CHAPTER 2
LITERATURE REVIEW
LITERATURE REVIEW

The literature on the factors influencing academic performance among elementary school age children was reviewed. The search was carried out using search questions and key terms as mentioned in Table 2.1 & 2.2.

Boolean operator: ‘OR’ was used to combine all key terms under each concept and ‘AND’ was used to combine all 3 concepts together.

Search Online Databases used: PubMed / MEDLINE, Scopus, Web of Science, CINAHL plus full text (EBSCOhost), Cochrane Library online, IndMED, and OT seeker (Occupational Therapy) using a Single Window SEARCH @ Health Science Library, Manipal University.

Search strategy limitation used: Restricted search to last 10 years (2007) and only English language.

Other Search key words used: Geographical location: India, Karnataka and Udupi

Other search strategies used:
- Grey literature: Google scholar, government reports, research reports and fact sheets
- Hand searching: Non-indexed journals and citation searching.

The articles published from the year 2000 were taken into consideration for further review. The articles related to VP, VMI and handwriting published from the year 1990 were also later on considered as limited literature was available from the year 2000.
Table 2.1.

**Search Questions and Key Terms**

Search question: In elementary school children, do family factors/environmental factors/child factors have an impact/relationship on academic performance?

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<tr>
<th>Concept 1</th>
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<tr>
<td>Elementary school children</td>
<td>Family factors</td>
<td>Environmental factors</td>
<td>Child factors</td>
<td>Academic performance</td>
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<td>Primary school children</td>
<td>Type of family</td>
<td>School environment</td>
<td>Nutrition status: Malnutrition / Obesity/BMI</td>
<td>School performance</td>
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<td>Socio economic status</td>
<td>Peer interaction</td>
<td>Medical conditions: Learning disability/</td>
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<td>Parental education</td>
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Table 2.2.

**Search Questions and Key Terms**

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<th>Search question: In elementary school children, does visual perception have an impact/relationship on academic performance?</th>
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<th>Search question: In elementary school children, does visual motor integration have an impact/relationship on academic performance?</th>
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<th>Search question: In elementary school children, does handwriting have an impact/relationship on academic performance?</th>
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The reviewed literature has been divided into the following themes for clarity of understanding.

- Environmental factors influencing academic performance
- Family factors influencing academic performance
- Child factors influencing academic performance

2.1. Environmental factors influencing academic performance

The following was the literature obtained on the environmental factors that influence academic performance:

- A cross-sectional study was conducted to assess the factors influencing academic performance in primary school children. It was found that clean air, good light, less classroom noise and comfortable school environment had positive influence on academic performance (Habibullah & Ashraf, 2013).

- According to Mathee et al. (2007), environmental exposure to lead may put school going children at risk of intellectual impairment and poor educational attainment.

- Noisy environment and too much television viewing at home was associated with poor academic performance among children or even school dropouts among children (Karande & Kulkarni, 2005; Kawada, 2004).

One of the studies (Habibullah & Ashraf, 2013) reviewed under environmental factors that influence academic performance was cross-sectional, has used a questionnaire to measure the perception of environmental factors influencing academic performance and only descriptive statistics has been used for analysis. The other articles were reviews (Mathee et al., 2007; Karande & Kulkarni, 2005; Kawada, 2004).
2.2. Family factors influencing academic performance

The following are the various family factors that influence academic performance among elementary school children:

- A review article mentioned that better use of human capital at home and school i.e. education, job skills and work experience contribute to a child’s ability in education (Parcel et al., 2010).

- Tyler et al. (2008) reported that, in most primary age group children, the sudden exposure to different languages, values, and behavioral expectations between home and school cultures may impede their academic success.

- Children’s academic achievement in mathematics was positively associated with parental education level, job status, the child’s early literacy experiences and attendance in preschool (Lopez et al., 2007).

- Children who have had frequent change of schools were likely to have unsmooth academic or school experiences due to the lack of continuity in the content and feelings of alienation in the new environment (Engec, 2006; Mantzicopoulos & Knutson, 2000).

- Family involvement was found to have positive influence over a child’s academic performance (Furrer & Skinner, 2003).

A study (Tyler et al., 2008) done to review the influence of family factors on academic performance in the United States elementary school children’s parents was cross sectional and only a questionnaire was used to assess the same. Another qualitative longitudinal study done on United States first to eighth graders had a small sample size (Lopez et al., 2007). And many other studies (Engec, 2006; Mantzicopoulos & Knutson, 2000; Furrer & Skinner, 2003) were either cross sectional done only on economically
disadvantaged children or used non-standardized assessment tools such as questionnaires used to find the parents’ and teachers’ perception of child’s academic performance. The psychometric properties of these questionnaires are not completely established yet.

2.3. Child factors influencing academic performance

The following are the various child related factors that can influence children’s academic performance.

2.3.1. General medical aspects:

Review articles (Karande & Kulkarni, 2005; Habibullah & Ashraf, 2013) have emphasized on certain medical conditions that have been identified to have impact on the academic performance of primary school children. The medical problems identified were:

- Preterm born children or babies born with low birth weight are at risk of poor academic performance in their school age, even without any neurological deficits (Huddy, Jonson, & Hope, 2001; Weindrich, Jennen-Steinmetz, Laucht, & Schmidt, 2003).

- Malnutrition in children was associated with poor academic performance in school (Liu, Raine, Venables, Dalais, & Mednick, 2003).

- Children with hearing and visual problems during the first four years of life have been reported to show significantly poor academic performance especially in expressive language and mathematics (Roberts, Burchinal, & Zeisel, 2002; Dandona et al., 2002).

- Children with idiopathic onset of epilepsy were prone to have problems in processing memory tasks resulting in poor academic performance (Schouten, Oostrom, Pestman, Peters, & Jennekens-Schinkel, 2002).
• Children with Cerebral Palsy (CP) and its associated co-morbidities usually have limitations in functional activities which influence their learning capabilities resulting in poor academic performance (Schenker, Coster, & Parush, 2005; Beckung & Hagberg, 2002).

• As stated in a review article, children with Learning Disabilities (LD) have cognitive difficulties that are intrinsic in nature and lead to a lower than expected academic performance in school (Siqueira & Gurge-Giannetti, 2011).

• Children diagnosed with Mental Retardation (MR) are associated with poor school performance or academic failure (Siqueira & Gurge-Giannetti, 2011).

• Children with Attention Deficit Hyperactivity Disorder (ADHD) were found to have poorer grades, higher rates of school failure, repeated grades, greater rates of academic underachievement (Barry, Lyman, & Klinger, 2002), school dropout, suspensions from school and poor academic achievements (Preston, Heaton, McCann, Watson, & Selke, 2009; Polderman et al., 2010; Siqueira & Gurge-Giannetti, 2011).

• Increased weight status in primary school age children was associated with cognitive performance (Afzal & Gortmaker, 2015) and poorer academic outcomes (Joshi, Howat, Bryan, & Dick, 2011; Habibullah & Ashraf, 2013). Children who were obese were likely to repeat a grade in school when comparing their academic performance with other typically developing children (Halfon et al., 2013).

• Leukemia and lymphoma, sickle cell anemia, thalassemia major, hemophilia, type 1 diabetes mellitus, congenital hypothyroidism and habitual snoring are other medical problems that affect the child’s academic performance (Krawczuk-Rybak et al., 2012; Schatz, Brown, Pascual, Hsu & DeBaun, 2001; Shapiro et al., 2001; Urschitz et al., 2003).
2.3.2. Psychological aspects:

Psychological aspects of the child is a factor that cannot be neglected in the realm of child factors contributing to poor academic performance among elementary school age children. Discussed below are the prominent ones identified in the literature.

- Highly anxious children are found to have problems in academic performance (Siqueira & Gurge-Giannetti, 2010; Hughes, Lourea-Waddell, & Kendall, 2008; Mazzone et al., 2007). The tasks that were found to be problematic were decoding and verbal fluency (Grills-Taquechel et al., 2012).

- Psychological distress among children such as peer victimization poses difficulties focusing and engaging in school related activities that may result in poor academic performance (Flook, Repetti, & Ullman, 2005; McLeod & Fettes, 2007).

- Peer victimized school age children faced greater difficulty in psychosocial adjustments and academic achievements than non-victimized children (Totura, Green, Karver, & Gesten, 2009; Espelage et al., 2013). A longitudinal study by Buhs, Ladd, and Herald (2006) found that there was a strong link between peer rejection and children’s school performance.

- Few depressive symptoms related to emotions and cognition were found to influence academic performance (Bailey, Zauszneiwski, Heinzer, & Hemstrom-Krainess, 2007). An association was found between depressive symptoms and decrease in grades among school age children (Preiss & Franova 2006; Valdez, Lambert, & Ialongo, 2011).

- Short duration of sleep was identified as one of the reason that is likely to cause poor academic outcome in primary school age children (Li et al., 2013; Brockmann et al., 2012; O’Brien, 2009). Matricciani et al. (2012) found that increased sleep fragmentation, poor sleep, late bedtimes and early awakenings
seriously affect learning capacity, school achievement, and neurobehavioral functioning. A meta-analytic review showed the strongest relationship between sleepiness (i.e. sleep quality, sleep duration) and school performance (Dewald et al., 2010).

2.3.3. Cognitive aspects:

The cognitive factors contributing to academic performance are discussed in this section.

- Cognitive abilities were identified as one of the contributing factors for academic achievement in primary school children (Ong et al., 2010).

- Good attentional abilities enhance reading and writing skills which in turn can influence performance in academics (Polderman et al., 2010).

- Working memory was found to be necessary while writing and reading, to recall the text that was read previously, decoding the unfamiliar words, getting ahead in passage reading and reclaiming semantic awareness of familiar words (Titz & Karbach, 2014).

- A study compared high working memory children with low working memory children in mathematics and concluded the positive association between them (Barrouillet & Lepine, 2005).

- Children with low academic performance scored less in cognitive abilities test in a study done on children aged four- eleven years (Uyanik, Aki, Duger, Bumin, & Kayihan, 1999; Siqueira & Gurge-Giannetti 2010; Karande & Kulkarni, 2005).

Two articles included from India and the United States were review articles (Karande & Kulkarni, 2005; Siqueira & Gurge-Giannetti, 2011). One of the United States based study used postal questionnaire which was non-standardized (Huddy et al.,
2001). Another study done in Germany included only two subjects i.e. German and mathematics to assess the academic performance (Weindrich et al., 2003). This study along with another study done in Mauritius had a long gap between baseline and follow-up (Weindrich et al., 2003; Liu et al., 2003). A study done in Netherlands assessed only memory using a non-standardized assessment tool i.e. word span using nouns (Schouten et al., 2002). A study done in Israel used data which was retrospective and assessed overall activity performance rather than academics (Beckung & Hagberg, 2002). A systematic review done in Netherlands was based on electronic databases (Polderman et al., 2010). Hence, most of the studies reviewed were cross sectional, few with smaller sample size and few used non-standardized tools for assessment (Dandona et al., 2002; Preston et al., 2009; Krawczuk-Rybak et al., 2012; Urschitz et al., 2003; Schatz et al., 2001; Brockmann et al., 2012; Hughes et al., 2008). Three studies assessed the influence of cognition on academic performance but without considering the other confounders (Ong et al., 2010; Titz & Karbach, 2014; Barrouillet & Lepine, 2005). Some of the studies did not describe the screening process accurately and few were based only on parent’s report of their children’s abilities (Joshi et al., 2011; Urschitz et al., 2003; Mazzone et al., 2007; Li et al., 2013; Schatz et al., 2001; Uyanik et al., 1999).

2.3.4. **VP and academic performance**

Following was the literature reviewed to identify the influence of VP on academic performance.

- A cross-sectional study examined the association of VP skills, as well as visual-motor coordination with various measures of academic achievement among school age children. A total of 97 participants with age range from five to 18 years were involved in the study. A comprehensive assessment of VP, and academic achievement was routinely administered. VP skills were measured
using copy-a-figure task. After controlling for gender, socioeconomic status, and intelligence (IQ), the results showed that, children’s math and written expression achievement had positive association with VP (Carlson et al., 2013).

- In 2010, a cross sectional study by Dhingra et al. (2010) was undertaken to study the relationship of different perceptual abilities and academic performance among primary school age children (fourth, fifth and sixth standard). The relationship of these abilities with performances in three academic areas such as reading, spelling and mathematics were explored. A sample of 200 academic underachievers were selected across Jammu district from 59 schools. The results showed that, reading (r=0.157) and spelling (r=0.541) were both significantly associated with VP as well as kinesthetic and auditory abilities, mathematics was related with only auditory and VP. Overall, the study concluded that, visual perceptual ability was highly significant with academic performance among primary school aged children.

- A cross sectional study on visual memory as a predictor of below-average academic achievement in second through fifth grades was conducted by Kulp, Edwards, and Mitchell (2002). The visual memory subtest of Test of Visual Perceptual Skills (TVPS), Otis-Lennon School ability test and Stanford achievement test was administered on 155 children. Visual memory score showed a positive trend in predicting reading comprehension. While controlling for age and verbal ability, poor visual memory ability was significantly related to below-average reading decoding, mathematics, and overall academic achievement.

- A cross sectional study for a period of three years was done in four primary schools of Benton County, Indiana. The tests for cognition, sensory, perceptual, and linguistic skills were administered on 470 first grade children to determine
which variable predicts academic achievement in the early grades of elementary school. The instrument used to assess VP was the Developmental Test of Visual Perception. Based on factor analysis, the reading related skills such as phonological awareness, letter identification and word identification were identified as the first strongest predictors. Visual cognition (i.e. visual perceptual abilities) was found to be the second strongest predictor of mathematics and reading grades (Watson et al., 2003).

- A study done by Sortor and Kulp (2003) found a significant relationship between VP and academic achievement test score in reading and mathematics. The study included 155 children from second through fourth grade.

- There are also some studies that have shown no positive correlation between VP and academic performance among school age children. In a study done on school-age children with age group range from six to 19 years, visual perceptual skills showed no correlation in both calculation and reasoning clusters skills in mathematics while the other components such as short-term memory, working memory, long-term retrieval, comprehension-knowledge, fluid reasoning, processing speed, reasoning and auditory processing showed moderate to strong association with either mathematics calculation skills or mathematics reasoning clusters (Floyd et al., 2003).

- A meta-analysis on assessing the relationship between auditory and visual perception and reading achievement was done by Kavale and Forness (2000). It revealed that reading skill involves the ability to analyze, sequence and remember auditory stimuli rather than the ability to perceive those stimuli. Phonemic awareness can be considered as a better predictor of reading ability than IQ and perceptual processes beyond grade three. This meta-analysis included 267 studies from 1950 to 1980.
Majority of the studies reviewed were cross-sectional and assessed children from second through sixth standard (Carlson et al., 2013; Dhingra et al., 2010; Kulp et al., 2002; Sortor & Kulp, 2003). The studies included a wide age range and analysis was also carried out all together for these age ranges (Floyd et al., 2003) and few with no consideration for other factors. One of the studies included only visual memory, which is only one of the component of VP (Kulp et al., 2002). One meta-analysis found reviewed studies and concluded that VP cannot be the primary factor in predicting reading ability (Kavale & Forness, 2000).

2.3.5. VMI and academic performance

Following is the literature on the relationship between VMI and academic performance among elementary school age children.

- Emam and Kazem (2014) investigated the differences in VMI between children with and without Reading Disabilities (RDs) in Oman. A total of 364 school age children from public elementary schools in Oman, participated in the study of which 171 pupils were already diagnosed as having RDs while 175 were typically developing pupils. The mean age was found to be 8.61 years and 8.62 years respectively. Data obtained from the Full Range Test of Visual Motor Integration (FRTVMI), and the demographic information was analyzed using descriptive statistics. The results showed that, the typically developing children scored higher on the FRTVMI. The study concluded that, VMI ability is required for good reading performance among elementary school age children.

- Another cross sectional study by Pienaar, Barhorst, and Twisk (2014) was conducted to determine the relationship between academic performance and VMI in first grade South African learners. The participants were selected from first grade (n = 812; 418 boys and 394 girls), with a mean age of 6.78 years using
stratified random sampling. The Beery-Buktenica Developmental Test of Visual Motor Integration (Beery VMI) was used to assess VMI and academic performance in mathematics and reading was assessed using Mastery of Basic Learning Areas Questionnaire (MBLAQ). The results of the study concluded that, VMI is closely related to basic academic skills required in the first formal elementary school years for a successful academic outcome.

- A cross sectional study aimed at verifying the relationship between VMI ability and academic performance, was conducted in Brazil. The sample size was 77 involving children in the second year of elementary education at a public school. The age range of the participants was between 6 years and 9 months to 8 years and 4 months, with an average of 7 years and 6 months. The Beery VMI and the Academic Performance Test (Teste De Desempenho Escolar – TDE) were the two instruments used for data collection. The results showed that, there was a significant relationship between VMI ability and academic skills of reading (r=0.230), writing (r=0.244) and arithmetic (r=0.277). The study concluded that, VMI has a greater influence on the elementary school children`s performance in school activities (Pereira, Araujo, & Braccialli, 2011).

- An early childhood longitudinal study was conducted based on the data obtained from the United States kindergarten cohort national dataset which included 12,583 participants of both genders. Hierarchical regression analysis was done after controlling for initial skills and demographic information. The result revealed that, early kindergarten VMI contributed to successful performance in reading and mathematics at the end of first grade. Further analyses showed that information from VMI is useful in identifying children at risk for academic underachievement. The study concluded that, VMI evaluation may play a
significant role in designing and implementing an early school achievement battery (Son & Meisels, 2006).

- Barnhardt et al. (2005) carried out a comparative study to show the relationship between VMI and achievement in academics. One group consisted of 18 children with normal VMI and the other group consisted of 19 children with low VMI. The ages, gender profiles, reading and cognitive levels of the two groups were similar. Each participant in both groups copied and solved mathematic problems and copied a written passage. Results revealed that, the low VMI group made more errors than the normal VMI group.

- Other previous studies (Sortor & Kulp, 2003; Chen, Bleything, & Lim, 2011; Kulp, 1999) have shown that, there is a positive relationship between academic performance of primary school age children and VMI skills.

- Contrast results were found in a cross sectional study done by Carlson et al. (2013). No correlation was found between visual motor coordination and the participants’ mathematics achievement, reading, written expression and oral language when other variables such as gender, socioeconomic status and IQ were controlled. A total of 97 participants with age range from 5 to 18 years were involved in the study. A comprehensive assessment of VP, VMI and academic achievement was routinely administered. Visual motor coordination was measured using tracing tasks, while visual-perception skills were measured using copy-a-figure task.

A study done in Oman (Emam & Kazem, 2014) that assessed the effect of VMI on academic performance was cross-sectional and was not clear in its analysis on the effect of VMI on children without reading disabilities. The other studies were cross-sectional in nature and had smaller sample size with wide age ranges (Pienaar et al.,
2014; Pereira et al., 2011; Barnhardt et al., 2005; Carlson et al., 2013). One study was on cursive writing, mathematics and reading (Kulp, 1999) and the other was only on mathematics and reading (Son & Meisels, 2006). Combined analysis was done for all ages together in one of the studies reviewed (Carlson et al., 2013).

2.3.6. **Handwriting and academic performance**

The literature relating to influence of handwriting on academic performance in elementary school children was reviewed.

- Oche (2014) examined the relationship between handwriting and grades in mathematics among secondary school students in the north central region of Nigeria. A sample of 200 students and 150 teachers were selected randomly from different upper grade classes. A five point structured questionnaire was used for data collection. The study recommended that, teachers should teach handwriting and also emphasize its importance in schools especially at the elementary phase in order to progress in academics at the later stage of their academic carrier.

- A cross-sectional study examined whether the fine motor skills (handwriting and manipulation skills) of economically disadvantaged pre-school students predict later academic achievement in second grade. 3,234 second grade children with mean age of 62.5 months participated in the study. Learning Accomplishment Profile–Diagnostic (LAP-D) was used to assess development of language, cognitive, and fine motor skills. Academic performance was calculated from the marks obtained in mathematics and reading in second grade as well as from Stanford Achievement test. Results showed that, handwriting had significant positive relationship with second-grade math scores which meant that handwriting in school age children is an important predictor of later academic achievement (Dinehart & Manfra, 2013).
• Pontart et al. (2013) identified the influence of handwriting skills on spelling performance among grade two to grade nine students. 84 French speaking students with no history of learning problems were recruited from four public schools in France. The subjects were divided into two groups which included primary graders (44 students) and lower secondary school graders (40 students). The subjects were asked to perform writing and dictation tasks. Results showed significant and positive relationship between handwriting and spelling tasks in both the primary and lower secondary grade children.

• A study was conducted by Medwell, Strand, and Wray (2009) to study the relationship between handwriting and sentence composition. Sample size was 198 children (101 boys and 97 girls) within the age range from 10 to 11 years. The subjects were recruited from four primary schools and they were divided into two groups. A composition task, a copying task and alphabet writing task was given to assess handwriting components such as neatness, speed and orthographic-motor integration respectively. The researcher reported that, there was a strong relationship between writing and academic performance. The study suggests that, a proportion of children suffering from low levels of handwriting automaticity, may perform poorly in their academics.

• Handwriting has an impact on academic success and difficulties in handwriting exhibit problems in composition skills (as cited in Hacker, 2010).

• A review article on “handwriting development, competency and intervention” done by Feder and Mejnemer in 2007 stated that difficulty in handwriting had an impact on academic success and life skills.

• Another review article by Cahill (2009) stated that “handwriting is tied to academic achievement, especially composition and literacy skills”.

Denton, Cope, and Moser (2006) stated in their study that handwriting skill is one of the significant skills in elementary school children and difficulty in this significant skill can affect a child’s expertise in school related tasks.

Most of the studies reviewed in the literature on the effect of handwriting on academic performance were cross-sectional and on non-Indian populations (Oche, 2014; Dinehart & Manfra, 2013; Pontart et al., 2013; Medwell et al., 2009). One study observed the children’s perception of their handwriting (Oche, 2014), one on spelling (Pontart et al., 2013) and two on math and reading abilities (Dinehart & Manfra, 2013; Medwell et al., 2009). Non-standardized instruments such as dictation, and compositions were used in few of the studies. One study had smaller sample size but interestingly used electronic tablet for handwriting (Oche, 2014; Pontart et al., 2013). Another study reported the descriptive statistics only, while another study did not consider the other factors such as IQ, sensory skills, etc., (Oche, 2014; Medwell et al., 2009). The screening procedure was not clear in one of the studies (Medwell et al., 2009). A study included children selectively only from low economic population (Dinehart & Manfra, 2013).

2.4. Research gaps

- The literature focusing on child factors were more related to psychological aspects and general medical aspects.
- Only limited research evidence is available related to the influence of VP, VMI and handwriting on academic performance in elementary school children.
- Equivocal results were found in the review of literature on the influence of VP and VMI on academic performance.
The reviewed literature is mostly from a western population. Limited data is available regarding the influence of VP, VMI and handwriting on academic performance in elementary school children from the Indian context.

Most of the studies are cross-sectional, few studies examined these factors longitudinally.

Though results of some studies supported that VP and VMI are significantly correlated with academic performance, their statistical significance was found to be weak.

Studies relating to the influence of handwriting on academic performance were limited.

Furthermore, no studies in India have examined the yearly changes of VP, VMI and handwriting in elementary school children and the impact of these changes on academic performance.

The conclusion of the literature review is that the evidence of the impact of VP, VMI and handwriting towards academic performance is limited. Longitudinal studies were needed to identify children who are at risk of educational failures with poor academic achievement in their early schooling which may lead to the following alternative hypotheses.

VP, VMI, and handwriting may have a relationship with academic performance over a period of three-years, among elementary school children.

Academic performance may be predicted through their performance in VP, VMI, and handwriting in elementary school children.

VP, VMI, and handwriting may change over a period of three-years among a cohort of elementary school children.