interest for many years. Dating back to the early 20th century, observations noted that children facing difficulties in word reading often had a history of oral language issues in their early years (Orton, 1925).

Subsequent research has consistently supported this observation, revealing that children with dyslexia frequently have a background of "spoken language" or "verbal" deficits (Gallagher et al., 2000; Lambrecht-Smith et al., 2010; Scarborough & Dobrich, 1990; Snowling, 1981).

Catts et al., (2005) delineate three potential perspectives regarding the connection between Specific Language Impairment (SLI) and dyslexia. The first posits that both conditions arise from an inherent phonological processing difficulty, and dyslexia represents a less severe manifestation of the challenges observed in SLI. The second suggests that both disorders result from a deficit in phonological processing, but SLI occurs when this deficit is coupled with deficiencies in other processing areas. The third model proposes two distinct causes for SLI and dyslexia, with the overlap between the disorders attributed to the coexistence of two separate conditions. In essence, some children exhibit varying degrees of both disorders, yet the two conditions do not originate from a singular underlying factor.

Speech-language therapists play a pivotal role in the assessment, identification, and intervention processes related to dyslexia, a language-based reading disorder, as well as language and speech disorders frequently associated with dyslexia. The Speech and Language Therapy National Core Education Program of Turkey (2016) emphasizes that graduates from language and speech therapy programs should possess the competence to conduct functional evaluations, differential diagnoses, and interventions for dyslexia. The responsibilities of speech-language therapists in dyslexia management encompass preventing reading difficulties in children by supporting their language and early literacy skills, identifying those at risk for reading difficulties, evaluating their reading skills, implementing interventions for their reading skills, reporting results, and providing consultation to families and other professionals working with dyslexic children (ASHA, 2001).

2.9.Dyslexia in the Republic of Kosovo and in Poland

Studies conducted in Poland suggest that approximately one in five student’s faces learning difficulties (W. Pilecka, 1998). Additionally, research from the OECD indicates that around 30% of student’s worldwide experience delays in their learning processes (Denek, 2005). In Poland from 2 to 15 percent of school children are at risk of dyslexia, with 3 to 4 percent being severe cases (Al-Khamisy, 2017). Among the various learning disorders diagnosed in Poland, developmental dyslexia is one of the most prevalent. In Poland, dyslexia is diagnosed through Psychological and Pedagogical Counseling Centers, where specialists such as psychologists, educators, and speech therapists use standardized assessment tools to

identify the underlying causes of reading and writing difficulties. These assessments typically measure perceptual–motor functions (including visual and auditory analysis), rapid naming, memory, attention, literacy skills (decoding and reading comprehension), as well as overall intellectual functioning. When the results meet the diagnostic criteria for dyslexia, students receive official documentation confirming the condition, which is then added to their school records (Kuracki & Dłużniewska. 2023).

Based on the research of Ignaciuk & Łockiewicz (2023), in Poland, corrective and compensatory classes (zajęcia korekcyjno-kompensacyjne) for students with dyslexia are offered in schools in small groups led by specialist teachers, in accordance with the Ministry of Education regulation of 2017 (MEN, 2017). However, support at the university level remains limited. The Law on Higher Education and Science (2018) introduced many reforms in higher education, but it did not establish mechanisms for assisting students with dyslexia. This gap was recognized by two initiatives. The Resolution of the Advisory Panel for Student Affairs (MNiSW, 2019) highlighted the absence of systemic support for students with learning disorders and proposed measures such as diagnostic services, adapted study materials, exam accommodation, and training for academic staff. Similarly, the Commission for Equality of Educational Opportunity at CRASP (2016), initiated by several Krakow universities, developed principles of inclusive education inspired by the concept of "reasonable adjustments" applied in the UK. Importantly, the Commission stressed the need to extend support not only to students with official disability certificates (orzeczenie), but also to those with dyslexia, who in Poland are recognized through psychological-pedagogical opinions (opinia psychologiczno-pedagogiczna) under the Education Law (Prawo Oświatowe, 2016). Despite these recommendations, the Law on Higher Education and Science still does not impose binding obligations on universities to make adjustments for students with dyslexia. Most institutions therefore manage support through their Offices for Persons with Disabilities, applying a general procedure that treats dyslexia as part of the wider disability category.

"Data reveals a noticeable rise in the number of children diagnosed with dyslexia between 2002 and 2006, with percentages increasing annually: 7.4% in 2002, 7.8% in 2003, 8.1% in 2004, 9.4% in 2005, and 10.3% in 2006. Upon closer examination of specific regions, significant differences emerge, particularly in the Pomorskie and Kujawsko-Pomorskie provinces, where diagnoses increased by over 200% between 2002 and 2006 (275% in Kujawsko-Pomorskie). Increases of 60% were observed in the Warminsko-Mazurskie province, while the Dolnoslaskie (almost 53%), Podkarpackie (47.5%), Slaskie (45.5%), Lubelskie (41%), and Podlaskie (41%) provinces saw rises between 40-50%. Smaller

increases, around 30%, were noted in the Lubuskie (33%), Zachodniopomorskie (27%), Wielkopolskie (26.7%), and Lodzkie (25%) provinces. However, the Mazowieckie (15%) and Opolskie (12%) provinces recorded factors below 20%. The Małopolskie province remained stable, while a positive change was observed in Świętokrzyskie.These trends, particularly concerning regions like Kujawsko-Pomorskie, which is one of the country's poorest areas, might reflect economic influences on education. Families in such regions may allocate less money to support their children's development, potentially exacerbating educational challenges (Chrzanowska, 2010 p. 241-244)".

Analyses of inclusive education conducted by various scholars and international organizations highlight that, although Kosovo has established a legal framework, its practical implementation remains limited. Schools continue to face significant obstacles, including inadequate teacher preparation, scarce resources, insufficient infrastructure, and persistent social stigma. Inclusive education is essential for providing children with disabilities equal opportunities for both academic achievement and social integration, yet in Kosovo—where complex social and political dynamics shape policy—its realization is far from complete. Nevertheless, progress can be observed through international partnerships and initiatives, particularly those supported by UNICEF and the World Bank. Strengthening teacher training, expanding resources, and fostering greater public awareness are key steps toward bringing educational practice into closer alignment with existing legislation (Belegu – Caka, 2025). Over the past decade, Kosovo has demonstrated a growing acknowledgment of the needs of children with disabilities (KEC, 2006). Efforts have been made to promote equality and inclusion within the Kosovar education system (Ministry of Education, Science and Technology, 2007), with various national and international organizations organizing seminars to raise awareness of children's rights in education (KEC, 2006). However, despite these endeavors, Kosovo lags considerably behind developed nations in addressing the needs of children with disabilities within its education system (Ministry of Education, Science and Technology, 2007).

In terms of research and literature, there is a significant dearth of information concerning the current situation of children with disabilities in Kosovo's educational landscape. Unfortunately, efforts to gather more information specifically about children with disabilities in Prishtina or Kosovo at large proved fruitless. Since the 1999 war in Kosovo, there has been an increased recognition of the needs of children with disabilities (Kosova Education Center, KEC, 2006). Although substantial actions have been taken to promote equality and prevent exclusion in the Kosovar education system (Ministry of Education, Science and Technology, 2007), Kosovo

still falls far behind wealthier nations in understanding and addressing children's needs and their inclusion in education (Ministry of Education, Science and Technology, 2007).

A publication from the Institute of Education Development highlights dyslexia as one of the most prevalent educational challenges, yet it remains relatively unknown in Albanian schools. While there is no comprehensive data on the prevalence of dyslexia in Kosovo, it is estimated to affect 6-17% of the population to varying degrees of severity (IED, 2016). The lack of guidance for teachers in Kosovo on how to support dyslexic students is evident in the MEN Regulation of January 7, 2003, which outlines principles for organizing psychological and pedagogical assistance in public educational institutions (Journal of Laws No 11, p.114, translated by Kamila Leciejewska). This regulation emphasizes the importance of recognizing learning difficulties, providing various forms of support, and adjusting educational requirements to individual student needs, particularly for those with specific learning difficulties or disabilities. Psycho-pedagogical support in Kosovo schools includes compensatory classes, speech therapy, socio-therapy, and other therapeutic interventions, as well as psycho-educational support for students and parents, along with advice and consultations for teachers and parents (ABBOU, 2022).

A study by Duranovic et al. (2018) examined public awareness of dyslexia in Balkan countries, including Kosovo, Bosnia and Herzegovina, Bulgaria, Croatia, and Montenegro. These nations face similar economic challenges, with a close interconnection between education, economics, and literacy, especially considering their shared history as former Yugoslav republics. Despite significant changes in education systems since independence, they still grapple with residual challenges from the past. In Kosovo, a strategic plan for inclusive education was established in 2002 (Landsman & Maloku-Berdyna, 2009), aiming to integrate children with special needs (SN) into regular education and society. However, despite efforts, Kosovo lags behind developed countries in understanding and including children with disabilities in the education system (Kosova Education Center, 2006). The lack of legislative recognition for students with developmental disabilities (DD) stems from insufficient knowledge for their identification and support (Avdyli & Cuetos, 2012; Jusufi, 2014). Responses from the public regarding support for individuals with DD highlight the need for professional assistance, speech-language pathologists (SLPs), special educators, psychologists, or doctors (BIH 41.08%; KOS 25.0%; BUL 27.38%; CRO 53.38%, MNE 41.05%). Additionally, there's a call for social support, artistic development, increased physical activity, accommodations in schools, and raising public awareness (BIH 3.50%) (BIH 11.15%; CRO 9.56%; MNE 9.47%; CRO 17.65%; BIH 10.83%; Ba 54.76%). Only a small percentage

believes nothing can be done for people with DD (2.94% in KOS, 0.65% in BIH, and 1.58% in MNE). Despite this, only 42.5% of participants in the study had basic knowledge of DD, with common misconceptions persisting, such as linking dyslexia with impaired intelligence (IQ) (NCLD, 2012; Wadlington & Wadlington, 2005).

3. RESEARCH AIM

This research aims to explore the predispositions for dyslexia and examine the neurolinguistics aspects among preschool-aged children in the Republic of Kosovo and Poland. By focusing on these two distinct regions, the study seeks to identify potential commonalities and differences in dyslexia patterns. Through in-depth neurolinguistics assessments, including language processing, phonological awareness, and cognitive functions, the research aims to provide valuable insights into early indicators and risk factors for dyslexia in young children. The findings could have significant implications for early intervention strategies and educational policies that support children with dyslexia across diverse cultural and linguistic backgrounds. Additionally, the research strives to raise awareness about identifying early signs of dyslexia by standardizing the first speech therapy instrument to assess dyslexia predispositions in both Kosovo and Poland.

3.1. Research Question

Is there any predisposition of preschool age children for dyslexia and can they be identified earlier?

3.2.Research Objectives:

1. To find if there is a predisposition that children of the preparatory class aged 4-6 years show signs in which dyslexia is possible
2. To identify if the signs we encounter during the evaluation are a predictor of the occurrence of dyslexia

3. To evaluate the appearance of dyslexia signs, affect the neurolinguistics aspect

3.3.Hypotheses:

H1: Learning difficulties manifest across all cultural and linguistic backgrounds

H2: Early language and phonological processing abilities predict later differences in reading and spelling skills across the entire group.

H3: Indicators observed during assessment serve as predictors for the potential development of dyslexia.

H4: The emergence of dyslexia-related signs influences children's neurolinguistic development over time.

4. METHODOLOGY

4.1. Participants

In the first phase of the research, 88 young learners from the Republic of Kosovo and Poland were selected to participate in the study. The participants, aged 4 to 5 years, were chosen to ensure a balanced representation of both genders, as gender equality was a central aspect of the research design. The inclusion criteria for this phase primarily focused on age and gender, with the intention of having an equal number of male and female participants to avoid any gender bias. The selection process was handled by the educators of the children, who identified eligible participants based on the established criteria. Parental consent was obtained through a formal written consent form, ensuring that all parents were fully informed about the nature of the study and their child's involvement. Additionally, the participants were explicitly informed that their participation in the research was entirely voluntary, and they were free to withdraw from the study at any time if they felt uncomfortable or simply chose not to continue. This voluntary participation was emphasized to ensure ethical standards were met.

In the second phase of the research, the same group of children was invited to participate again. However, due to various factors, only 79 of the original 88 participants were available to continue in the study, now at the age of 6 and 7. Of the remaining participants, 41 were from the Republic of Kosovo and 38 were from Poland. This slight reduction in the sample size may be attributed to factors such as absences, parental decisions, or other logistical reasons. Despite this, the second phase retained a significant number of participants from both countries, allowing for meaningful comparisons between the two groups as originally intended.

4.2.Instrument

To facilitate this research, a custom-designed instrument in the form of a battery test has been developed. This instrument is designed to assess the predispositions of dyslexia based on the age of the child, specifically categorized for two age groups: 4-year-olds and 5-year-olds (with modifications planned for the subsequent phases of the research). The instrument comprises 12 subtests that encompass evaluations of cognitive abilities, knowledge of shapes and colors, orientation, pen handling and usage, non-verbal and verbal auditory tasks, coping skills, visual memory tasks, and hand and eye lateralization. It is important to note that the instrument is available in two languages, Albanian and Polish, ensuring accessibility for a diverse group of participants. Before the data collection, firstly, it was pilot projected in Kosovo. The pilot project enabled us to fine-tune the test, making

necessary adjustments to enhance its effectiveness. The evaluation process with this instrument typically takes around 40 minutes per child, contingent upon the child's cooperation during the assessment. The assessments are conducted in a controlled environment, specifically in a private room within the school or kindergarten, ensuring minimal noise and distractions. This approach aims to create an optimal testing atmosphere for accurate and reliable results. Additionally, the instrument's design and structure cater to the developmental nuances of different age groups, allowing for a comprehensive understanding of dyslexia predispositions across varying stages of early childhood.

The same procedure was followed in the second phase of the research, with the exception that the instrument was adjusted to suit the children's age. Some of the tasks from the self created instrument and the process of the data collection:

FIRST PHASE INSTRUMENT (AGES 4-5 Y.O)

Questions:

Age 4.

- How old are you? **FOUR YEARS OLD** ☐
- What do you use to wash your hands? **SOAP** ☐
- Where do you go with your mother when you are not feeling good? **DOCTOR** ☐

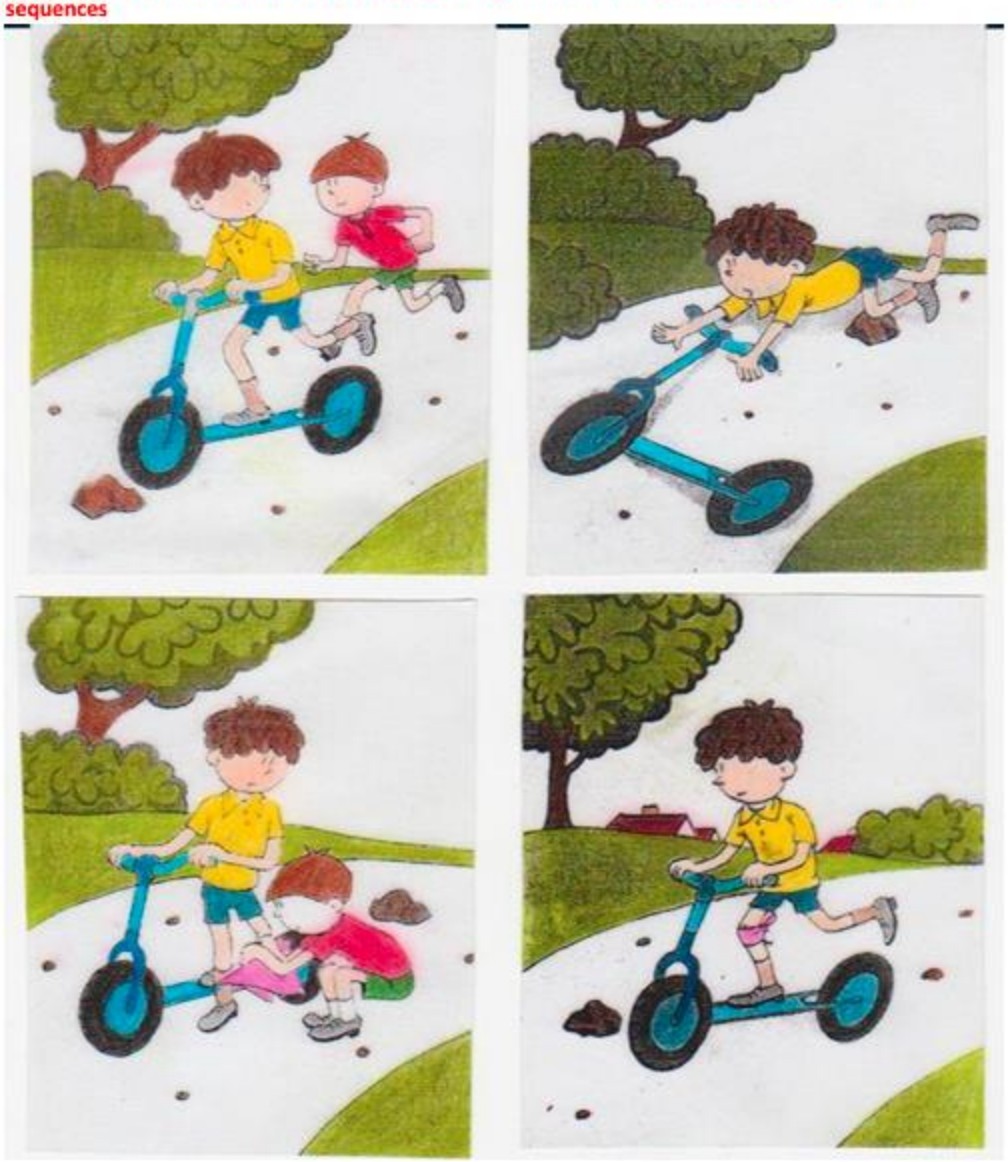
Questions:

Age 5.

- Who is the person who takes care of our teeth? **DENTIST** ☐
- What day is today? _____ ☐
- Where do we buy bread? **BAKERY** ☐

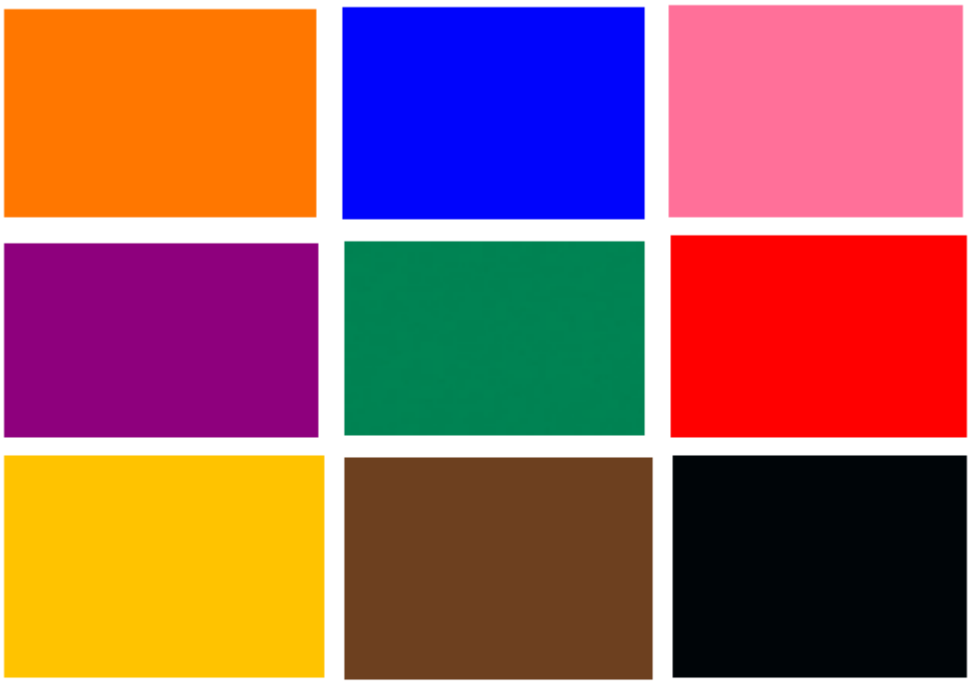
Give the pics to the child in the right order and he/she will only tell what is happening in the sequences

Give the pics to the child in the right order and he/she will only tell what is happening in the sequences



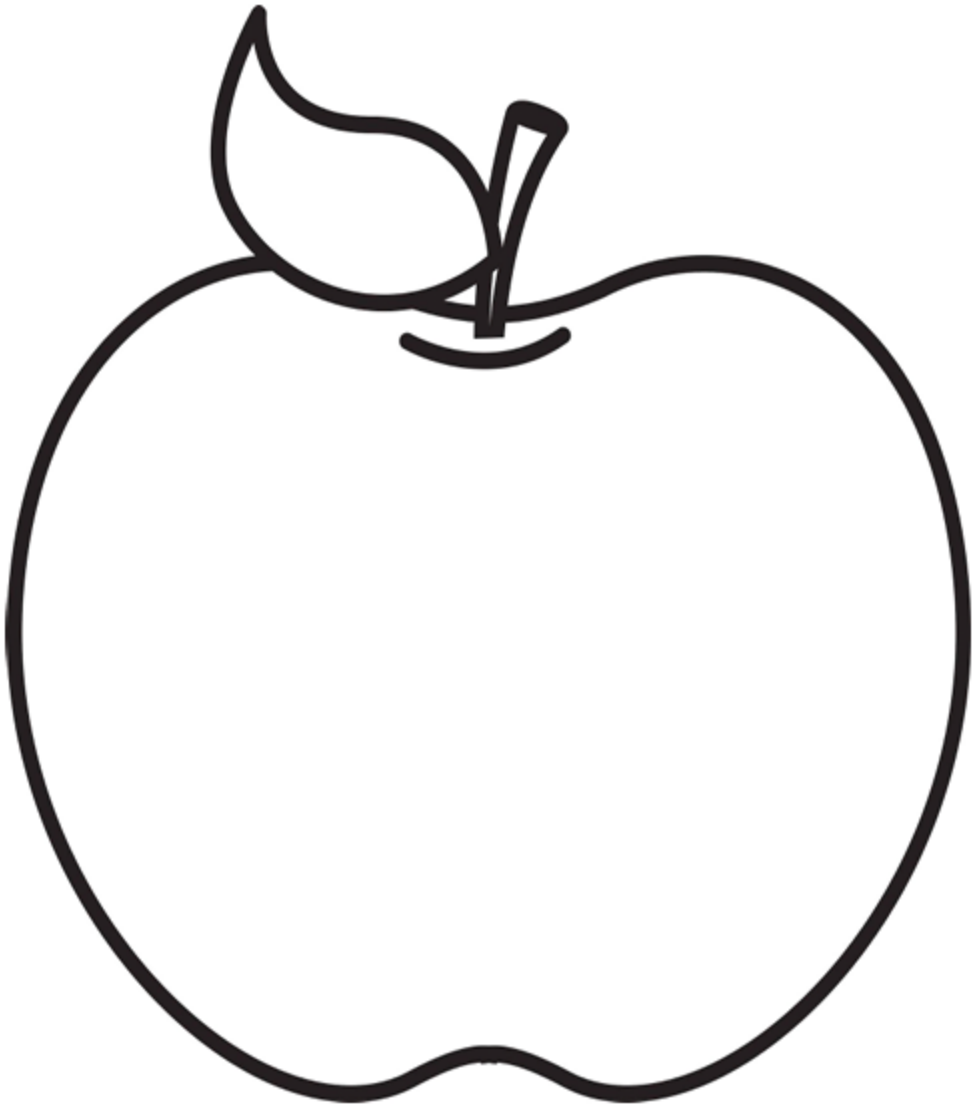
Colors

Portokalli –Orange, E kalter – Blue, Vjollce – Purple, E gjelbert- Green, Pembe - Pink, Kuqe - Red, Verdhe - Yellow, Kafe - Brown, Zeze - Black



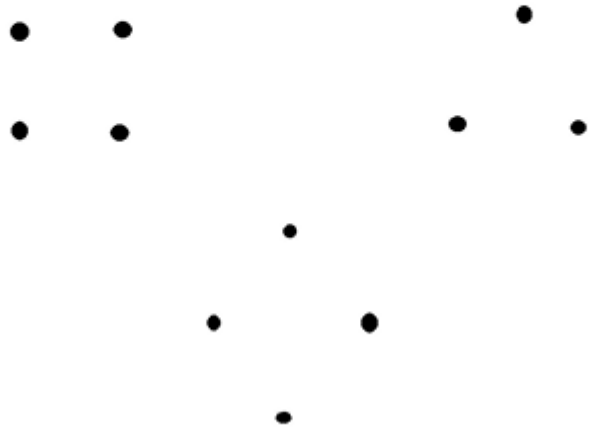
Shapes

Puzzle 1. – Pieces should be cut by therapist and given to the child in that way so he/she will complete the puzzle



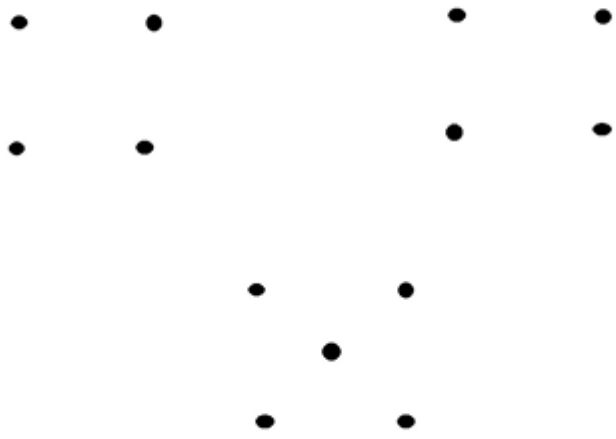
Coping skills- **Therapist stands in front or next to the child and fills the dots with lines first and after the child should copy him/her**

Age 4.

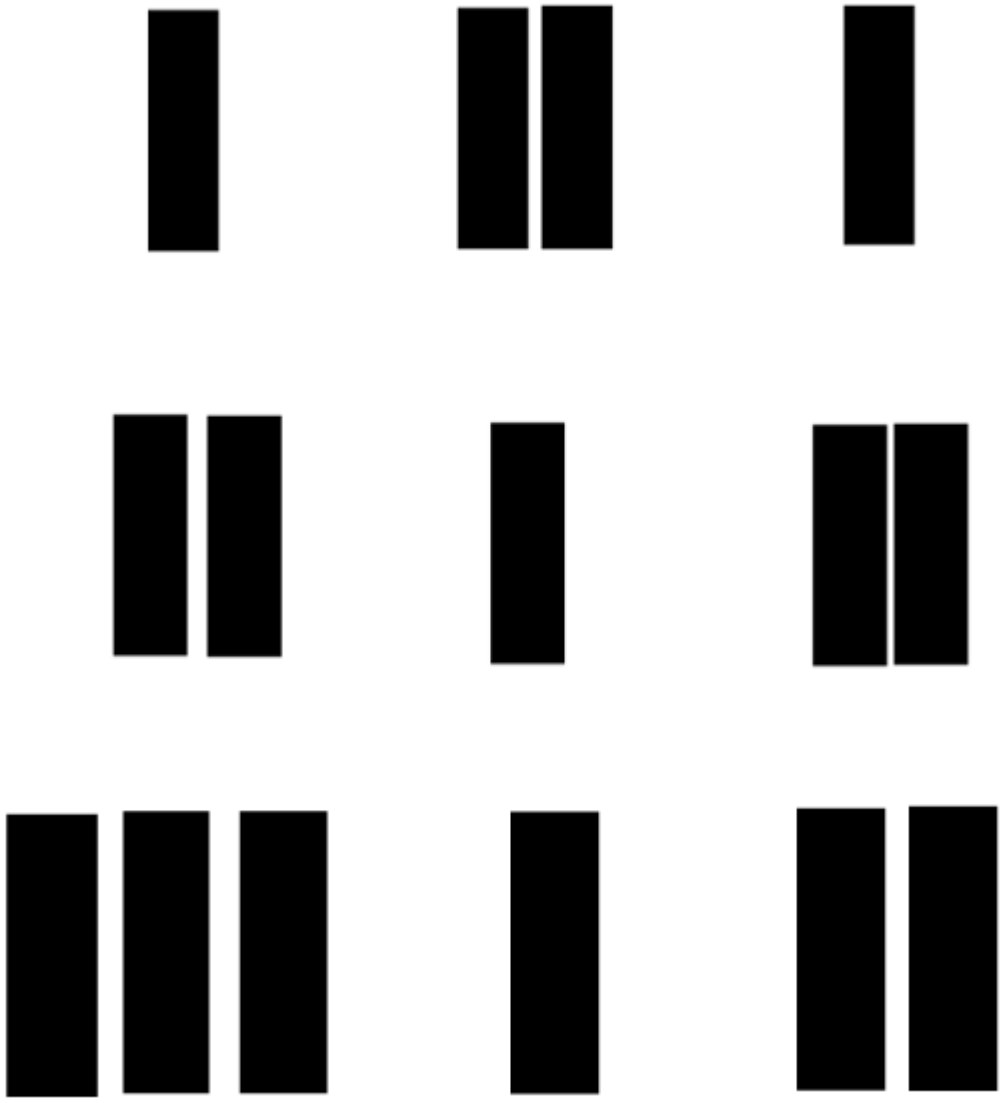


Coping skills- **Therapist stands in front or next to the child and fills the dots with lines first and after the child should copy him/her**

Age 5.



Nonverbal auditive task



Verbal auditive task

4 Y.O – Kosovar pupils

SYLLABLE

1st trial - LI QE NI

2nd trial - KA MI ONI

FLU TU RA

WORDS

1st trial - LOPATA

2nd trial - FUSTANI

3rd trial - PIKTURA

Sentences without meaning - none sense sentences

The dog is driving the flight red car - Qeni po nget makinen e kuqe fluturuese

The lion is eating a banana and meows - Luani po han banane dhe mjaullon

A mouse is eating an elephant and is talking with the cat - Miu po han elefantin dhe po flet me macen

5 Y.O – Kosovar pupils

SYLLABLE

1st trial - KESH TJE LLA

2nd trial - POR TO KA LLI

3rd trial - TREN DA FILI

WORDS

1st trial – MBESHTJELLE

2nd trial – KATEDRALE

3rd trial – PLAZHI

Sentences without meaning - none sense sentences

Nje djale dhe nje vajze po fluturojne mbi yje – A boy and a girl are flying above the stars

Qeni I kuq lan floket dhe skuqi bananet-Red dog washed his head and reddish the banana

Nje lope varet ne liber dhe pi bari blu – A cow hangs in the book and drinks blue grass.

SECOND PHASE INTSTRUMENT (AGES 6-7 Y.O)

Questions:

Age 6

- How old were you last year? **FIVE** ☐
- How many days are in a week? **SEVEN** ☐
- ☐
- Which season comes before winter? **FALL/AUTUMN**

Questions:

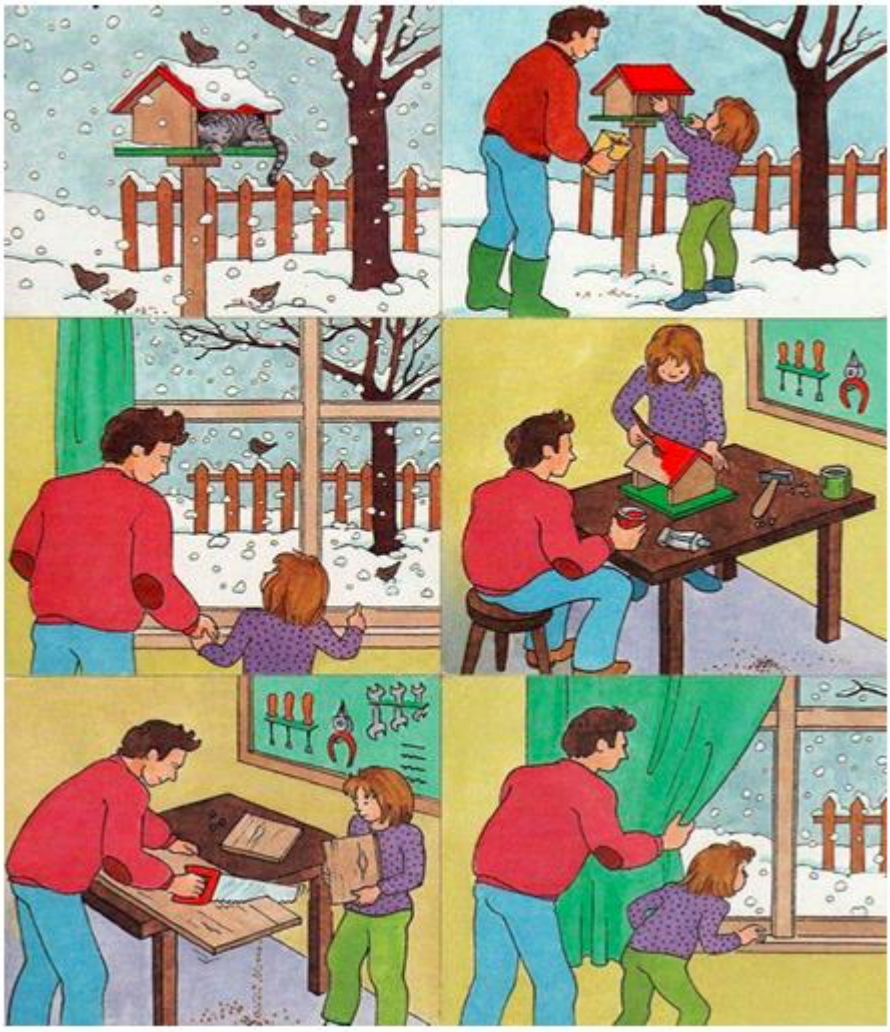
Age 7

- What day will it be tomorrow? _____ ☐
- What is the month before December? **NOVEMBER** ☐
- What day is the day after tomorrow? ____ ☐

Give the pictures to the child in the right order and he/she will only tell what is happening in the sequences

Number of words:_____

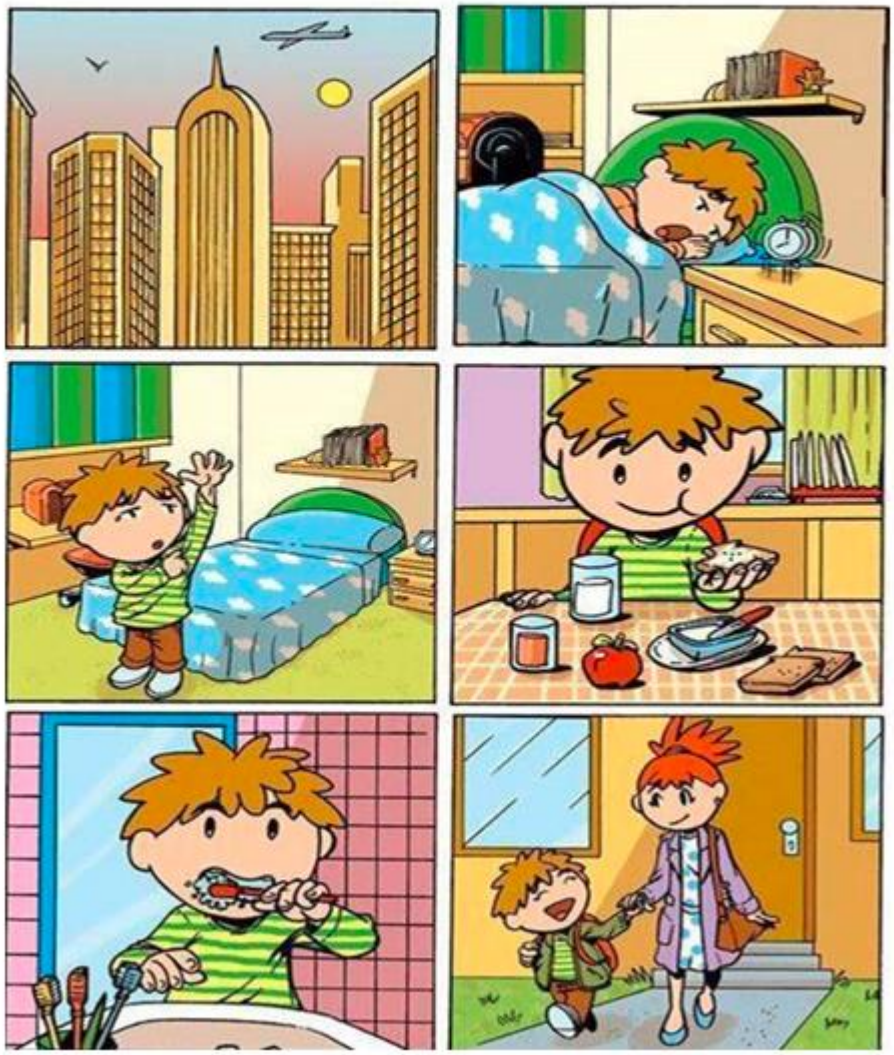
Order:_____



Give the pictures to the child in the right order and he/she will only tell what is happening in the sequences

Number of words:_____

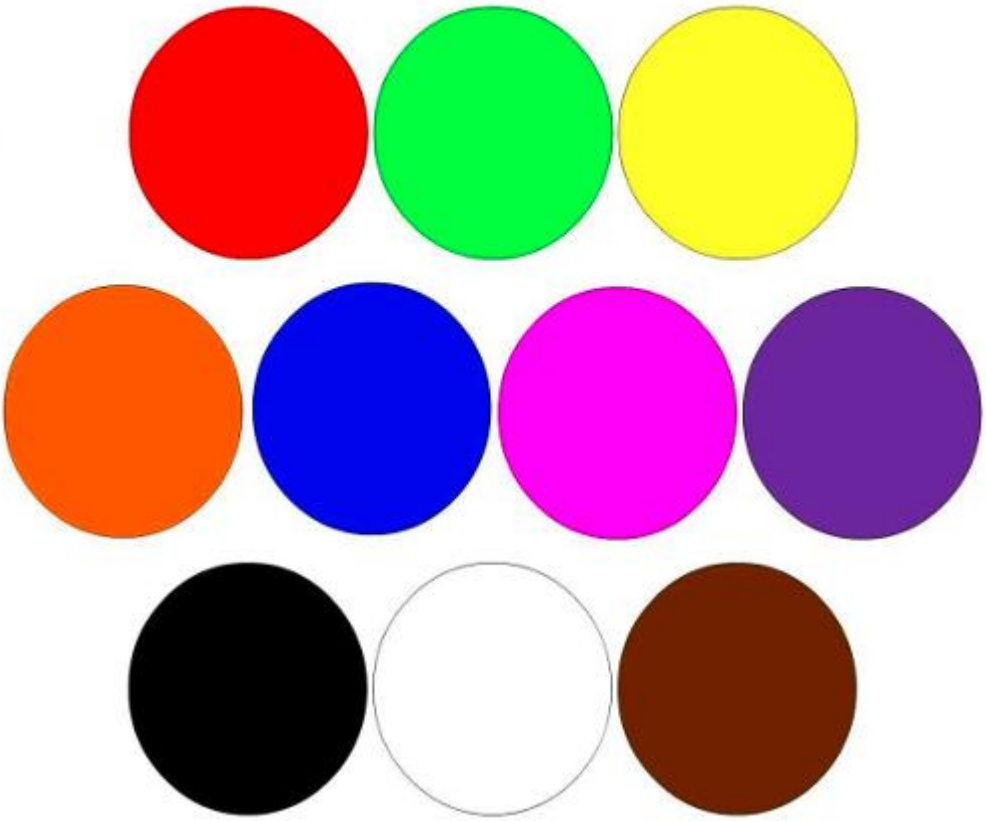
Order:_____



Colors

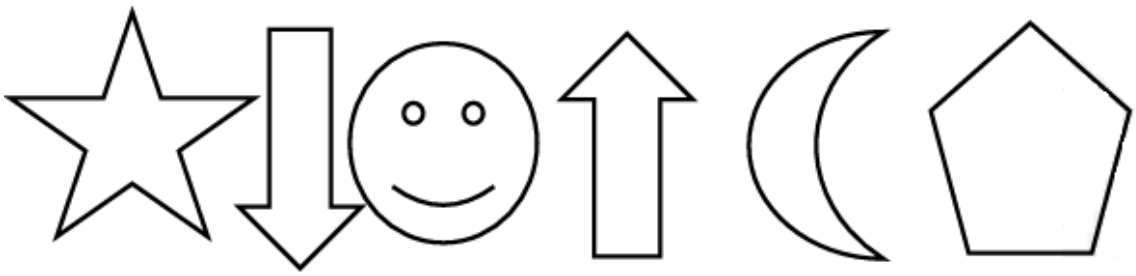
POINTS 0, 1, 2

E kuqe- Red, E gjelbert- Green, E verdhe- Yellow, Portokalli- Orange, E kaltert- Blue, E pembe- Pink, E vjollce- Purple, E zeze- Black, E bardhe- White, E kafte- Brown



Shapes

POINTS 0, 1, 2



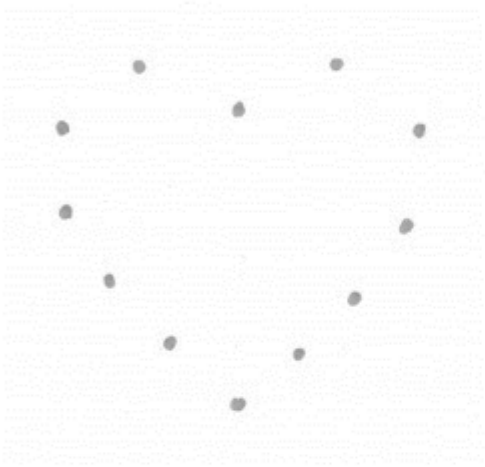
POINTS 0, 1, 2

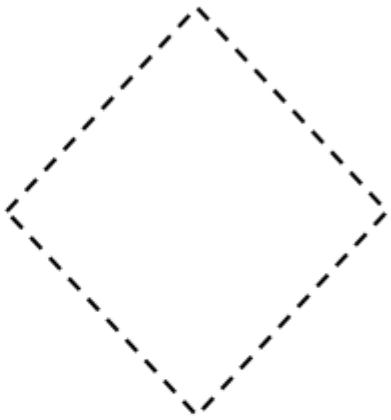
Puzzle 1. – Pieces should be cut by therapist and given to the child in that way so he/she will complete the puzzle

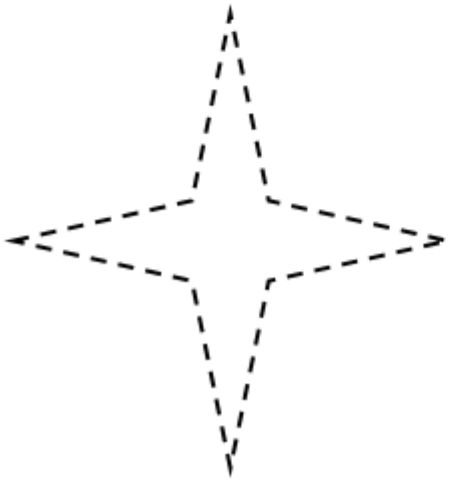
Copying skills - POINTS 0, 1, 2

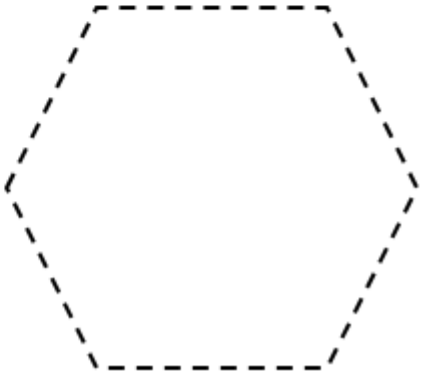
The therapist stands in front or next to the child and fills the dots with lines first, and after, the child should copy him/her.

Age 6 & 7

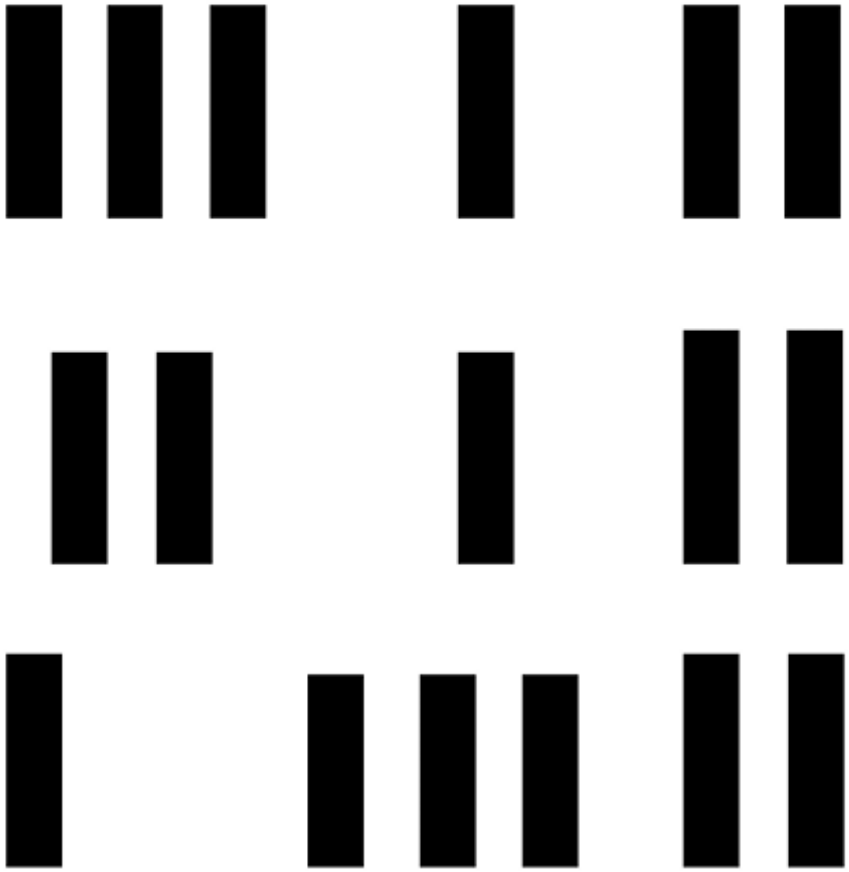








Non-verbal auditive test **POINTS 0, 1, 2**



VERBAL AUDITIVE TASK - POINTS 0, 1, 2

6 year olds

SYLLABLES POINTS 0, 1, 2

- 1st trial - GA FO RRJA
- 2nd trial – LI BRA RIA
- 3rd trial - BI BLO TE KA

WORDS POINTS 0, 1, 2

- 1st trial - TAVOLINA
- 2nd trial - DINOSAURI
- 3rd trial - MIKROVALA

SENTENCES WITHOUT MEANING – NONSENSE SENTENCES POINTS 0, 1, 2

- Makaronat fluturuese po vallëzojnë në re. – Flying pasta is dancing in the clouds.
- Karriget po pastrojnë qiellin e kuq me duart e tyre. – The chairs are cleaning the red sky with their hands.
- Lulet këndojnë ccdo mëngjes dhe lëvizin kembet e tyre.- Flowers sing every morning and move their feet.

7 year olds

SYLLABLES POINTS 0, 1, 2

- 1st trial – HI PO PO TA MI
- 2nd trial – TU LI PA NI
- 3rd trial – FLU TU ROJ

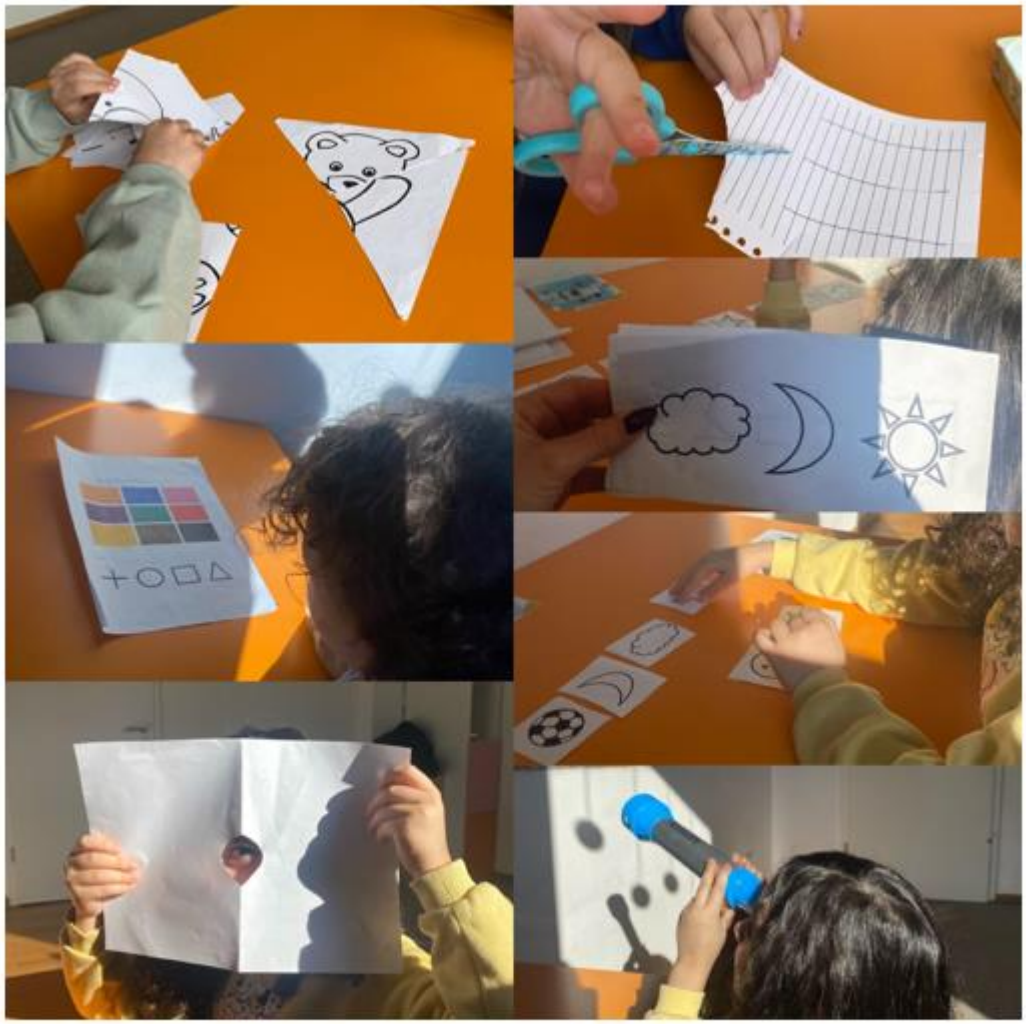
WORDS POINTS 0, 1, 2

- 1st trial – GJAKFTOHTË
- 2nd trial – HELIKOPTERI
- 3rd trial – PËRMIRËSIM

SENTENCES WITHOUT MEANING – NONSENSE SENTENCES POINTS 0, 1, 2

- Një djalë dhe motra e tij po hanë një njëbrirësh dhe po pijnë qumështin e tij. – A boy and his sister are eating a unicorn and drinking its milk.
- Macja e vjollce ra në qiell kur po ngiste pemën. -The purple cat fell on the sky when it was riding a tree.
- Qeni im po rri në këmbë dhe po pi çaj të nxehtë të pembe.– My dog is standing up and eating hot pink tea.

Implementation of the instrument (data collection in Prishtinë, Republic of Kosova)



Kindergarten name: " Bota e cudirave "

Implementation of the instrument (data collection in Krakow, Poland)

Kindergarten name: " Przedszkole nr 40 Zgromadzenia Córek Bozej Mitosci "

Implementation of the instrument (data collection)




4.3.Procedure

Before initiating data collection, formal approval was sought from my supervisor to commence evaluations with the children. Upon obtaining this initial approval, further authorization was required from the Directorates of the Institutions where data collection was to take place. Additionally, due to the participants being minors, parental consent was indispensable. Consent forms were diligently prepared and distributed, ensuring parents were fully informed and granting permission for their children to partake in both the evaluations and the subsequent phases of the project. Once all necessary documentation was secured, data collection commenced and evaluations were conducted in a designated private space, improvised to minimize external disturbances. Pupils were escorted from their classrooms to the evaluation room by their teachers, ensuring a smooth transition. In the case of data collection in Poland, a speech therapy student from the Speech Therapy Master Studies program at the Uniwersytet Komisji Edukacji Narodowej w Krakowie was enlisted to assist due to language barriers throughout the PBSD funds from the Doctoral School at UKEN. The same meticulous procedure for obtaining permissions was followed in Poland, particularly in

Krakow. Consent forms provided a comprehensive explanation of the research purpose, procedures, and ensured confidentiality. Upon completion of data collection from both countries, preliminary and final results were analyzed using the statistical software IBM SPSS Statistics 21, setting the stage for further in-depth analysis and interpretation.

5. RESULTS

Statistical analyses were conducted in order to address the research questions, using IBM SPSS Statistics 29 software. The analyses included descriptive statistics with the Shapiro-Wilk test, independent samples t-test with Levene's test for homogeneity of variances, Pearson's *r* correlation with Fisher's *r* to *Z* transformation, and linear regression analysis. The significance level adopted for all analyses was $\alpha = 0,05$.

Descriptive and Shapiro-Wilk normality test

In the first step of the analysis, distributions of quantitative variables were examined to assess normality of distributions. Basic descriptive statistics were calculated along with the Shapiro-Wilk test for normality of distribution. The results of this analysis are presented in Table 1.

Table 1

Descriptive Statistics with Shapiro-Wilk Test

Zmienna zależna	*M*	*Me*	*SD*	*Sk.*	*Kurt.*	*Min*	*Max*	*W*	*p*
Comprehension phase 1	125,15	117	30,57	0,89	,45	79	227	,94	<,001
Comprehension phase 2	122,92	110	75,24	1,32	1,14	36	346	,86	<,001
Phonological phase 1	37,06	34,5	15,77	0,71	0,26	11	81	,96	,014
Phonological phase 2	59,20	56	25,16	0,22	-0,29	0	119	,99	,762
Copying phase 1	50,93	51	6,37	0,38	0,81	32	71	,97	,084
Copying phase 2	16,29	16	3,91	0,37	-0,31	9	26	,97	,114
Storytelling word count phase 1 picture 1	18,23	16	9,10	1,40	2,82	4	52	,90	<,001
Storytelling word count phase 1 picture 2	18,83	18	8,59	0,35	-0,30	1	42	,99	,682
Storytelling word count phase 2 picture 1	33,09	33	14,75	0,08	-0,57	0	68	,99	,765
Storytelling word count phase 2 picture 2	24,80	22	13,88	1,06	0,55	0	64	,90	<,001

Note. M - mean; *Me* - median; *SD* - standard deviation; *Sk.* - skewness; *Kurt.* - kurtosis; *Min* - minimum value; *Maks.* - maximum value; *W* - Shapiro-Wilk test statistic; *p* - statistical significance for the Shapiro-Wilk test.

The Shapiro-Wilk test was statistically significant for most of the variables, indicating that their distributions deviated significantly from normal. However, it should be noted that the skewness values for these distributions did not exceed the conventional absolute threshold of 2, suggesting that the asymmetry was relatively mild. Therefore, the decision was made to proceed with parametric tests for subsequent analyses.

Language skill differences between Polish and Kosovar children

Polish and Kosovar children were compared in terms of all three language skills in phases 1 and 2 using independent samples t-test (table 2).

Table 2

Language skills in both phases among Polish and Kosovan children – t-test

	Poland (n = 47)		Kosovo (n = 41)					95% *CI*		
Dependent variable	*M*	*SD*	*M*	*SD*	*t*	*df*	*p*	*LL*	*UL*	Cohen's *d*
Comprehension phase 1	111,95	23,01	140,29	31,38	-4,77[a]	72,46	**<,001**	-40,18	-16,50	1,04
Comprehension phase 2	86,97	39,18	156,24	85,17	-4,70[a]	57,13	**<,001**	-98,79	-39,75	1,03
Phonological phase 1	31,36	14,71	43,59	14,51	-3,91	86	**<,001**	-18,43	-6,01	0,84
Phonological phase 2	55,21	18,82	62,90	29,63	-1,39[a]	68,38	0,170	-18,75	3,37	0,31
Copying phase 1	49,21	4,89	52,90	7,31	-2,81	86	**,006**	-6,30	-1,08	0,60
Copying phase 2	16,50	3,81	16,10	4,04	0,45	77	0,651	-1,36	2,17	0,10

1. *Note*. *n* - number of observations; *M* - mean; *SD* - standard deviation; *t* - test statistic; *df* - degrees of freedom; *p* - statistical significance; *CI* - confidence interval for the difference between means; *LL* and *UL* - lower and upper limits of the confidence interval.

[a]Levene's test was statistically significant - results with Welch's correction are reported.

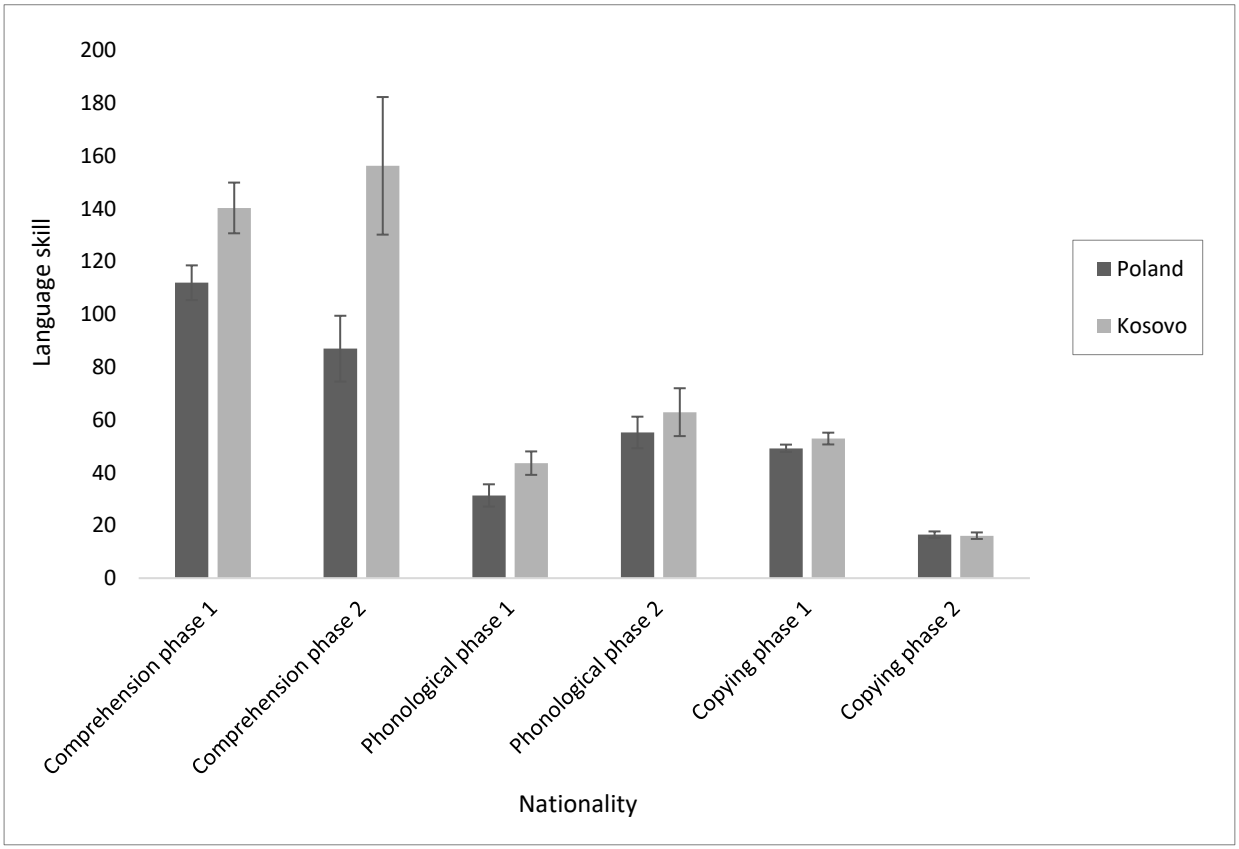
The test results were statistically significant for four of the six variables tested. Polish and Kosovar children differed in comprehension skills in both phases, but the differences in phonological and copying skills were only significant in phase 1. This suggests that the influence of language on the development of language abilities may gradually diminish as children develop.

The t-test results revealed significant differences between Polish and Kosovar children in comprehension skills, with Kosovar children achieving higher scores in both phases. The effect sizes for both phases were large (Cohen's $d > 0,8$), indicating substantial differences between groups. Similarly, Kosovar children achieved statistically significantly higher scores in phonological skills in phase 1 and the effect size of this difference was large. Kosovar children scored higher also in copying skills in phase 1, and the size of this effect was medium.

These results suggest that although Kosovar children initially demonstrated advantages in all examined language skills, the differences between groups diminished over time, completely disappearing for phonological and copying skills in phase 2. Mean scores in both groups were presented in Figure 1.

Figure 1

Language skills in both phases among Polish and Kosovan children – means with standard errors



Next, we tested for national differences within word counts in particular storytelling tasks. We compared Polish and Kosovar children in terms of both storytelling tasks in phases 1 and 2 using independent samples t-test (Table 3).

Table 3

Storytelling word count in both phases among Polish and Kosovan children – t-test

	Poland (n = 47)		Kosovo (n = 41)					95% *CI*		
Dependent variable	*M*	*SD*	*M*	*SD*	*t*	*df*	*p*	*LL*	*UL*	Cohen's *d*
Storytelling word count phase 1 picture 1	15,74	9,00	21,07	8,45	-2,85	86	**,005**	-9,04	-1,61	,61
Storytelling word count phase 1 picture 2	15,62	7,38	22,51	8,48	-4,08	86	**<,001**	-10,26	-3,53	,87
Storytelling word count phase 2 picture 1	33,47	13,57	32,73	15,93	0,22	77	,825	-5,91	7,40	,05
Storytelling word count phase 2 picture 2	20,26	8,03	29,00	16,68	-3,00[a]	58,53	**,004**	-14,57	-2,91	,66

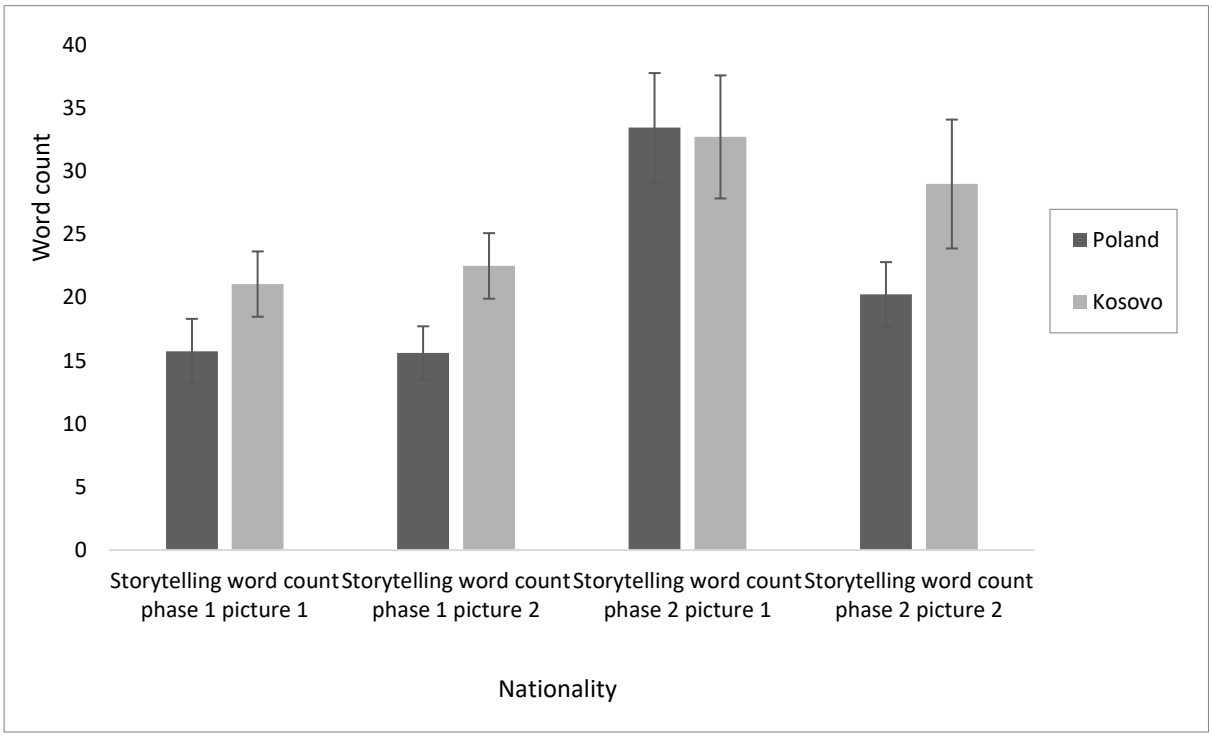
Note. *n* - number of observations; *M* - mean; *SD* - standard deviation; *t* - test statistic; *df* - degrees of freedom; *p* - statistical significance; *CI* - confidence interval for the difference between means; *LL* and *UL* - lower and upper limits of the confidence interval.

[a]Levene's test was statistically significant - results with Welch's correction are reported.

The test results were statistically significant for both tasks in phase 1 and one task in phase 2. Kosovar children has a statistically significantly higher word count when describing both pictures in phase 1 and the effect sizes of these differences were medium and large, respectively for pictures 1 and 2. In phase 2, Kosovar children had a significantly higher word count when describing picture 2 and this effect was moderate. There was no difference between Polish and Kosovar children in terms of word count in describing picture 1 in phase 2. Mean scores in both groups were presented in Figure 2.

Figure 2

Storytelling word count in both phases among Polish and Kosovan children – means with standard errors



Correlations between language skills

In the next step of the analysis we tested for associations between language skills in both phases of the study. Pearson's correlation analysis was performed (Table 3).

Table 4

Correlation coefficients matrix of all language skills in both phases

Variable	Comprehension phase 1	Comprehension phase 2	Phonological phase 1	Phonological phase 2	Copying phase 1	Copying phase 2
Comprehension phase 1	-	**,39*** **	,07	,16	**,30** **	,17
Comprehension phase 2	**,39*** **	-	,06	,20	**,31** **	-,14
Phonological phase 1	,07	,06	-	-,01	,06	-,04
Phonological phase 2	,16	,20	-,01	-	,16	**,29***
Copying phase 1	**,30** **	**,31** **	,06	,16	-	-,09
Copying phase 2	,17	-0,14	-,04	**,29***	-,09	-

*** - $p < 0{,}001$; ** - $p < 0{,}01$; * - $p < 0{,}05$

Correlation analysis revealed several statistically significant associations between variables. Comprehension skills in phase 1 were moderately positively associated with comprehension and copying skills in phase 2. Similarly, comprehension skills in phase 2 were moderately positively associated with copying skills in phase 1.

Surprisingly, phonological skills in phase 1 were not significantly correlated with any other variable. Only in phase 2, this skill was positively weakly correlated with copying in phase 2.

All in all, most of the significant correlations concerned associations between comprehension and copying. Phonological skills were less associated with other variables.

Next, we performed the same correlation analysis but divided into Polish and Kosovar sample (table 4), followed by a transformation of Pearson's *r* do Fisher's *Z*. The purpose of the transformation was to check if the difference between correlations in both groups was statistically significant.

We noted that comprehension in phase 1 was significantly positively correlated with copying in phase 2 among Polish children, but such correlation was not significant in Kosovar sample. However, Fisher's *Z* test showed no significant differences between these correlation coefficients in the two groups, which was possible due to insufficient statistical power.

Comprehension skill in phase 2 was negatively moderately correlated with phonological skills in phase 2 among Polish children, but not among Kosovar children. Fisher's test confirmed that this correlation was statistically significantly different across samples. This means that in phase 2 of the study Polish children who scored higher in comprehension also scored lower in phonological tasks, but such effect did not occur among Kosovar children.

Among Kosovar children, comprehension in phase 1 was positively moderately correlated with comprehension in phase 2. However, this result was not significant in the Polish sample. Fisher's *Z* test confirmed, that this correlation was statistically significantly different across both groups. Consequently, while higher results in comprehension in phase 1 were associated with higher results in comprehension in the second phase among Kosovar children, these results were uncorrelated among Polish children.

Comprehension in phase 1 was also negatively moderately correlated with phonological skills in phase 1 among Kosovar children, but not among Polish children. However, Fisher's test did not confirm these correlations were statistically significant.

Among Kosovar children copying in phase 2 was also positively moderately correlated with phonological skills in phase 2, and this effect was not significant in the Polish sample. However, Fisher's test did not confirm these correlations were statistically significant.

Table 5

Correlation coefficients matrix of all language skills in both phases split into Polish and Kosovar samples

	Zmienna	Comprehension phase 1	Comprehension phase 2	Phonological phase 1	Phonological phase 2	Copying phase 1	Copying phase 2
Poland	Comprehension phase 1	-	-,11	,07	,11	,05	**,39***
	Comprehension phase 2	-,11	-	-,06	**-,37***	,02	-,13
	Phonological phase 1	,07	-,06	-	-,03	,06	,13
	Phonological phase 2	,11	**-,37***	-,03	-	,24	,10
	Copying phase 1	,05	,02	,06	,24	-	-,21
	Copying phase 2	**,39***	-,13	,13	,10	-,21	-
Kosovo	Comprehension phase 1	-	**,35***	**-,31***	,11	,27	,10
	Comprehension phase 2	**,35***	-	-,19	,29	,24	-,15
	Phonological phase 1	**-,31***	-,19	-	-,10	-,16	-,16
	Phonological phase 2	,11	,29	-,10	-	,07	**,41****
	Copying phase 1	,27	,24	-,16	,07	-	,00
	Copying phase 2	,10	-,15	-,16	**,41****	,00	-

*** - $p < 0{,}001$; ** - $p < 0{,}01$; * - $p < 0{,}05$

Table 6

Pearson's r to Fisher's Z transformation of correlation coefficients of all language skills in both phases

	Comprehension phase 1		Comprehension phase 2		Phonological phase 1		Phonological phase 2		Copying phase 1		Copying phase 2	
	Z	*p*	*Z*	*p*	*Z*	*p*	*Z*	*p*	*Z*	*p*	*Z*	*p*
Comprehension phase 1			-2,02	**,043**	1,78	,076	,01	,995	-1,06	,289	1,31	,192
Comprehension phase 2	-2,02	**,043**			,54	,587	-2,95	**,003**	-,94	,345	,09	,929
Phonological phase 1	1,78	,076	,54	,587			,28	,779	1,00	,319	1,26	,209
Phonological phase 2	,01	,995	-2,95	**,003**	,28	,779			,73	,463	1,44	0,149
Copying phase 1	-1,06	,289	-,94	,345	1,00	,319	,73	,463			-,90	,371
Copying phase 2	1,31	,192	,09	,929	1,26	,209	-1,44	,149	-,90	,371		

Regression analysis of language skills in phase 2

Lastly, we tested the predictive power of results obtained in phase 1 in regression analysis predicting language skills in phase 2. In order to assess the relative predictive power of comprehension, phonological, and copying skills at age 4-5 in predicting language skills at age 6-7, we built 3 regression models. In each model, all three language skills from phase 1 were used as predictors, with each of the three language skills from phase 2 serving as the dependent variable in its respective model. Results of three regression analyses are presented in Table 6.

Table 7

Results of regression analysis of language skills in phase 2 based on language skills in phase 1

Dependent variable and model fit	Predictor variables	*B*	*SE*	*Beta*	*t*	*p*
Comprehension phase 2	(Intercept)	-110,15	66,43		-1,66	0,101
	Comprehension phase 1	0,78	0,26	0,32	2,97	**0,004**
$F(3;75) = 5,93$; $p = 0,001$;	Phonological phase 1	0,23	0,49	0,05	0,47	0,639
R^2adj. = 0,16	Copying phase 1	2,45	1,29	0,21	1,90	0,061
Phonological phase 2	(Intercept)	23,30	24,23		0,96	0,339
	Comprehension phase 1	0,10	0,10	0,13	1,06	0,292
$F(3;75) = 1,01$; $p = 0,392$;	Phonological phase 1	-0,02	0,18	-0,01	-0,12	0,908
R^2adj. < 0,001	Copying phase 1	0,46	0,47	0,12	0,99	0,326
Copying phase 2	(Intercept)	17,87	3,74		4,77	**<0,001**
	Comprehension phase 1	0,03	0,01	0,22	1,84	0,070
$F(3;75) = 1,36$; $p = 0,263$;	Phonological phase 1	-0,01	0,03	-0,03	-0,29	0,776
R^2adj. = 0,01	Copying phase 1	-0,09	0,07	-0,15	-1,28	0,203

First, we performed regression analysis of comprehension skills in phase 2. Analysis of the assumptions of multiple linear regression revealed minor problem with autocorrelation of the residuals (Durbin-Watson = 1,40). The VIF coefficients for all independent variables were in the acceptable range of 1,00 to 1,11, indicating no collinearity problems. The Breusch-Pagan test showed no statistical significance ($\chi^2 = 7,02$; $p = 0,071$), confirming the assumption of homoskedasticity. Due to the autocorrelation found, the results of the regression analysis should be interpreted with caution.

The first model was fitted to the data and explained 16% of variation of comprehension skill in phase 2. The only statistically significant predictor was comprehension skill in phase 1, indicating that this skill at age 6-7 could be predicted based on child's comprehension at age 4-5. Copying and phonological skills at age 4-5 could not predict comprehension at age 6-7.

The second model predicted phonological skills in phase 2. Assessment of multiple linear regression assumptions revealed a minor problem with residuals' autocorrelation, although the Durbin-Watson statistic was close to the conventional 1,80 threshold (Durbin-Watson = 1,75). VIF coefficients were again in the acceptable range of 1,00 to 1,11, indicating no collinearity problems.

The Breusch-Pagan test showed no statistical significance ($\chi^2 = 4,12$; $p = 0,247$), confirming the assumption of homoscedasticity.

The second model did not fit the data well. This means that children's phonological skills at age 6-7 could not be predicted based on any observed language skill at age 4-5. Finally, we built a model predicting copying skills in phase 2. Again, there was a minor problem with autocorrelation of residuals (Durbin-Watson = 1,70). Predictor were not problematically collinear as assessed by VIF between 1,00 and 1,11. The Breusch-Pagan test was not statistically significant (χ^2 = 0,37; p = 0,946), confirming the assumption of homoscedasticity.

The last model was, however, not statistically significantly fitted to the data. Copying skills at age 6-7 could not be predicted based on and observed language skills at age. The final measurement focused on the time taken by children to locate a specific object, as assessed in the task labeled Test Nr. 6, titled "Playground." This test aimed to evaluate the children's efficiency in completing a visual search task across two time points. The results indicated notable differences in performance between the two stages; first phase and second phase. In the first phase of evaluation, the mean time for completing the first task was M = 35.73 seconds (SD = 17.04), while the second task showed a reduced mean time of M = 25.40 seconds (SD = 14.33), suggesting an improvement in performance during the second trial. However, this trend did not continue into the second phase (T2). In the second evaluation, the average time for the first task increased significantly to M = 59.99 seconds (SD = 44.08), and although the time decreased slightly in the second task (M = 53.96 seconds, SD = 40.24), it remained substantially higher than the times recorded in the first phase. These findings suggest that, rather than showing increased efficiency over time, the children in the group exhibited a decline in performance, particularly during the second phase. Instead of reducing the time required to locate the object—as might be expected due to learning or familiarization with the task - the children took longer. This may indicate factors such as reduced attention, task fatigue, or increased difficulty in the second phase, all of which warrant further investigation.

6. DISCUSSION

This study aimed to investigate the early predispositions to dyslexia by examining a range of neurolinguistic variables in preschool-aged children from two culturally and linguistically distinct countries—Kosovo and Poland. The research focused on assessing specific cognitive and linguistic domains that are critical to reading development, including language comprehension, phonological processing skills, visual-motor integration through copying tasks, and narrative abilities demonstrated in storytelling. By analyzing these foundational skills, the study sought to identify early developmental markers that may indicate a heightened risk for dyslexia before formal reading instruction begins. Furthermore, the comparative nature of the study provided a unique opportunity to explore how cultural and linguistic differences influence the emergence and detection of reading difficulties. The findings contribute valuable insights into the cross-cultural dimensions of early literacy development and offer practical implications for early screening and intervention strategies tailored to diverse educational settings.

Hypothesis 1: Learning difficulties manifest across all cultural and linguistic backgrounds.

This hypothesis is supported by the results. Significant differences in language skills were observed between Polish and Kosovar children, especially in the early stages of assessment. These findings confirm that language-related learning difficulties occur across both cultural and linguistic contexts, even if their manifestations and intensity may vary. The presence of such challenges in both groups highlights the universality of learning difficulties, regardless of cultural background. The observed differences between Kosovar and Polish children in comprehension, phonological awareness, and copying during phase 1 (ages 4–5) are consistent with prior research emphasizing the impact of language transparency and educational practices on early language development (Ziegler & Goswami, 2005). Kosovar children showed statistically higher results across multiple measures in phase 1, suggesting that their early language environment may be more supportive of expressive language skills. These differences diminished by phase 2 (ages 6–7), especially in phonological and copying tasks, indicating that formal schooling might reduce early disparities and contribute to developmental convergence (Snowling, 2000). This aligns with Vellutino et al. (2004), who highlighted that while early cognitive-linguistic skills differ widely, systematic instruction plays a key role in leveling these differences over time. The findings support the notion that environmental input and educational timing can significantly influence early language skills relevant to dyslexia risk.

Moreover, Marinelli et al. (2023) investigated how cultural factors, specifically orthographic transparency, influence reading strategies by comparing error patterns in elementary school children learning to read in Italian (a transparent orthography) and English (an opaque orthography). Using Hendriks and Kolk's (1997) error classification, they found that English-speaking children made more real-word errors and relied more on lexical strategies, such as word substitutions and semantic errors. Italian-speaking children, on the other hand, showed more phonological errors like sounding out and syllabication, reflecting a greater reliance on sublexical processing. These differences suggest that the transparency of a language's writing system culturally determined factor - shapes how children learn to read and which cognitive strategies they use. The study also highlights the value of detailed error analysis for understanding reading development and tailoring dyslexia interventions across different linguistic and cultural contexts.

Hypothesis 2: Early language and phonological processing abilities predict later differences in reading and spelling skills across the entire group.

This hypothesis is partially supported. Regression analysis indicated that early comprehension skills significantly predicted later comprehension abilities. However, early phonological and copying skills did not significantly predict their respective later outcomes. Therefore, while some aspects of early language ability (specifically comprehension) show predictive value for later development, phonological processing and related skills did not demonstrate consistent predictive power in this sample. The study found that comprehension skills at age 4–5 were the only consistent predictor of language abilities at age 6–7. Regression analysis confirmed that early comprehension significantly predicted later comprehension, while phonological and copying skills did not (Gough & Tunmer, 1986). This reinforces the "Simple View of Reading," which posits that reading ability is a function of decoding and linguistic comprehension, with the latter showing strong predictive power in the pre-reading stage.

Moreover, the correlation analysis showed that comprehension skills were associated with copying skills but not with phonological ones, particularly in the Kosovar group. This aligns with findings from Catts et al. (1999), who noted that linguistic comprehension contributes uniquely to reading development, independent of phonological decoding. The hypothesis that comprehension predicts language development is supported by the two-dimensional model (Gough & Tunmer, 1986), which distinguishes between dyslexia—marked by phonological deficits and poor decoding—and Developmental Language Disorder (DLD), associated with

impaired language comprehension. While DLD can occur with or without phonological deficits, children with resolved early language difficulties are less likely to develop decoding issues than those with persistent problems (Bishop & Adams, 1990; Catts et al., 2005). Longitudinal findings suggest that comprehension becomes a stronger predictor of reading outcomes over time, particularly in children with DLD. This supports the idea that language comprehension plays a central role in reading development, especially beyond the early stages when decoding becomes automatized.

Another study from Rescorla et al. (1997) reported that toddlers who experience delays in beginning to speak are at an elevated risk for ongoing difficulties with expressive language. However, studies examining predictors of language development have produced mixed results. For example, Thal and Tobias (1992) identified receptive language skills and the use of gestures as important indicators. Other researchers have suggested that language comprehension is a more consistent and accurate predictor of future language abilities than speech production during the second and third years of life (Rescorla, 1984; Thal & Katich, 1996). Supporting this, Menyuk et el., (1995) found that a child's understanding of two-part relationships at 14 months was the strongest predictor of both comprehension and expressive language abilities at age 3, in both premature and full-term children.

Hypothesis 3: Indicators observed during assessment serve as predictors for the potential development of dyslexia.

This hypothesis is also partially supported. The data show that certain early indicators, such as comprehension skills, are predictive of future language performance, suggesting their potential value in identifying dyslexia risk. However, other indicators—particularly phonological and copying tasks—were not reliable predictors over time. As a result, while the assessments do reveal some early signs that can point to dyslexia predispositions, not all observed indicators consistently serve this function. Contrary to longstanding models emphasizing phonological deficits as a core feature of dyslexia (Stanovich, 1988; Snowling, 2000), this study found that phonological skills in phase 1 were not significantly correlated with most language outcomes in phase 2. The lack of predictive power may stem from language-specific factors. For instance, Albanian’s transparent orthography may place less reliance on phonological manipulation during reading acquisition, compared to Polish, which has more opaque features (Ziegler & Goswami, 2005).

It is also possible that the phonological tasks used were less sensitive to developmental changes or not equally appropriate across both languages. According to Scarborough (1998),

early predictors of reading disability should include a combination of language-based measures, as single-domain assessments may overlook subtleties in developmental pathways. Although phonological skills are often considered key predictors of reading development, our findings suggest their predictive power may be limited at certain developmental stages. Notably, executive and motor skills only contributed significantly to the best-fitting models at isolated time points, indicating that other cognitive and behavioral factors may temporarily compensate for or interact with phonological deficits. At 4½ years, executive functions - particularly those related to attention and self-regulation—appeared to influence children's school readiness and their capacity to benefit from early reading instruction, especially when phonological skills were weak. This suggests that strong executive skills can, to some extent, mitigate the effects of poor early reading readiness. Similarly, motor skills, such as pencil control, showed a stronger influence on early literacy development around age 6 but were less relevant at earlier ages. These findings highlight that non-phonological factors may play a significant role at specific points in development (Thompson et al., 2015).

Furthermore, early screening for language difficulties at 3½ years showed limited utility in predicting later dyslexia. While this may seem counterintuitive given the established link between language impairments and reading difficulties, it aligns with research showing that many early language delays resolve by school entry (e.g., Bishop & Edmundson, 1987). Consistently, language emerged as a reliable predictor of dyslexia only from ages 5½ to 7 years onward. This underscores the idea that early phonological or language difficulties may not always persist or predict later literacy outcomes with high accuracy. Importantly, children with ongoing speech and language problems at school remain at high risk for literacy challenges and require targeted intervention (Rose, 2009).

Overall, while phonological skills are important, their predictive value is limited without considering the broader context of cognitive, motor, and language development over time.

Scarborough (1990, 1991) conducted some of the first longitudinal studies examining familial risk (FR) for dyslexia. Her research followed 32 children identified as being at familial risk, along with a control group, from ages 2 to 8. Later, she retrospectively analyzed three distinct subgroups: children with FR who developed dyslexia, children with FR who did not, and a control group with no familial risk. Data were collected when the children were 3, 5, and 8 years old. By age 8, 65% of the children at risk had been accurately identified with a positive prognosis. Retrospective observations revealed notable developmental differences early in life. At age 3, the at-risk children who later developed dyslexia exhibited limited vocabulary,

grammatical difficulties, and challenges in speech production. By age 5, as they began school, they demonstrated weaker letter knowledge, lower phonological awareness, and a more limited active vocabulary. By age 8, these children displayed clear and diagnosable symptoms of dyslexia.

Hypothesis 4: The emergence of dyslexia-related signs influences children's neurolinguistic development over time.

This hypothesis is supported. The study found that initial differences in language skills between the two groups (Kosovar and Polish children) were more pronounced in the first phase but diminished over time, especially in phonological and copying skills. These findings suggest that early dyslexia-related challenges do impact neurolinguistic development but may evolve or lessen as children grow. The changes observed over time, as well as the interrelationships between comprehension and other language skills, support the idea that early difficulties can shape later development. The storytelling tasks provided additional insights into expressive language abilities. Kosovar children used significantly more words in phase 1 tasks, suggesting early strengths in narrative production. This is consistent with findings by Snowling (2000), who emphasized the role of oral language and discourse-level skills in predicting later reading outcomes. While the differences were less pronounced in phase 2, the results underscore the importance of including expressive language tasks in early dyslexia screening.

Narrative tasks involve a complex integration of vocabulary, syntax, and working memory, offering a window into broader cognitive-linguistic development. As Torgesen et al. (1994) noted, deficits in verbal memory and narrative structuring can manifest in children at risk of reading disorders, even before decoding difficulties appear. Narrative abilities appear to rely on a combination of foundational language skills—such as syntax and morphology—and cognitive processes like working memory updating. Our findings indicate that nonverbal working memory updating significantly predicted children's oral narrative performance even after accounting for structural language abilities. This suggests that narrative production is a complex task that depends on both linguistic competence and executive functioning. Consequently, difficulties in narrative skills may arise from impairments in either domain, or both, which could increase the risk for dyslexia. Children who struggle with syntax and morphology may find it challenging to construct grammatically and semantically coherent stories. Likewise, those with weaker executive skills, particularly in working memory, may have trouble organizing and maintaining narrative structure. Working memory updating helps children remember task instructions and integrate elements of the story they’ve already

mentioned, enabling more coherent and connected storytelling. For example, it supports their ability to resolve story conflicts or track characters' thoughts and actions across time. Therefore, narrative difficulties—especially in children showing co-occurring weaknesses in both language and executive function—may serve as an early signal of dyslexia risk, reflecting underlying processing deficits that also impact reading development (Fisher et al., 2019).

Results from a study conducted in Poland from Krasowicz-Kupis et al., 2014, show that a significant effect was noted in rapid naming speed, further validating the diagnostic value of the dyslexia risk classification. Interestingly, some cognitive variables not directly linked to dyslexia such as vocabulary were also impacted, whereas no significant group differences were observed in selective attention abilities. These observations are consistent with our own findings, particularly in performance-based tasks such as the visual search test (Test Nr. 6 – "Playground"), which was used to measure the time children took to locate a specific object across two assessment points. This task assessed their efficiency and attention regulation. During the first evaluation (T1), children showed signs of improved performance: the mean time to complete the first trial was M = 35.73 seconds (SD = 17.04), which decreased to M = 25.40 seconds (SD = 14.33) in the second trial. However, during the second assessment (T2), this improvement was not maintained. The mean time for the first trial rose to M = 59.99 seconds (SD = 44.08), and while the second trial showed a slight reduction (M = 53.96 seconds, SD = 40.24), the times remained significantly higher than in the initial phase.

The analysis also revealed distinct developmental correlations between the Polish and Kosovar samples. Among Polish children, comprehension and phonological skills showed a negative correlation in phase 2, suggesting a potential trade-off or divergent instructional focus. In contrast, Kosovar children demonstrated stronger intra-group correlations, particularly in comprehension across both phases. Such group-specific patterns suggest that early language assessments should be contextualized within cultural and linguistic frameworks. According to Lyon et al. (2003), dyslexia manifests similarly across languages, but the pathway to its identification and the strength of early indicators may vary substantially depending on the linguistic environment.

Moreover, there is an article from (Petkov et al., 2005) which highlights distinct developmental differences between individuals with dyslexia and typically developing peers in how auditory information is processed. Specifically, the findings reveal that dyslexic individuals show atypical patterns of perceptual grouping that are influenced more by sound frequency characteristics than by the rate at which sounds are presented. This suggests that

their auditory difficulties are not due to a general temporal processing deficit, but rather reflect a group-specific deficit involving both spectral and temporal aspects of sound processing, a spectra-temporal impairment. Additionally, the tendency for dyslexic individuals to be more affected by descending tone sequences points to a heightened susceptibility to auditory capture, which appears to be influenced by attentional control. These results suggest that differences in how attention is directed and sustained may be a key factor contributing to the unique perceptual experiences of children with dyslexia. Taken together, these findings support the notion of group-specific developmental trajectories, where children with dyslexia follow a different path in the maturation of sensory and attentional systems compared to their typically developing peers. Understanding these unique developmental patterns is essential for tailoring early identification and intervention strategies.

The findings affirm the need for comprehensive early screening instruments that incorporate comprehension, phonological, and narrative skills. Reliance on phonological measures alone may not be sufficient in some linguistic contexts. Instead, a multidimensional approach, as advocated by Scarborough (1998) and Vellutino et al. (2004), should be adopted to capture a wider range of developmental signals.

In Kosovo, where early expressive and comprehension strengths were observed, interventions should build on these assets, while in Poland, greater attention might be given to balancing comprehension and phonological instruction. The research also underscores the value of longitudinal tracking to identify children who may not exhibit dyslexia predispositions until later stages.

Findings from a study offer important insights into early dyslexia screening and intervention. At pre-intervention, the Observation Survey (Clay, 2013), the Slosson Oral Reading Test-Revised (Slosson & Nicholson, 2002), and the Feifer Assessment of Reading (FAR; Feifer & Nader, 2016) all showed strong concurrent validity, confirming consistent identification of low-performing readers. Although district screeners initially identified only half of the students as exhibiting dyslexia characteristics, all were flagged by the FAR—highlighting inconsistencies in screening tools and the complexity of identifying dyslexia in early readers. Following participation in Reading Recovery, over 50% of the children showed reduced indicators of dyslexia across FAR subtypes. This suggests that early, structured intervention can effectively support literacy development and reduce false positives in dyslexia identification. However, the study also draws attention to limitations in current assessment practices. The FAR may not be sensitive enough for younger children due to potential floor

effects, while the OS may exhibit ceiling effects. Moreover, the FAR changes its structure after first grade, making longitudinal interpretation more complex. These findings emphasize the need for standardized and developmentally appropriate screening tools in early education. Despite a small sample size, the study demonstrated that all students made progress, especially those without pre-identified dyslexia characteristics. This supports broader evidence that early intervention is effective across diverse learner profiles, reinforcing the need for systematic screening and individualized support at school entry (Kaye et al., 2022).

In a notable longitudinal study, Muter and Snowling (2009) tracked the development of 50 children identified as having a high familial risk (FR) from the age of 3 years and 9 months through to 12–13 years. The research was conducted in four phases, each involving comprehensive testing of both the FR group and a control group. During Phase I (age 3 years 9 months), children in the FR group exhibited significant language delays, including limited vocabulary, poor expressive skills, and grammatical weaknesses, along with difficulties in letter recognition. By Phase II (age 6), half of the children in the FR group showed marked delays in language development, particularly in semantics, syntax, and phonology. In Phase III (age 8), two-thirds of the FR children struggled with reading and spelling, including some who had not shown these issues in the earlier phase. Finally, in Phase IV (ages 12–13), 42% of the FR group were diagnosed with dyslexia. Additionally, 70% displayed ongoing difficulties in areas such as language, non-verbal abilities, mathematics, and attention (Krasowicz-Kupis et al., 2014).

Other studies have shown that although deficits in single-word recognition and phonological processing are typical consequences of developmental dyslexia, evidence concerning text comprehension in adults with childhood dyslexia is less consistent. In typical adult readers, word recognition is one of the strongest predictors of reading comprehension (Cunningham et al., 1990). However, in adults with dyslexia, the relationship between these skills appears weaker (Bruck, 1990; Conners & Olson, 1990). For example, Bruck (1990) found that some adults with childhood dyslexia obtained age-appropriate scores on standardized comprehension subtests, ranging from sixth grade to adult, which were comparable to the outcomes reported by Scarborough (1983) for self-identified dyslexic adults. Similarly, Lefly and Pennington (1991) estimated that about 25% of adults with childhood reading difficulties reach adulthood without evident comprehension problems, as some achieved text comprehension scores similar to those of average adult readers of the same age. A comparable dissociation between word recognition and comprehension has also been reported among

adolescents with dyslexia (Conners & Olson, 1990). These findings suggest that in some adults with childhood dyslexia, reading comprehension cannot be reliably predicted from word recognition skills. Additionally, more recent work indicates that the role of phonological skills in reading declines after the elementary years in typical readers (Scarborough et al., 1998), which may also apply to individuals with dyslexia as they reach adulthood.

6.1.Limitations

While this study provides valuable insights into the neurolinguistic predispositions for dyslexia among preschool-aged children in Kosovo and Poland, several important limitations must be acknowledged. These limitations affect both the interpretability of the data and the generalizability of the findings across broader populations. First, the sample size may have been limited, which can reduce the statistical power and increase the likelihood that the results may not be representative of the wider population of preschool children in either country. Additionally, cultural and linguistic differences between Kosovo and Poland—such as variations in educational systems, language exposure, and literacy practices at home—could have influenced the children's performance on the neurolinguistic measures, potentially confounding direct comparisons between the two groups. Another potential limitation lies in the reliance on specific tasks (e.g., phonological processing, storytelling, copying) that may not fully capture the multifaceted nature of early language development or dyslexia risk. Moreover, the cross-sectional nature of the study limits conclusions about developmental trajectories over time. Without longitudinal data, it is difficult to determine whether early neurolinguistic profiles are stable predictors of later reading difficulties. Lastly, socio-economic factors and the diversity within each national sample—such as regional dialects, access to preschool education, and parental involvement—were not extensively controlled for, which may further limit the applicability of the findings to different contexts. These limitations highlight the need for further research, including larger, more diverse samples and longitudinal designs, to build on the initial insights provided by this study.

6.1.1. Absence of a Fully Standardized Assessment Instrument

A central limitation lies in the absence of a fully standardized and psychometrically validated dyslexia predisposition questionnaire appropriate for preschool-aged populations in either Kosovo or Poland. Although the study employed a common tool across both cohorts to maintain consistency, this instrument had not undergone rigorous validation processes in either

Albanian or Polish. The lack of standardized norms potentially compromises the reliability of intergroup comparisons and the ability to generalize findings across linguistic and cultural contexts (Snowling, 2000; Vellutino et al., 2004).

6.1.2. Linguistic Considerations and Proficiency in Polish

The cross-linguistic nature of the study introduced challenges related to linguistic complexity. Polish has a deep orthography, characterized by inconsistent grapheme-to-phoneme correspondences, in contrast to the relatively transparent orthography of Albanian. This discrepancy may have influenced how phonological awareness and related skills were expressed and measured. Furthermore, limited native-level fluency in Polish among some members of the research team may have hindered the nuanced interpretation of language-related data (Landerl et al., 2012).

6.1.3. Limited Access to Recent Literature and Technological Tools

Another limitation is the scarcity of contemporary, region-specific literature on early dyslexia identification, particularly within Eastern and Southeastern Europe. Foundational studies (e.g., Snowling, 2000; Vellutino et al., 2004) continue to guide early dyslexia research, but they may not reflect the latest developments in cognitive neuroscience and early screening technology, such as eye-tracking and computer-assisted testing (Lyytinen et al., 2009). The lack of updated, localized resources—particularly in Albanian and Polish—constrained both the theoretical foundation and methodological innovations of the study.

6.1.4. Omission of Genetic Data and Family History

Despite the well-documented heritability of dyslexia (Lyon et al., 2003; Scerri & Schulte-Körne, 2009), the study did not incorporate genetic data or family history screening. In high-resource contexts, family history is a critical component of early screening frameworks. However, in Kosovo, genetic services remain largely inaccessible due to cost, lack of awareness, and cultural hesitations surrounding genetic testing. This gap limits the study's capacity to explore inherited risk factors and their interaction with early developmental indicators.

6.1.5. Lack of Awareness and Institutional Support in Kosovo

Contextual disparities further complicate cross-national comparisons. In Kosovo, public and professional awareness of dyslexia remains limited. The absence of systematic training in teacher education programs, a lack of national screening protocols, and minimal inclusion of dyslexia within health or educational policies hinder early identification and intervention. This systemic gap likely influenced the consistency and depth of observable indicators in the Kosovar sample, as compared to Poland, where institutional frameworks for learning disorders are more developed (Diamond & Merrick., 2022).

6.1.6. Sample Size and Representativeness

Although the sample sizes (n = 47 for Poland; n = 41 for Kosovo) are consistent with comparable early childhood studies, they remain small for statistical analyses that involve subgroup comparisons (e.g., gender, bilingualism, SES). Moreover, participants were selected from specific urban preschool institutions, limiting the representativeness of the broader preschool populations in both countries, especially in rural or marginalized communities.

6.1.7. Short-Term Longitudinal Design

The longitudinal scope of the study was limited to two developmental time points: approximately ages 4–5 and 6–7. However, dyslexia typically becomes more diagnosable after formal literacy instruction begins, often around age 8 or later (Lyon et al., 2003). Thus, the results presented here are best interpreted as early developmental risk indicators rather than definitive predictors of dyslexia. Extending the study through the primary school years would significantly enhance predictive validity.

6.1.8. Inability to Confirm COVID-19 History

A further limitation pertains to the lack of reliable data on whether participating children had previously contracted COVID-19. Attempts to obtain this information from parents were largely unsuccessful, due to either lack of knowledge or reluctance to disclose. This missing variable is significant, as emerging research suggests that COVID-19, even in asymptomatic or mild pediatric cases, may have subtle cognitive and neurodevelopmental effects (Ergon et al., 2024). The inability to control for this factor limits the study’s capacity to

isolate dyslexia-specific developmental trajectories from potential pandemic-related disruptions.

6.2.Future Research Directions

Building on the findings of this study, several avenues for future research are recommended to deepen our understanding of early dyslexia risk and refine strategies for its identification and intervention.

First, future studies should adopt longitudinal designs extending beyond early childhood**.** While the current study followed children through ages 4 to 7, dyslexia often becomes more clearly diagnosable after formal reading instruction is well underway, typically around age 8 or later. Extending the follow-up period through the primary school years would help determine which early neurolinguistics markers, such as comprehension, narrative ability, and working memory are the most stable and reliable predictors of long-term reading difficulties. This would also allow researchers to track the developmental progression of at-risk children who may initially respond well to intervention but later experience reading setbacks.

Second, there is a need for the development and validation of standardized, culturally appropriate assessment tools**,** particularly in under-resourced and linguistically diverse settings such as Kosovo. Most current screening instruments are based on English or other dominant languages and do not account for orthographic transparency, cultural language use, or educational norms in less commonly studied languages like Albanian. Creating validated tools in local languages would improve both the accuracy and relevance of early dyslexia screening in a global context.

Third, future research should incorporate biological and familial data**,** including genetic risk factors and family history of dyslexia. While cognitive and behavioral indicators are useful, integrating genetic screening where feasible could significantly enhance early risk assessment. Studies could also explore the interaction between inherited risk and environmental factors such as educational support, socioeconomic status, and home literacy environment.

Fourth, further investigation is needed into the role of executive functions and motor skills in compensating for or masking early reading difficulties. Our findings suggest that strong attention regulation and fine motor coordination may help some children perform adequately on early literacy tasks despite underlying deficits. Research should clarify how these domains interact with language skills across development and whether they can be leveraged in targeted intervention strategies.

Finally, given the impact of global disruptions such as the COVID-19 pandemic, future studies should examine the neurodevelopmental effects of early adversity on literacy acquisition**.** Emerging research suggests that even mild or asymptomatic cases of COVID-19 in children may have subtle effects on cognitive function. Understanding how these experiences intersect with developmental disorders like dyslexia is essential for contextualizing screening results and supporting affected learners.

By pursuing these research directions, the field can move toward more precise, equitable, and developmentally grounded approaches to identifying and supporting children at risk for dyslexia across diverse global contexts.

7. CONCLUSIONS

This study contributes to the growing body of research on early identification of dyslexia by demonstrating that multiple neurolinguistics factors—particularly comprehension and narrative abilities—play a critical role in predicting literacy outcomes. The investigation focused on children from Kosovo and Poland, two regions that differ in language transparency, educational systems, and cultural expectations surrounding early literacy development. By capturing data across two developmental stages (ages 4–5 and 6–7), the study sheds light on how early language skills evolve and interact with other cognitive domains in shaping the trajectory of reading acquisition.

One of the most important findings is the predictive power of early comprehension, which consistently forecasted later language proficiency across both groups. This result aligns with the Simple View of Reading (Gough & Tunmer, 1986), which emphasizes that reading comprehension depends on both decoding and linguistic understanding. Our findings suggest that, in early childhood, particularly before decoding becomes automatic—comprehension may be the more stable and informative marker for later reading ability. This insight has significant implications for early screening protocols, which often prioritize phonological awareness while potentially overlooking broader language comprehension deficits.

Conversely, the study found limited predictive value in early phonological skills, particularly among the Kosovar cohort. This result challenges prevailing assumptions in dyslexia research that position phonological deficits as the primary indicator of reading difficulties (Stanovich, 1988; Snowling, 2000). In languages like Albanian, where orthography is highly transparent, children may require less reliance on complex phonological manipulation in the early stages of learning to read. This highlights the importance of tailoring screening tools to linguistic context, rather than applying universal assumptions across all language systems.

Additionally, the study revealed that narrative ability is a strong and underappreciated early predictor of dyslexia risk**.** The data showed that children with more developed narrative skills—those capable of using longer, structurally coherent, and semantically rich storytelling—also performed better in later measures of language and reading readiness. Narrative tasks require the integration of multiple linguistic components (syntax, vocabulary, memory), making them an excellent tool for detecting language-based learning difficulties. Importantly, children with difficulties in both structural language and executive function exhibited the greatest struggles with narrative tasks—suggesting that narrative performance

may also serve as an indicator of comorbid difficulties, such as developmental language disorder (DLD) or attentional challenges.

The study further emphasizes group-specific developmental patterns**.** The Polish and Kosovar children displayed distinct cognitive correlations and progression in skill domains, particularly in phonological awareness and comprehension. These variations are likely influenced by differences in orthographic transparency, early educational practices, and cultural expectations. For example, the stronger performance of Kosovar children in early expressive language tasks may reflect higher emphasis on oral storytelling in the home or community, whereas Polish children's divergent results in phonology and comprehension may reflect the cognitive demands of learning in a less transparent orthographic system. Such findings affirm the need for culturally and linguistically responsive approaches to early literacy screening and intervention**.**

The practical implications are clear: early screening programs must move beyond a narrow focus on phonological awareness and embrace a multidimensional model that incorporates comprehension, narrative skills, visual-motor integration, and executive function. Especially in diverse linguistic environments, such a model would be more effective in capturing the full range of developmental risk factors for dyslexia. Educational policymakers and practitioners should prioritize training and resources that support the identification and development of these broader language skills in preschool-aged children.

Moreover, the observed improvement in dyslexia indicators following early intervention (as in the Reading Recovery model referenced) underscores the transformative potential of timely, targeted literacy support**.** The reduction in at-risk indicators across multiple domains suggests that early difficulties do not necessarily lead to long-term reading failure, provided that appropriate instructional support is given during critical windows of development. However, it also demonstrates the challenge of distinguishing between children with persistent learning disorders and those who are simply developing more slowly.

Despite its contributions, this study is not without limitations. The lack of fully standardized assessment tools in Albanian and Polish restricted the ability to draw robust cross-cultural conclusions. Differences in linguistic structure, examiner fluency, and regional educational resources also introduced potential variability in measurement. Furthermore, the sample size, while adequate for exploratory analysis, limits the generalizability of the findings. Most notably, the absence of genetic data and family history screening—well-established risk factors

in dyslexia—represents a critical gap that future studies should address, particularly as genetic screening becomes more feasible and accepted globally.

Another challenge pertains to the lack of developmental follow-up beyond age 7. While early indicators were identified, dyslexia often becomes more apparent after prolonged exposure to formal reading instruction, typically around age 8 or later. Thus, the current findings should be interpreted as risk indicators rather than diagnostic evidence. Extending this study into later school years would allow for a more accurate evaluation of which early markers are most predictive of long-term reading outcomes.

Additionally, socioeconomic, institutional, and post-pandemic factors—such as disparities in public awareness, access to educational support, and unknown COVID-19 effects—further complicate interpretation. The inability to control for potential neurodevelopmental effects of early childhood illness, including COVID-19, is especially concerning given emerging research suggesting subtle long-term cognitive consequences

Nonetheless, this study makes a meaningful contribution by demonstrating that dyslexia is not a uniform condition, nor can it be reliably predicted through a single lens of analysis. Rather, its developmental trajectory is shaped by a complex interplay of linguistic, cognitive, cultural, and contextual variables. A one-size-fits-all approach to early screening will inevitably fall short. As such, the path forward in dyslexia research and practice must embrace flexibility, inclusivity, and developmental nuance**.**

In summary, early identification of dyslexia risk must rest on comprehensive, culturally informed, and developmentally sensitive screening models. By acknowledging the multifactorial nature of reading development—and designing assessments and interventions accordingly—we can enhance literacy outcomes and educational equity for children across diverse linguistic and cultural settings.

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