International Journal of Education and Social Development
ISSN: 3078-9931 (Print), ISSN: 3078-2287 (Online) | Vol. 5, No. 3, 2025

The Role of Parents' Educational Involvement in Children's Reading Achievement: the case of Hong Kong

Yijia Zhan

Moray House School of Education and Sport, the University of Edinburgh, Edinburgh, UK

Abstract: Based on the data from Hong Kong in PIRLS 2016, this study explores the influence of parents' involvement during the preschool and primary school years on children's reading performance and compares the influence of these two stages. Combined with descriptive analysis and inferential analysis of the data, we found that parents' participation in reading education during the preschool stage (such as reading books, telling stories, reading signs loudly, and playing word games) can improve children's reading performance, and the reading achievement will improve as involvement frequency increases. In primary school, parents' active academic concern for their children (such as asking whether their homework has been completed) can help children improve their reading performance, while parents' too frequent direct guidance for their children's studies (such as helping the child with homework, reviewing the children's homework to make sure it is correct) will hinder the development of their reading achievement. Moreover, in these two stages, parents' involvement in preschool education has a greater impact on children's reading achievement than during primary school.

Keywords: Reading achievement, parents' involvement, early literacy activities, academic concerns and tutoring.

1. Introduction

1.1. Background and Significance of the Study

The capacity to read proficiently is a fundamental skill that significantly contributes to children's academic achievement. In addition, it serves as a reliable predictor of their academic growth and future accomplishments [1]. Reading is one of the main ways to acquire subject knowledge. Whether natural science, social science or humanities, students must acquire relevant knowledge by reading textbooks, reference materials, and academic articles. Students with advanced reading abilities can comprehend information faster and more efficiently, thereby establishing a strong educational groundwork for their academic pursuits. Simultaneously, students possessing proficient reading skills have the capacity to acquire knowledge from literary works spanning several fields of study, fostering the development of interdisciplinary comprehension and introspection [2]. The act of reading encompasses more than simply acquiring knowledge; it also involves the cultivation of critical thinking abilities. Engaging in critical reading enables students to evaluate the trustworthiness of information and the soundness of concepts [3]. This skill is paramount in natural science, social sciences, and humanities. Reading ability even has the power to change people's lives. As Castles et al. state, knowledge gain, participation in culture, democracy, and professional success are all based on reading [4]. Learning to read is a transforming ability that impacts almost every facet of a person's life, from societal engagement and global knowledge to personal growth and employment chances [5]. As a potentially life-changing investment, mastering reading skills is crucial.

The cultivation of reading proficiency holds significant value in all students' educational pursuits and daily experiences [6]. Due to the growing significance of reading skills in the overall development of pupils, there has been a heightened focus on cultivating students' reading abilities. Parental participation plays a crucial role in advancing children's reading abilities. There is a growing amount of research that shows that effective parental educational involvement can have a profound effect on children's reading achievement, for example, Clark and Rumbold argue that parents' involvement is crucial in providing assistance and fostering the development of children's reading skills [7], Castro et al. point out the provision of parental support, direction, and motivation can elicit children's inclination towards reading and enhance their reading proficiency, thereby fostering their overall reading accomplishment [8], IEA and TIMSS & PIRLS International Study Center (International Association for the Evaluation of Educational Achievement and Trends in International Mathematics and Science Study & Progress in International Reading Literacy Study International Study Center) [9] also states that 'home support has a substantial impact on reading achievement'.

Examining the influence of parents' involvement on children's reading achievement holds significant practical consequences for policymakers, parents, and children. First, identifying specific elements of parental educational involvement that benefit children's reading achievement can contribute to the formulation of evidence-based interventions and programs. Furthermore, parents can contribute to the enhancement of reading achievement by identifying and implementing effective strategies and practices. This involvement allows parents to establish efficient environments that foster reading, make informed decisions regarding suitable resources and strategies for enhancing their children's reading abilities, and reinforce crucial reading skills. Moreover, attaining reading proficiency is fundamental to achieving academic excellence and fostering continuous learning throughout one's life. Proficient reading abilities not only facilitate children's comprehension of material across many academic subjects but also cultivate their capacity for critical analysis and evaluation. Research on the impact of parents' involvement and identifying practical approaches can maximize children's reading achievements and contribute to their long-term success.

1.2. Statement of the Study Problem

This study aims to investigate the impact of parental participation on the advancement of children's reading achievements. The concept of parental educational involvement in the development of children's reading skills pertains to the manner and degree to which parents engage in extracurricular activities that enhance their children's literacy abilities. These involvements encompass actions such as establishing an environment conducive to literacy within the household and closely monitoring their children's advancements in reading, among other related activities [10]. Parents play a crucial role in shaping their children's literacy experiences, providing support, and creating an environment that fosters an interest in reading. However, varying patterns of parental involvement at different stages of the children's learning may not have the same impact on the children's reading achievement. Therefore, some questions remain unanswered. First, at which stage does parental involvement impact children's reading achievement more: early in the school year or during the academic process in school? Second, if there is a lack of investment in early initiation, is it possible to make up for it through later academic tutoring? In order to close these gaps in the literature, this study makes an effort.

This study aims to examine the characteristics of parents' educational involvement during various stages of children's development, specifically focusing on 'early literacy activities' and 'academic concerns and tutoring in primary school'. Measurements include the time parents devote to the programme, as well as the ways in which they are involved. It is also assessed how different combinations of parental involvement at these two stages will affect children's reading achievement. Through examining these inquiries, our objective is to gain a deeper comprehension of the influence of parental engagement in education on children's reading accomplishments. Additionally, we aim to offer suggestions for fostering the enhancement of children's reading skills based on the results.

This study focuses on the performance of Hong Kong and uses the data of Hong Kong from 2011 to 2016 as the data source [11]. As education in Hong Kong society is highly valued, there is a wealth of data collected that allows for a more in-depth study of the impact of parental involvement in reading education on children's achievement [12]. However, the high emphasis on education has also put a strain on education in Hong Kong. Hong Kong's education system is famous for its fierce competition, and local parents are particularly concerned about improving their children's academic performance [13]. Many parents are eager to know how to efficiently participate in their children's education and help them achieve academic success. Therefore, it is of practical significance to take Hong Kong as the case to study parents' involvement in children's education at different stages, which can help parents in Hong Kong find the most suitable time and way to participate in education, to better cope with children's education.

1.3. Research Objectives and Questions

Therefore, to explore the role of parents' educational involvement in shaping children's reading achievement and attempted to determine which forms of educational engagement had a greater impact on children's reading achievement, this study sought to explore the following three questions:

Q1: What is the relationship between parental involvement in early literacy activities and children's reading achievement?

Q2: What is the relationship between parental involvement in academic concerns and tutoring in primary school and children's reading achievement?

Q3: Does parental involvement in early literacy activities have a more significant impact on children's reading achievement than academic concerns and tutoring in primary school, and does a high degree of academic concerns and tutoring in primary school have an impact on children's reading achievement when the degree of parental involvement in early literacy activities is low?

1.4. Overview of the Structure

Chapter 2 synthesises the relevant literature on the impact of parents' educational involvement on children's reading achievement and identifies some gaps in present-day research in this area. Chapter 3 is about the research methodology, in which the data sources, the basis of selection, introduction to the variables, research design, research methods and ethical considerations are described in detail. Chapter 4 presents and discusses the research results, including descriptive, correlation and regression analyses, presenting the results through tables and graphs, describing, and analysing the results in the context of the research questions, and explaining unexpected or contradictory results. Chapter 5 summarises the study's conclusions, points out the limitations and suggests directions for future research. The final section summarises the complete text, including a summary of the research questions and implications, a restatement of the research questions, and suggestions for practical applications.

2. Literature Review

2.1. The Importance of Categorising Parents' Involvement as Two Stages: Pre-School and School Years

Parental involvement in their children's education is characterised differently at different educational stages and this can impact their children's achievement differently. In this study, we categorised parental involvement in children's education into two distinct phases: during preschool and primary school years. This classification was employed to delineate better and investigate the varying effects of parental involvement across different developmental stages.

Firstly, children's educational priorities differ during the preschool and school years, so the focus of parental involvement needs to be different between these two periods. The goals, content, and methods of education are different in a preschool year and the school year, with preschool education focusing more on the development of basic skills such as cognition and language, while education in the school years focuses more on the acquisition of subject knowledge and the development of individual competencies. Therefore, parents need to participate differently during the preschool and school years. In the preschool stage, parents can help children understand and use language by listening to them, participating in conversations, playing with them, and encouraging them to explore actively [14]. During the school year, parents should focus on cultivating their children's ability to manage time, finish homework independently, and encourage them to take on more personal and school responsibilities [15]. Parents' involvement in activities has different emphases at different stages, bringing different influences, so it should be studied separately.

Secondly, the influence of parents' involvement in children's reading may be different at different stages, and the nature and degree of its influence may also change with children's development. Preschool children are more dependent on their parents, so parents and children reading together can enhance children's reading skill development [16]. With the advancement of children's reading abilities, parents need to guide their children to exercise more complex reading comprehension and critical thinking after they begin school, and simple reading companionship cannot help at this time. And at the preschool stage, the children's interaction with their parents are predominant, so parental involvement may have a more significant impact on the children; when entering school, the influence of the school and peers increases, and that of the parents may be relatively weaker [17]. Thus, despite the same level of parental involvement, the impact may vary at different stages of the children's development.

Moreover, the influence of early parenting has the potential to shape subsequent educational outcomes and cognitive development. Flouri and Buchanan conducted a study which revealed that high-quality preschool education from parents could establish a solid groundwork for a child's educational journey during their school-age years [18]. Fantuzzo et al.'s research also confirmed parental involvement in the preschool years affects children's preschool educational outcomes as well as their academic achievement during the school year [19]. Therefore, the involvement of parents in the preschool stage not only directly supports the development of children in preschool, but also builds the groundwork for their future achievement in school. Thus, by categorising and examining the effects of parental involvement on reading achievement during the preschool and school learning periods, we can better understand the differences in parental involvement's roles in the different stages of the children's developmental process.

In addition, the educational climate in Hong Kong is well-known for its intense rivalry, which may increase parents' expectations and anxiety and lead them to adopt different participation strategies in their children's preschool and school education stages. Fierce educational competition may significantly impact the differences in how parents participate in education before and during their children's schooling. At the same time, Hong Kong has consistently introduced several educational reforms in recent years, including the Early Childhood Education Curriculum [20] and the New Senior Secondary Curriculum [21]. These educational reforms and policies may also complicate parents' educational participation at different stages of their children's growth.

2.2. The Role of Parents' Educational Involvement in Children'S Achievement

2.2.1. Key Concepts and Existing Research

Various literature has emphasized the vital role of parental involvement in influencing student achievement. For example, Jeynes in his book, enumerating many empirical examples emphasizes that parents' participation is an important factor to promote children's academic success [22]. Cheung and Pomerantz state that the more parents are involved in their children's learning, the more motivated the child is to do well in school for parent-directed reasons [23]. Meanwhile, many researchers have further pointed out that parental education in reading plays a long-term and critical role in children's achievement. For instance, Sénéchal and LeFevre argue that parents play a crucial role in developing their children's early literacy skills and that parents who actively engage in conversations with their children, participate in reading aloud, tell stories, and help a language-rich environment develop their children's vocabulary and language skills, which will be directly related to their children's academic achievement [24]. In addition, parents can provide support and guidance to their children during the reading process, such as helping their children choose appropriate books, asking questions and providing feedback. Such involvement can strengthen children's reading skills and promote independent reading habits [25]. Leseman and De Jong also found through their research that creating a literacy-rich environment at home is vital for children's grades to increase, such as parents modelling reading behaviours and showing positive attitudes toward reading, encouraging regular reading, and doing literacy-related activities like word games in the home [16].

Moreover, due to the history and geographical location of Hong Kong, it is a blend of many languages and cultures, which contains both Eastern Confucian educational ideas and Western educational philosophies [26], this unique cultural background may have influenced the manner and extent of parental involvement, and Hong Kong's education system is the result of a fusion of Eastern and Western educational philosophies, incorporating elements of both British and Chinese education [27], thus it can provide a distinct perspective and in-depth understanding for studying the effects of parental involvement on children's reading achievement.

2.2.2. Limitations in Previous Research

However, fewer studies have broken down parental involvement into early and later academic tutoring and compared both effects on children's reading achievement. Meanwhile, some parents may lack early literacy education for their children for a variety of reasons, such as a lack of awareness of the importance of early literacy education [28], parents' educational backgrounds being so limited that they do not have the necessary skills to support their children's early literacy development [29], family poverty prevents them from providing resources [30], busy work schedules do not allow enough time for early literacy education [31] and so on. Given its importance, a question which remains is: When early parental involvement has been missing and cannot be returned to repair, can academic concerns and tutoring during the children's learning process make a difference, and how much of a difference is it likely to make? There is very little research currently in this area, so this study will attempt to fill this gap.

2.3. The Importance of Linking Parents' Involvement Directly with Children's Reading Achievement

Throughout the above articles, it can be seen that most studies use the concept of 'student achievement' in a general way; fewer studies have investigated the impact that parental involvement directly has on students' reading achievement. However, since reading is not only a skill but also an assistive tool, and because education affects different skills? differently, it is essential to link parents' educational involvement directly to children's reading achievement.

Firstly, it is very important to be proficient in the skills of reading. Reading skills are essential for individuals to

participate fully in modern society and to realise their full potential [32]. In addition, reading is not only a skill that needs to be mastered but also a tool for learning other subjects, and it must be noticed in children's academic development [33]. No matter what subject is being studied, reading skills are needed to retrieve information, understand text, and answer questions; it constitutes an integral part of children's academic foundation and therefore requires particular attention and meticulous training.

Second, we need to be aware that different academic disciplines require unique skill sets and that the same educational investment will likely have a different impact on a child's learning in different subjects. Literature and science are vastly distinct [34]. For example, the impact of early home education can show differences across disciplines: children exposed to books and reading at home at an early age may develop a stronger grasp of language, which proves beneficial for literature-based disciplines [35]; on the contrary, early introduction to science concepts and critical thinking may stimulate children's abilities in the science disciplines [36]. Therefore, instead of equating all subjects regarding skill acquisition and academic achievement, we should study them separately. For this reason, it is important to use reading achievement as a separate dependent variable in this study to make the research results more accurate and for this specific important outcome.

In view of the critical role of reading skills and the differences between disciplines, it is essential to make reading achievement an independent dependent variable in educational research. By focusing specifically on reading achievement, researchers can gain a more precise understanding of the effectiveness of different educational interventions and strategies, which in turn can guide more effective parental involvement strategies to foster children's academic development.

2.4. Research Design

Based on the literature review, the following three hypotheses were formulated in this study:

H1: Higher levels of parental involvement in early literacy activities are associated with better reading achievement for children.

H2: Higher levels of parental involvement in academic concerns and tutoring in primary school are associated with better reading achievement for children.

H3: Children in Category C are expected to have better reading scores than children in Category D, but lower scores than children in Categories A and B (The four classifications are shown in Figure 1).

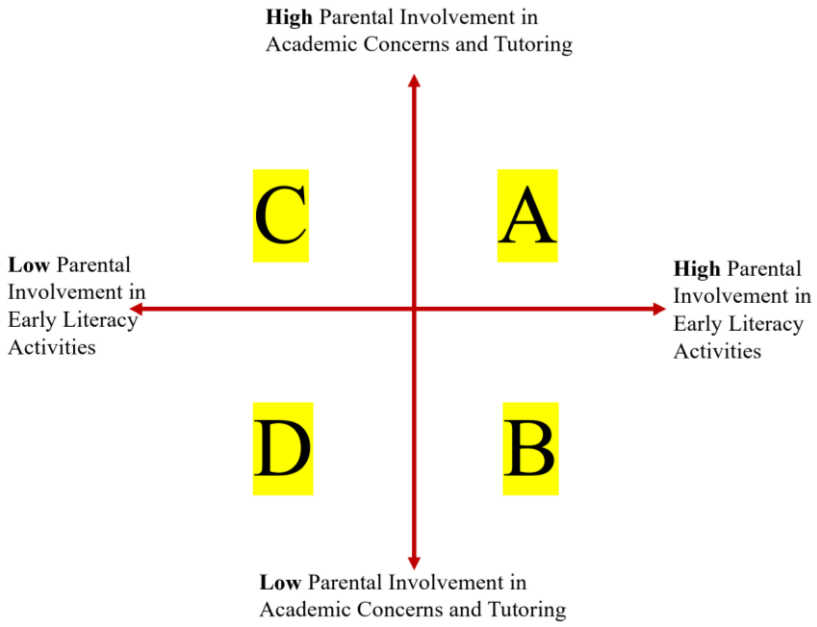

Figure 1. Four Combinations of Parental Involvement in Early Literacy Activities and Academic Concerns and Tutoring

3. Methodology

3.1. Research Philosophy

This study adopts positivism as the philosophical basis. As a philosophy, positivism believes that only factual knowledge obtained through observation is trustworthy [37]. Positivism emphasizes that knowledge comes from experience, and researchers should maintain the principle of objective value neutrality and reveal the objective laws of natural society and human society through natural science research methods.

Positivism epistemology advocates that people's knowledge mainly comes from experience, emphasizes that observation and experiment are the basis of understanding reality, and relies on collecting many observational data to sum up general principles and laws [38]. Epistemology is related to the whole research process and is the basic assumption for educational researchers to design research. Badley pointed out that epistemology affects how we seek knowledge, especially deploying research methods [39]. Positivism advocates the objective measurement process and the application of statistical analysis to avoid the influence of the subjectivity of the knower to a certain extent [40]. Therefore, in this study, we collect many students' reading test scores and questionnaire survey results, and analyze and measure these data to understand the relationship between parents' involvement and children's reading scores.

Positivism methodology advocates quantitative research methods to test research hypotheses, and holds that only by using quantitative data can we reveal the relationship that determines human behavior [41]. As a way of thinking, methodology standardizes the investigation procedure in research [42]. Positivism methodology is widely used in educational research to acquire knowledge about the

objectivity and accuracy of education and promote the development of pedagogy [43]. Therefore, we use quantitative methods in this study to get a more objective and in-depth understanding of the research problem.

3.2. Data and Sample

This study uses data from the 2016 Progress in International Reading Literacy Study (PIRLS) in Hong Kong. As an international comparative research project designed and implemented by the International Association for the Evaluation of Educational Achievement (IEA), PIRLS 2016 followed the standard procedures of international educational assessment and used a two-stage sampling method for data collection, the first for a sample of schools, and the second for a sample of students in the selected schools [44]. The sample consisted of students in grade 4 or equivalent in the year the data were collected, a grade in which students had already received some training in reading skills. When distributing the questionnaire, the researcher ensured that all participants understood the purpose of the questionnaire and made it clear that their participation was voluntary. To ensure the high quality of data obtained, PIRLS used a variety of methods to distribute and collect questionnaires, such as providing paper questionnaires to be filled out by students in class or at designated times and places, distributing the questionnaires through e-mails; and using telephone or face-to-face interviews to investigate information that may involve some sensitive issues or require more detailed explanations. After administering the reading tests and questionnaires, the IEA investigative team collected and collated the data, handled all the information collected confidentially, and ensured that it was only used for research purposes to protect the identity of the students, parents, teachers, and schools that participated in the survey (more information about Ethics is included in the Ethics Form attached at the end of the dissertation).

PIRLS 2016 covered data from 57 countries or regions, each with a separate subset of data. The study not only assessed students' reading achievement but also collected information about children's home experiences in learning to read. It also followed the categories of school background, student achievement, student background, home background, within-country scoring reliability, student-teacher linkage and teacher background into seven sub-datasets for each country or region.

As the database source for PIRLS 2016 consisted of 57 countries or regions with different education systems, the selection of data from multiple countries or regions needed to consider different cultural contexts and complex reasons. If a single country or region was selected, a more in-depth and targeted study can be carried out, and a better understanding of the educational phenomena arising from the particular historical, cultural and economic context of the region can be achieved. Therefore, data from Hong Kong, China, from the PIRLS 2016 database was selected for this study to conduct a more in-depth study and to obtain more targeted research results.

The data used in this study were secondary data, downloaded from the DATA section of the IEA website. Version 27 of the IBM SPSS statistical software was used to process these secondary data. More specifically, this study relied on ASGHKGR4 PIRLS (Student Background Data Files) and ASHHKGR4 PIRLS (Home Background Data Files).

It was important to note that these two datasets only included data from Hong Kong, China, so the results may not be directly generalisable to other countries or regions. Moreover, the participants in the study were all enrolled in Primary Four, so the results may differ from those of other grades and were not directly transferable.

3.3. Variables

For testing these three hypotheses, we first merged the ASGHKGR4 dataset and the ASHHKGR4 dataset using the SPSS dataset merging option, as the ASGHKGR4 dataset had data about students' reading achievement and the ASHHKGR4 dataset contained only variables related to parental involvement. The two databases can be linked by a common STUDENT ID and GRADE ID. The new combined database, consisting of two separate databases containing student achievement and information about parental involvement, was used to examine the effect of parents' involvement on children's reading achievement.

After merging all relevant variables into one dataset, cases with missing data on all key variables were excluded, leaving a sample size of 3,349. The reason for not deleting all cases which had variables containing missing values was that a large number of cases have complete data on 'parents' involvement in early literacy activities' but have missing data on 'parents' involvement in academic concerns and tutoring in primary school'. Although removing all cases with missing values can reduce bias and keep the sample size the same in all analyses, this can lead to a significant reduction in the available sample size, influencing research on 'the relationship between parents' involvement in early literacy activities and reading achievement', and could have reduced the power of the statistical analysis to make the results less accurate. Therefore, we chose to keep a portion of the cases with missing data in this study to avoid causing a large reduction in sample size.

Secondly, PIRLS 2016 Assessment Frameworks categorizes 'reading books, telling stories, singing songs, playing with alphabet toys, talking with their children, helping children write letters or words, reading aloud signs and labels' as 'early childhood literacy activities' [45]. Although 'early literacy activities' is only a specific aspect of parental involvement during pre-school, this study explores the influence of parent-involved early reading activities on children's reading performance, focusing on the interaction between parents and children in early reading education. Thus, referring to the Home Questionnaire provided in the PIRLS 2016 User Guide on Page 1.41 (Figure 2), the nine variables about early literacy activities were selected to represent the level of parental involvement during pre-school. Our study was designed to use different values to represent the level of parental involvement, with higher numbers representing higher levels of parental involvement in their children's reading education, whereas the PIRLS 2016 database coded the raw data values as '1=Often', '2= Sometimes' and '3=Never or almost never', which was in a reversed order compared to the order used in this study. Therefore, these variables were recoded into different variables, and the values of the newly recoded variables were '1=Never or almost never', '2=Sometimes' and '3=Often'.

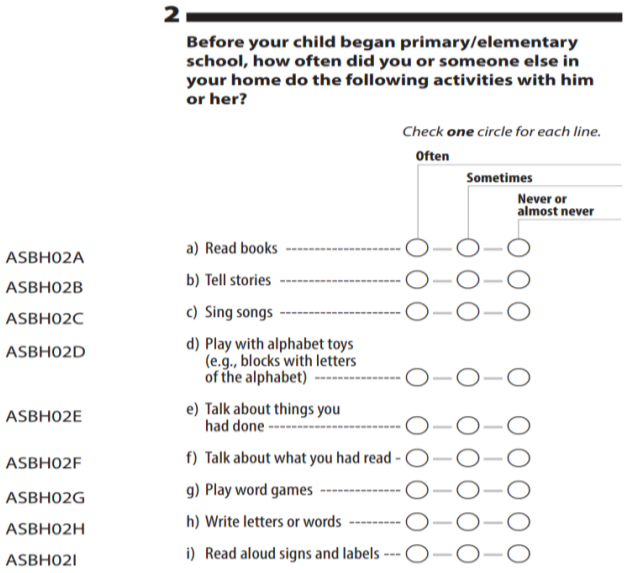

Figure 2. Home Questionnaire in PIRLS 2016 User Guide on Page 1.41

Similarly, as the focus of this study is how parents' involvement can support their children's learning and academic success in specific ways, focusing more on their academic performance, rather than all aspects of development in primary school. Therefore, although 'academic concerns and tutoring' is a more specific and limited aspect of parents' involvement in primary school, in this study, based on the questions in the PIRLS 2016 Home Questionnaire (Figure 4), the following three variables about academic concerns and tutoring were selected as representations of parents' involvement during primary school. In the raw data, '1= every day', '2= 3 or 4 times a week', '3= 1 or 2 times a week', '4= less than once a week' and '5= never or almost never', because the coding of these three variables also did not match the natural order of our theoretical concept, we also recoded these three variables into different variables and gave values to the new variables with '1=never or almost never', '2=less than once a week', '3=1 or 2 times a week', '4=3 or 4 times a week' and '5=every day'.

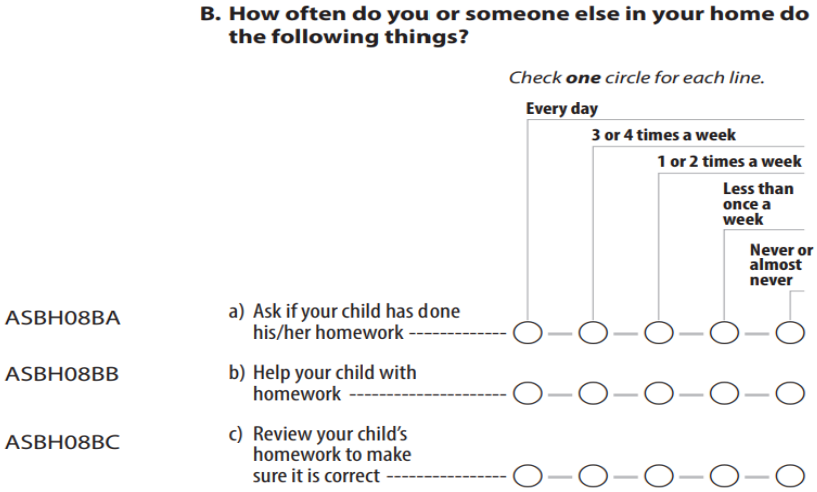

Figure 3. Home Questionnaire in PIRLS 2016 User Guide on Page 1.45

Thirdly, the nine new variables representing the level of parental involvement in early literacy activities were summed and recoded into a new variable (continuous variable) representing the total level of parents' involvement in early literacy activities. The same operation was also applied to the three new variables representing the level of parents' involvement in academic concerns and tutoring in primary school. The two continuous variables created by summing up the scores for each variable were also used as independent variables to examine the effect of high vs low parental involvement in different periods of children's development on fourth-grade reading achievement. More specifically, to examine Hypothesis 3, the medians of the independent variables Parents' Involvement in Early Literacy (Total) and Parents' Involvement in Academic Concerns and Tutoring in Primary School (Total) were first checked. Then, two dummy variables were created, with values above or equal to the median being given a value of '1', representing 'high involvement', and values below the median were given a value of '0', representing 'low involvement'. Next, a new categorical variable with four categories was generated by 'Compute Variable', representing categories A, B, C and D in Figure 1.

In addition, the Average Reading Scores was used in this study to represent students' reading achievement. The variable representing the Average Reading Scores, which was the dependent variable of this study, consisted of five separate variables in the original dataset (Figure 4). PIRLS used the statistical technique of 'Plausible Value' (PV) to deal with the uncertainty of student scores in large-scale educational assessments. Because of the large number of students participating in the PIRLS survey, it would take too much time to assess all the questions for each student, every student only needed to answer a portion of the test rather than all of the questions [46]. Therefore, PIRLS generated five 'plausible values' (PV1-5) for each student based on the student's responses, background information, and the answers and context information of other students, which represented the five different scores possible for the student on the same test to represent their likely range of reading ability. This approach provided a more accurate and comprehensive estimate of a student's ability, replacing the traditional one-off test score [47]. It is an approach that provides more information about a student's ability and helps to calculate more accurate statistics [48]. Thus, due to the adoption of this method, we cannot directly calculate each student's score, so we calculated the mean of these 5 Plausible Values and used the new variable (continuous variable) obtained from the calculation to represent students' reading achievement.

ASRREA01	PLAUSIBLE VALUE: OVERALL READING PV1	Score	Scale
ASRREA02	PLAUSIBLE VALUE: OVERALL READING PV2	Score	Scale
ASRREA03	PLAUSIBLE VALUE: OVERALL READING PV3	Score	Scale
ASRREA04	PLAUSIBLE VALUE: OVERALL READING PV4	Score	Scale
ASRREA05	PLAUSIBLE VALUE: OVERALL READING PV5	Score	Scale

Figure 4. Variables in the ASGR4 Dataset in the PIRLS 2016 Codebook

3.4. Methods

First, univariate analyses were conducted on all key variables to better understand the distribution of the sample. This included the presentation of descriptive statistics for each independent and dependent variable, the use of bar charts to show the distribution of each category in the categorical variables, the use of histograms to present the distribution of reading scores and to determine the normal distribution, as well as the use of pie charts and crosstabs to show the distribution of data for the four newly generated dummy variables.

Next, bivariate analyses were conducted. Spearman's correlation coefficient test can measure the correlation between ordered categorical and continuous variables [49]. Since in this study, the independent variables were all categorical variables with more than two categories, and Average Reading Scores as the dependent variable was a continuous variable, Spearman's correlation coefficient test was used to measure the strength and direction of the dependence between each of the independent variables and the dependent variable separately.

Linear regression analysis was then used to test the three hypotheses proposed in this study. All independent variables were converted to dummy variables before being analysed in linear regression analyses, and linear regression analyses were used to identify interdependencies between multiple variables. The first regression model analysed the effect of parental involvement in early literacy activities on reading scores; the second regression model was the effect of parental involvement in academic concerns and tutoring in primary school on reading scores; and the third group of regression models analysed the joint effect of the two stages of parental involvement by combining those variables and analysing which stage of parental involvement would have a more significant impact on the child's reading achievement.

3.5. Ethical Considerations

The aim of this study is to examine the relationship between parental educational involvement and children's reading achievement using the PIRLS 2016 dataset. As this study involves human subjects, it is important to consider ethical issues and to ensure that the study is conducted in an ethical manner. Firstly, as the PIRLS 2016 dataset has been de-identified of any personally identifiable information, it has ensured that the privacy of the participants is protected. Secondly, the study adheres to the terms of the PIRLS 2016 dataset and the original data sources have been identified in the study. Again, data analysis has been conducted in a neutral manner and findings are accurately reported. (The ethics table attached at the end of the paper contains more detailed information about ethics.)

4. Results

4.1. Descriptive Analysis of Variables

4.1.1. Parental Involvement in Early Literacy Activities

Regarding early parental involvement, as Figure 7 shows, all these nine variables have the largest percentage of the value '2=Sometimes', which is more than 50 per cent. Six variables, namely Read Book, Tell Stories, Sing Song, Talk What Had Done, Write Letters Words and Read Aloud Signs have the second largest percentage of value '3=Often' while the value '1=Never or almost never' has the lowest percentage. This indicates that these are the most commonly practiced activities. Whereas the three variables Play Alphabet, Discussion and Play Word Games have values of '1=Never or almost never' as the second largest percentage, with the lowest percentage showing of 'Often'. This indicates that these activities are less frequent or less likely to happen often.

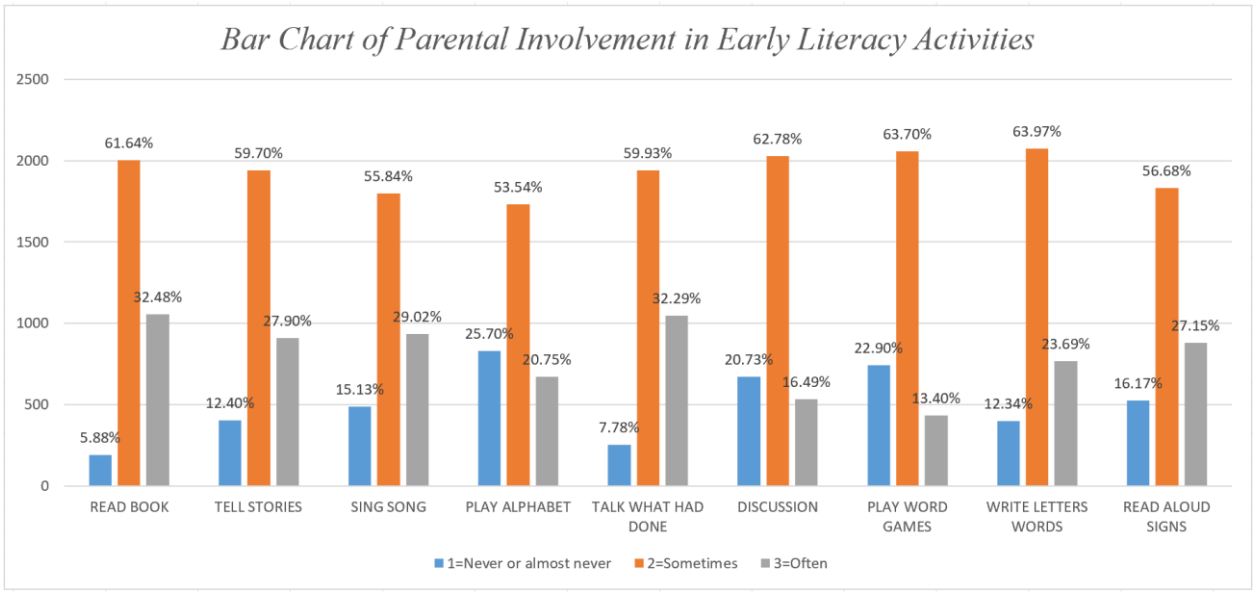

Figure 5. Bar Chart of Parental Involvement in Early Literacy Activities

The variable Parental Involvement in Early Literacy Activities (Total) is the sum of all nine variables. As shown in

Table 1, valid values are 3107 and missing values are 242, with a mean of 18.86, median of 19.00, mode of 18 and standard deviation of 3.31.

Table 1. Frequency Table of Parental Involvement in Early Literacy Activities (Total)

Frequency Table about Parental Involvement in Early Literacy Activities

PARENTAL INVOLVEMENT IN EARLY LITERACY ACTIVITIES (TOTAL)		
N	Valid	3107
	Missing	242
Mean		18.86
Median		19.00
Mode		18
Std. Deviation		3.31
Minimum		9
Maximum		27

4.1.2. Parental Involvement in Academic Concerns and Tutoring in Primary School

Parental Involvement in Academic Concerns and Tutoring in Primary Schools (Total) consisted of three variables. As shown in Figure 9, the percentage of value '5=every day' of Ask if Child Has Done Homework is 77.05%, which is more than 3/4 of the total and has an overwhelming advantage. The remaining four values together account for less than a quarter of the total. Regarding the frequency to which parents help their children with homework, slightly less than half of parents (46.25%) help their children daily, 9.85% of parents reported 'less than once a week' with the rest in between. Similarly, 46.49 % of parents reported reviewing their child's homework to ensure it is correct every day, which is the highest proportion among the five frequencies. The other four values account for little more than half of the total.

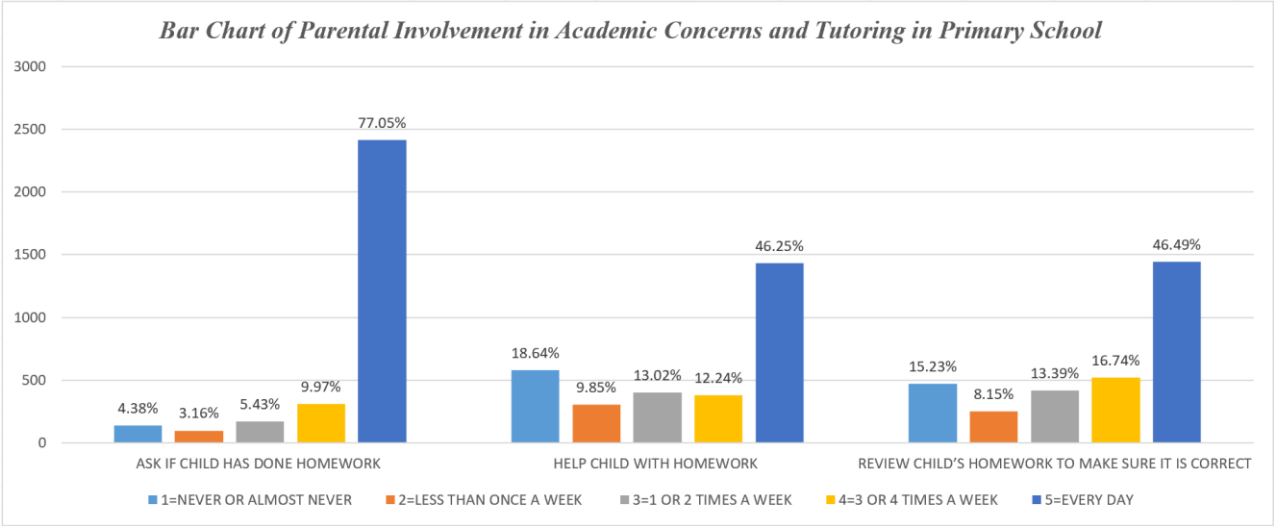

Figure 6. Bar Chart of Parental Involvement in Academic Concerns and Tutoring in Primary School

The variable Parental Involvement in Academic Concerns and Tutoring in Primary School (Total) is the sum of the above three variables. As Table 2 shows, there are 3087 valid values and 262 missing values, with a mean of 11.80, a median of 13.00, a mode of 15, and a standard deviation of 3.43.

Because the distribution of the total score is too skewed (most of the values are concentrated in the score '15'), the total score is compressed into two categories based on the median ('13'), with the data above the median coded as 1 (43.60%), and the rest coded as 0 (56.40%).

Table 2. Frequency Table of Parental Involvement in Academic Concerns and Tutoring in Primary School (Total)

Frequency Table about Parental Involvement in Academic Concerns and Tutoring in Primary School

PARENTAL INVOLVEMENT IN ACADEMIC CONCERNS AND TUTORING IN PRIMARY SCHOOL (TOTAL)		
N	Valid	3087
	Missing	262
Mean		11.80
Median		13.00
Mode		15
Std. Deviation		3.43
Minimum		3
Maximum		15

4.1.3. Parental Involvement in Early Literacy Activities * Parental Involvement in Academic Concerns and Tutoring in Primary School

In order to test Hypothesis 3, we created dummy variables for Parental Involvement in Early Literacy Activities (Total) and Parental Involvement in Academic Concerns and Tutoring in Primary School (Total) and combined them. As shown in Table 3, the sample size with valid values for both variables is 2928, 87.4% of the total sample size, and the number of missing cases is 421, approximately 12.6% of the total.

Since the median value of Parental involvement in Early Literacy Activities (Total) is 19.00 and the median value of Parental involvement in Academic Concerns and Tutoring in Primary School (Total) is 13.00, we used 19 and 13 as criteria to classify low and high involvement in early literacy activities (total) and academic concerns and tutoring in primary school (total), respectively. The combination of the two high/low categories of the two variables resulted in four categories: A (high pre-school involvement/ high primary school involvement), B (high pre-school involvement/ low primary school involvement), C (low pre-school involvement/ high primary school involvement), D (low pre-school involvement/ low primary school involvement). As shown in Figure 7, Group A has 594 cases, is the smallest percentage of the four groups, accounting for only 20.29% of the total; Group B has 646 cases, representing 22.06% of the total sample size; Group C has 678 cases, accounting for 23.16%, slightly higher than Group B; Group D has the

highest percentage, 34.49%, with 1010 cases.

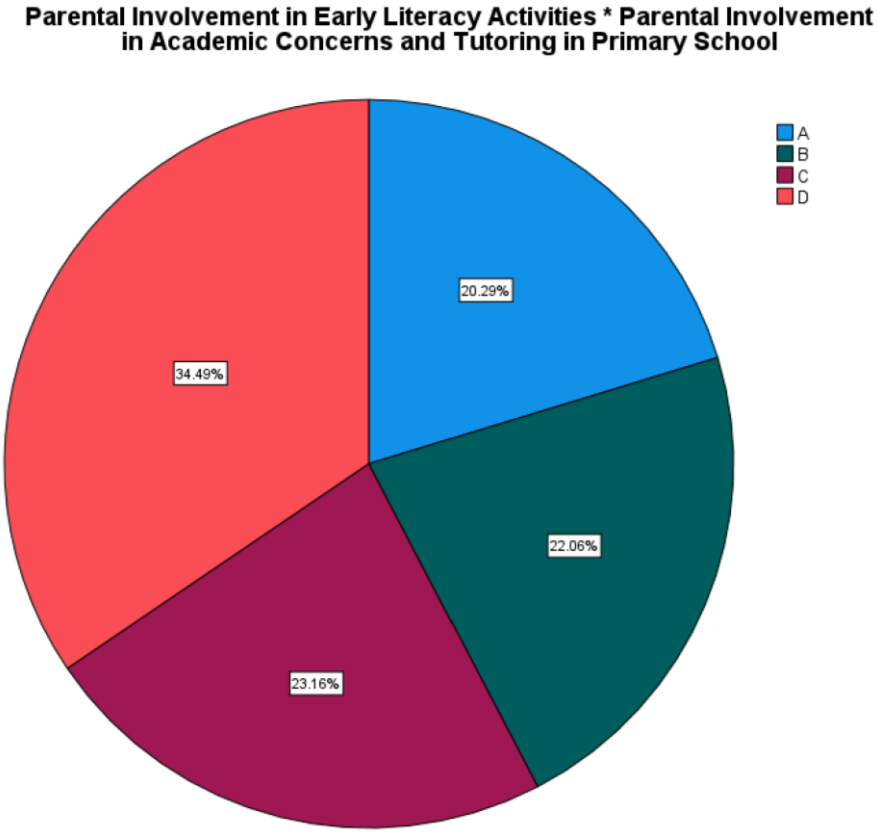

Figure 7. Pie Chart of Parental Involvement in Early Literacy Activities and Parental Involvement in Academic Concerns and Tutoring in Primary School

4.1.4. Average reading scores

As the only dependent variable in this study, Table 3 shows that Average Reading Scores has 3,349 valid cases and 0 missing cases. The highest reading score is 740, the lowest score is 295, and the mean score is 571.68. As Figure 8 shows, the standard deviation is 57.831, and the data for average reading scores could be roughly determined to be normally distributed.

Table 3. Frequency Table of Average Reading Scores

Frequency Table of Average Reading Scores		
		Average Reading Scores
N	Valid	3349
	Missing	0
Mean		571.68
Minimum		295
Maximum		740

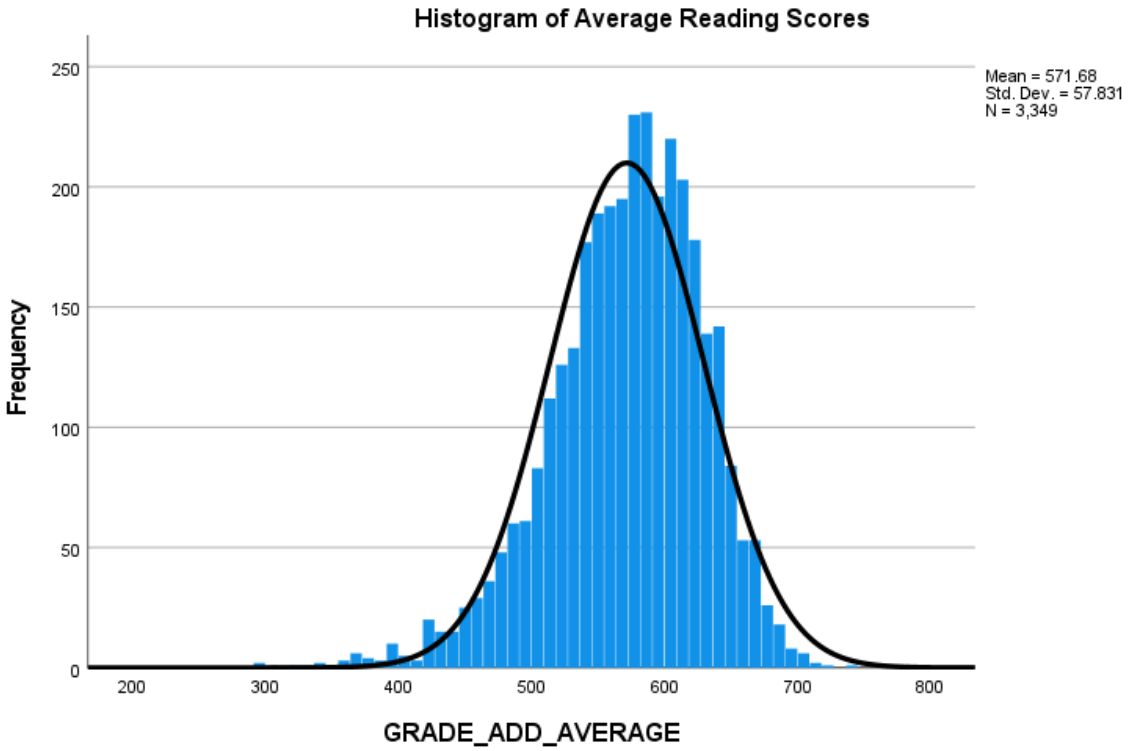

Figure 8. Histogram of Average Reading Scores

4.2. Correlation Analysis of Variables

4.2.1. Parental Involvement in Early Literacy Activities and Average Reading Scores

As seen in Table 4, Spearman's correlation coefficient between Parental Involvement in Early Literacy Activities (Total) and Average Reading Scores is 0.093, with a p-value of less than 0.001, indicating a very weak positive correlation between these two variables. Although this correlation may not be significant in a substantive sense, we can be pretty sure that this weak positive correlation is not generated by random error or chance but is at least 99% likely to be found in the actual population.

Among the nine early literacy activities parents are involved in, the activity with the highest correlation with reading achievement is reading books, with a Spearman's correlation coefficient of 0.195 (p-value < 0.001). The activity with the second strongest correlation is telling stories. The Spearman's correlation coefficient with Reading Scores is 0.138(p-value<0.001). Both variables have a significantly higher Spearman correlation coefficient than the variable Parental Involvement in Early Literacy Activities (Total). This indicates that reading books and storytelling are the two factors most strongly positively associated with reading grades across the nine early literacy activities in which parents engaged. The activities with the third and fourth strongest correlation with reading scores are reading aloud signs (0.064) and playing word games (0.057), both with a p-value <0.001. Although the associations are not very strong, the positive correlations are statistically significant, so we can conclude that there is a degree of positive correlation between read-aloud as well as playing word games and reading scores, which means that the more often parents engage in reading aloud or playing word games, the higher the child's reading scores.

The results in Table 4 also show a very weak positive correlation between playing the alphabet and reading scores (based on Spearman's correlation coefficient is 0.042). Although the p-value (0.017) is below the commonly used statistical significance threshold of 0.05 but much greater than 0.001, in this study, we chose to use a more rigorous significance level, focusing only on results with p-values less than 0.001 and ignoring p-values in the range of 0.001 to 0.05.

In addition, Spearman's correlation coefficient between Write Letters Words and Average Reading Scores is 0.019 with a p-value of 0.290, and between Sing Song and Average Reading Scores is 0.003 with a p-value of 0.985, which indicates that there is no significant correlation between independent and dependent variables. However, this does not necessarily mean that the two variables are completely unrelated in practice. It may be that the sample is too small or that the relationship between the two is non-linear or non-monotonic and therefore required further discussion and testing [50].

It is worth noting in particular that Spearman's correlation coefficient between Talk What Had Done and Average Reading Score is -0.008 with a p-value of 0.646; between Discussion and Average Reading Score is - 0.003 and a p-value of 0.884. Although Spearman's correlation coefficient is negative, the negative value is too small, which is less than 0.01, and the p-value is too large, which is much more than the commonly used statistical significance threshold of 0.05. Therefore, we cannot reject the null hypothesis and can tentatively conclude that there is no significant relationship between parents' involvement in their children's early reading activities by talking about what they had done or discussing and average reading scores.

Therefore, according to the results, the four variables with relatively strong Spearman's correlation coefficients and less than 0.01 p-values - Read Book, Tell Stories, Read Aloud Signs and Play Word Games are selected for logistic regression analyses as these four variables clearly showed a correlation with the Average Reading Scores.

Table 4. Correlation Table Between Parental Involvement in Early Literacy Activities and Average Reading Scores

Correlation Table between Parental Involvement in Early Literacy Activities and Average Reading Scores

	AVERAGE READING SCORES	
	Spearman's correlation coefficient	Sig. (2-tailed)
PARENTAL INVOLVEMENT IN EARLY LITERACY ACTIVITIES (TOTAL)	.093**	<.001
READ BOOK	.195**	<.001
TELL STORIES	.138**	<.001
SING SONG	.003**	.985
PLAY ALPHABET	.042**	.017
TALK WHAT HAD DONE	-.008	.646
DISCUSSION	-.003	.884
PLAY WORD GAMES	.057**	<.001
WRITE LETTERS WORDS	.019	.290
READ ALOUD SIGNS	.064**	<.001

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

4.2.2. Parental Involvement in Academic Concerns and Tutoring in Primary School and Average Reading Scores

Table 5 shows Spearman's correlation coefficient between Parental Involvement in Academic Concerns and Tutoring in Primary School (Total) and Average Reading Scores is -0.092, with a p-value of less than 0.001. The association between these two variables is not strong, but we can still conclude that they have some degree of negative correlation. Obviously, the negative correlation results are the opposite of our previous hypothesis 2.

Parental Involvement in Academic Concerns and Tutoring in Primary School (Total) consists of three variables in total. One of them, Ask if Child Has Done Homework can be termed as Parental Involvement in Academic Concerns in Primary School, while the other two variables Help Child with Homework and Review Child's Homework to Make Sure It Is Correct can be collectively referred to as Parental Involvement in Academic Tutoring in Primary School.

Spearman's correlation coefficient between Ask if Child Has Done Homework and Average Reading Scores is 0.34, which shows a moderate positive correlation between the two variables. However, the p-value of 0.06 is slightly higher than the critical value of 0.05, which is usually used to determine statistical significance, suggesting that we may need a larger sample size to clarify this positive correlation [51].

While Spearman's correlation coefficients between Help Child with Homework and Review Child's Homework to Make Sure It Is Correct, with Average Reading Scores are -0.111 and -0.074, respectively, with the p-value less than 0.001, which indicate a slight negative correlation between both independent variables and reading scores and that the correlation is statistically significant, in the sense that as the frequency of parents helping children with their homework as well as checking children's homework to ensure that it is correct during primary school increases, a slight decrease in the children's reading scores ensues.

Why is there such a negative correlation result? It may be since too frequent parental involvement in guiding the children's academic work may hinder the development of independent thinking and self-learning skills [52], trigger stress and anxiety [53], and lower the children's self-confidence [54]. This will be further discussed in Chapter 5.

Table 5. Correlation Table between Parental Involvement in Academic Concerns and Tutoring in Primary School and Average Reading Scores (12 category)

Correlation Table between Parental Involvement in Academic Concerns and Tutoring in Primary School and Average Reading Scores

	AVERAGE READING SCORES	
	Spearman's correlation coefficient	Sig. (2-tailed)
PARENTAL INVOLVEMENT IN ACADEMIC CONCERNS AND TUTORING IN PRIMARY SCHOOL (TOTAL)	-.092**	<.001
ASK IF CHILD HAS DONE HOMEWORK	0.34	0.06
HELP CHILD WITH HOMEWORK	-.111**	<.001
REVIEW CHILD'S HOMEWORK TO MAKE SURE IT IS CORRECT	-.074**	<.001

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

4.2.3. Parental Involvement in Early Literacy Activities * Parental Involvement in Academic Concerns and Tutoring in Primary School and Average Reading Scores

To test Hypothesis 3, we conducted a correlation test between the Parental Involvement in Early Literacy Activities (Total)* Parental Involvement in Academic Concerns and Tutoring in Primary School (Total) and Average Reading Scores, and the results are shown in Table 6, with a Spearman's correlation coefficient of 0.047 and a p-value of 0.01, which indicates that there is a very weak correlation between these two variables and that this weak correlation is statistically significant.

Table 6. Correlation Table between Parental Involvement in Early Literacy Activities (Total) * Parental Involvement *in Academic Concerns and Tutoring in Primary School (Total) and Average Reading Scores*

*Correlation Table between Parental Involvement in Early Literacy Activities (Total) * Parental Involvement in Academic Concerns and Tutoring in Primary School (Total) and Average Reading Scores*

	AVERAGE READING SCORES	
	Spearman's correlation coefficient	Sig. (2-tailed)
PARENTAL INVOLVEMENT IN EARLY LITERACY ACTIVITIES (TOTAL) * PARENTAL INVOLVEMENT IN ACADEMIC CONCERNS AND TUTORING IN PRIMARY SCHOOL (TOTAL)	.047**	.010

**. Correlation is significant at the 0.05 level (2-tailed).

Note. The categories of this ordinal variable are A, B, C, and D mentioned in Figure 7 :
A (high pre-school involvement/ high primary school involvement), B (high pre-school involvement/ low primary school involvement), C (low pre-school involvement/ high primary school involvement), D (low pre-school involvement/ low primary school involvement).

However, based on the results of the correlation test mentioned in the first two sections of this chapter, showed that Parental Involvement in Early Literacy Activities (Total) and Average Reading Scores are positively correlated, whereas Parental Involvement in Academic Concerns and Tutoring in Primary School (Total) and Average Reading Scores are negatively correlated, such results deviated from our initial hypothesis, so we need to recode the variables to test Hypothesis 3 and select only those variables that are positively correlated with Average Reading Scores, meaning that a new variable representing parents' early academic involvement is calculated by summing Read Book, Tell Stories, Read Aloud Signs and Play Word Games, also Ask if Child Has Done Homework is used to represent parents' involvement in academic concerns during the primary schools years, and these variables are then used to compute a new dummy variable.

Read Book, Tell Stories, Read Aloud Signs and Play Word Games are added together, and the median is calculated to be 8, so we created a new dummy variable Parental Involvement in Early Literacy Activities (New) and gave a value of 1 to data with values greater than 8, and a value of 0 to data less than or equal to 8. Ask if Child Has Done Homework also has a median value of 4, so after creating a new dummy variable Parental Involvement in Academic Concerns in Primary School, we also assigned a value of 1 to data with a value greater than 4, and a value of 0 to data less than or equal to 4. Then, executed 'compute variable' for the two new variables, computed Parental Involvement in Early Literacy Activities (New)*2+Parental Involvement in Academic Concerns in Primary School. The value with a result of 3 was named A1, the value with a result of 2 was coded B1, the value with a result of 1 was coded C1, and the value with an operation result of 0 was named D1. As shown in Table 1 and Figure 1 in the Appendix, Group B1 has the smallest percentage of the four groups (8.90%) with 280 cases; Group D1 has 414 cases, representing 13.16% of the total sample size; Group A1 had 678 cases, accounting for 37.09%; Group C1 has the highest percentage (40.85%) with 1285 cases.

Then run Spearman's correlation coefficient test for the new variable Parental Involvement in Early Literacy Activities (New)* Parental Involvement in Academic Concerns in Primary School and Average Reading Score. The results are shown in Table 7, the Spearman correlation coefficient is 0.442 and the p-value is less than 0.01, which indicates that the variables have a moderate positive correlation, and this positive correlation is statistically significant. And to better test whether there is a significant difference between the means of the reading scores corresponding to the different categorical variables, a bar chart was created to show the mean and standard deviation of reading scores for each category (A1, B1, C1 and D1). In Figure 9, the heights of the bars represent the means, and the error bars represent the standard deviation for each category. The average reading scores of the four types are significantly different. The average reading score of category A1 is the highest with a score of 582, followed by category B1 (578), category C1 has the third higher score 566, and category D1 is the lowest with 564. The difference in standard deviation also reflects the degree of dispersion of the reading scores corresponding to different categories. From the error bars, the standard deviation of category B is the smallest at 52.80, and the standard deviation of category A1 is the second smallest (56.02), which is smaller than that of categories C1 and D1. It can be concluded that the average reading scores corresponding to categories B1 and A1 have smaller variability than categories C1and D1.

Combined with Spearman's correlation coefficient test, and the mean and standard deviation of reading scores corresponding to different categories of independent variables, we can conclude that children's reading scores are significantly associated with different combinations of

parental involvement in children's pre-school and primary school periods, and the average reading scores corresponding to D1(low pre-school involvement/ low primary school involvement), C1(low pre-school involvement/ high primary school involvement), B1(high pre-school involvement/ low primary school involvement), and A1(high pre-school involvement/ high primary school involvement) increase sequentially.

Table 7. Correlation Table between Parental Involvement in Early Literacy Activities (Total) * Parental Involvement in Academic Concerns and Tutoring in Primary School (Total) and Average Reading Scores

*Correlation Table between Parental Involvement in Early Literacy Activities (New) * Parental Involvement in Academic Concerns in Primary School and Average Reading Scores*

	AVERAGE READING SCORES	
	Spearman's correlation coefficient	Sig. (2-tailed)
PARENTAL INVOLVEMENT IN EARLY LITERACY ACTIVITIES (NEW) * PARENTAL INVOLVEMENT IN ACADEMIC CONCERNS IN PRIMARY SCHOOL	.442**	<.001

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

Note. The categories of this ordinal variable are A1, B1, C1, and D1 mentioned in Table 1 and Figure 1 in the Appendix:
A1 (high pre-school involvement/ high primary school involvement), B1 (high pre-school involvement/ low primary school involvement), C1 (low pre-school involvement/ high primary school involvement), D1 (low pre-school involvement/ low primary school involvement).

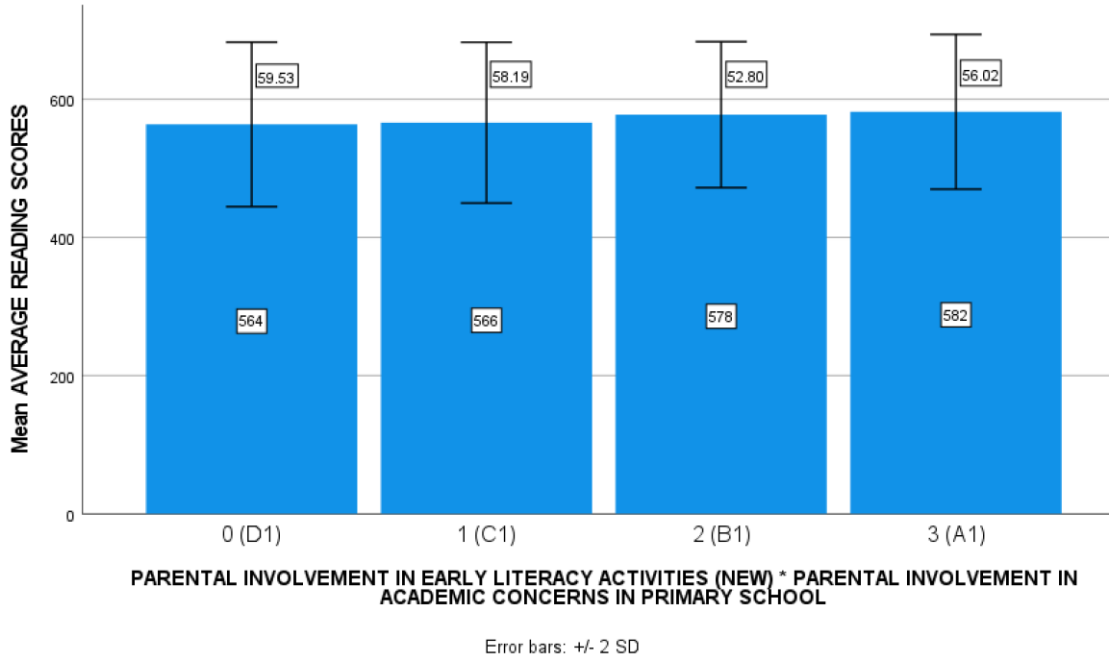

Figure 9. Bar Chart of the Mean and Standard Deviation of Average Reading Scores for Each Category (A1, B1, C1 and D1)

4.3. Regression Analysis of Variables

4.3.1. Feasibility Verification Before Running Linear Regression

In this section, linear regression analysis was used to test the three hypotheses developed in this study. We proposed three linear regression models, the first one using Read Book, Tell Stories, Read Aloud Signs and Play Word Games as independent variables and Average Reading Scores as the dependent variable to investigate the effect of parental involvement in early reading activities on reading scores; the second one using Ask if Child Has Done Homework, Help Child with Homework and Review Child's Homework to Make Sure It Is Correct as independent variables and Average Reading Scores as the dependent variable to explore the effect of parental involvement in the primary grades on reading scores. The third group took all the independent variables from the first two models. It analysed which stage of parental involvement would have a more significant impact on children's reading achievement and assessed the association between variables of interest after controlling for the other parental involvement factors.

Before running the regression analysis, the normality of the dependent variable was first ensured, as shown in Figure 8, where the distribution of reading scores is continuous and approximately distributed normally. Secondly, the normality

of the residuals in the regression analysis was also ascertained through a normal Q-Q plot, as shown in Figure 2 in the Appendix, where the points in the plot fall roughly on a straight line, indicating that the data generally fit a normal distribution [55]. Next, the results of the regression analysis may be affected by multicollinearity due to the presence of multiple correlated independent variables in the model, so we used Variance Inflation Factor (VIF) to check for multicollinearity [56], and the results as shown in Table 2 in the Appendix, showed that the VIFs of all the independent variables are less than the commonly recommended threshold of 5. Thus, some of the main assumptions of the linear regression analysis are satisfied.

4.3.2. Results of Linear Regression

According to Model 1, the constant 558.011 represent the average reading score of children whose parents never or almost never practiced reading, storytelling, reading signs aloud and playing with words activities with their parents before starting primary school (i.e. this is because 'never, almost never' is the reference category for all these variables). As the Adjusted R Square is 0.036, indicating that Model 1 could explain about 3.6% of the variance in the dependent variable (i.e. reading scores). Among them, apart from the variable Often Read Book, all the other variables have p-values higher than 0.05, indicating no statistically significant effects of these variables on the Average Reading Scores. Therefore, reading books often to their children is the only strong and significant early parental involvement factor.

Because a large proportion of the independent variables in Model 1 have p-values greater than 0.05, the model setup could be simplified and remove the factors which are not statistically significant. Combined with the results of the correlation test between each of the independent variables and Average Reading Scores in Section 2 of this Chapter (Table 6), Read Aloud Signs and Play Word Games both have correlations with the dependent variable that are less than 0.1, thus both variables are considered to be less predictive of the dependent variable. If the model contains too many independent variables which contribute little to the dependent variable, it may reduce the value of Adjusted R Square as well as the predictive accuracy of the model [57]. Therefore, Model 1 is adjusted by deleting the two variables, Read Aloud Signs and Play Word Games, while keeping the others unchanged, and linear regression analyses are performed again, with the results shown in the later columns of Model 1 in Table 8.

According to Adjusted Model 1, the Adjusted R Square was 0.041, indicating that Model 1 (Adjusted) could explain about 4.1% of the variation in the dependent variable, which is better than Model 1. According to the general regression equation: $Y = \beta0 + \beta1X1 + \beta2X2 + ... + \beta nXn + \varepsilon$ (Y = dependent variable, X1, X2, ..., Xn = independent variables, $\beta0$ = constants, $\beta1$, ..., βn = coefficients corresponding to each independent variable, ε = random error term). (Neter et al., 1996). We can derive: Average Reading Scores =551.978+11.909*Sometimes Read Books+30.193*Often Read Book+1.476*Sometines Tell Stories+8.197*Often Tell Stories+ε. According to Table 8, we could conclude that the Beta value, which is the standardised coefficient, of Often Read Book was 0.243, indicating that the respondent in this category has a reading score which is 0.243 standard deviations higher than those whose parents never/almost never read to them (i.e., the reference group). The magnitude of the beta coefficient is significantly greater than the other three variables, suggesting that Often Read Book had the greatest impact on Average Reading Scores in Model 1(Adjusted). Meanwhile, Sometimes Read Books has a Beta of 0.101, which is also significantly greater than the Beta values of the variables related to the frequency of Tell Stories (0.013 and 0.063), suggesting that parental involvement in reading books in the early literary activities would bring more help.

In Model 2, the constant 571.110 represented the value of reading scores of children whose parents never or almost never ask if the child has done his/her homework, help the child with homework, and review the child's homework to make sure it is correct. From Table 8, it can be seen that when parents every day ask if the child has done his/her homework, the corresponding B-value is 16.866, indicating that the child's average reading score is 16.866 points higher than when parents never or almost never ask if the child has done his/her homework, which proved that the parent's concern for the child's schoolwork in primary school had a significant help in improving the child's reading scores. However, other categories were not statistically significant ($p>0.05$). In contrast, the B-values of Helping the Child With Homework 3 or 4 Times a Week and Helping the Child with Homework Every Day are negative, -14.917 and -15.537, respectively, showing that compared to the case where parents never or almost never help the child with homework, child's average reading scores decreased by 14.917 and 15.537 points, respectively, which suggested that parental help with the child's homework more than three times a week in primary schools had a negative effect on the child's reading scores and the negative effect increases slightly as the number of times increases. The Adjusted R Square is 0.018, which was quite low, implying that Model 2 can only explain about 1.8% of the variance in the dependent variable and may not be able to predict the data well. This may be because the model does not contain enough independent variables that have a strong effect on predicting the dependent variable [58]. This could be due to the low variation in this variable as shown in the descriptive statistics section.

The results of the linear regression with the adjusted Model 2 are shown in Table 8. From Table 8, it can be seen that there is little change in the adjusted Model 2 compared to the original Model 2, only a slight increase in the R-squared which suggests a very slight improvement in the model explanatory power.

Model 3 combines all the variables related to parental involvement in pre-primary and primary school years. The Adjusted R Square is 0.052, and although the value is not very large, it is higher than the other models, suggesting that combining the variables together increases the explanatory power of reading scores. In Model 3, the p-values of reading books (sometimes, and often) and that of helping the child with homework (1 or 2 times a week, 3 or 4 times a week, and every day) - are all below the generally defined threshold of 0.05, which is statistically significant. Other categories of these variables and other variables have p-values greater than 0.05, possibly due to insufficient sample size or too small an effect [59]. Thus, we did not have enough evidence to reject the null hypothesis, and these variables were not included in the subsequent analyses.

In addition, by combining all the variables from Model 1 (Adjusted) and Model 2 (Adjusted) into Model 3 (Adjusted), it can be found that the Adjusted R Square of the combined model is 0.056, which is the largest among all six models,

meaning that the fit of Model 3 (Adjusted) is the best among all the models in this research. According to Table 8, we can find that when controlling for the other factors included in the model, the Beta values of the dependent variables related to the preschool stage increased compared to Model 1 (Adjusted) when the variable of parental involvement in the primary school stage was added, and the increase in the magnitude of Beta values is more marked for variables representing less frequent parental involvement in the preschool years (Sometimes Read Books and Sometimes Tell Stories). Further, when Parental Involvement in Early Literacy Activities is added, the positive impact of Ask if the Child has done Homework on reading achievement was significantly reduced. The strength of mediation can be approximatively calculated by dividing the difference in Beta before (Model 2 adjusted) and after by the Adjusted Beta (Model 3 adjusted). For instance, the beta coefficient of asking 'every day' for homework has dropped from 0.118 in Model 2 adjusted to 0.067 in Model 3 adjusted. This means that 43% of the association between asking every day for homework and reading scores (0.118- 0.067=0.051; 0.051/0.118=0.43) was explained by pre-school involvement. Nevertheless, an independent association remains statistically significant over and above the pre-school involvement. The negative association between frequent help with homework and reading scores remained statistically significant, and the magnitude of the coefficients changed very little in the last model, suggesting that this association was less influenced by the pre-school factors added in the last model.

Table 8. Linear Regression Models for Parental Involvement in Early Literacy Activities/ Parental Involvement in Academic Concerns and Tutoring in Primary School on Reading Scores

Linear Regression Models for Parental Involvement in Early Literacy Activities/ Parental Involvement in Academic Concerns and Tutoring in Primary School on Reading scores

			Model 1			Model 1 (Adjusted)			Model 2			Model 2 (Adjusted)			Model 3			Model 3 (Adjusted)		
			B	Beta	p-value	B	Beta	p-value	B	Beta	p-value	B	Beta	p-value	B	Beta	p-value	B	Beta	p-value
	Constant		558.011		0.000	551.978		0.000	571.110		0.000	570.953		0.000	564.086		0.000	554.616		0.000
PARENTAL INVOLVEMENT IN EARLY LITERACY ACTIVITIES	READ BOOK	(ref: Never or almost never)																		
		Sometimes	7.879	0.067	0.066	11.909	0.101	0.003							8.789	0.074	0.039	13.539	0.115	<.001
		Often	26.084	0.211	<.001	30.193	0.243	<.001							25.876	0.209	<.001	30.809	0.248	<.001
	TELL STORIES	(ref: Never or almost never)																		
		Sometimes	1.244	0.003	0.091	1.476	0.013	0.045							1.375	0.008	0.077	2.156	0.018	0.046
		Often	7.043	0.055	0.078	8.197	0.063	0.034							6.700	0.052	0.091	8.082	0.062	0.036
	READ ALOUD SIGNS	(ref: Never or almost never)																		
		Sometimes	-1.249	-0.010	0.625										-0.486	-0.004	0.849			
		Often	-2.691	-0.016	0.476										-2.120	-0.012	0.573			
	PLAY WORD GAMES	(ref: Never or almost never)																		
		Sometimes	-0.977	-0.008	0.730										-0.389	-0.003	0.891			
		Often	2.737	0.021	0.410										3.727	0.029	0.259			
PARENTAL INVOLVEMENT IN ACADEMIC CONCERNS AND TUTORING IN PRIMARY SCHOOL	ASK IF CHILD HAS DONE HOMEWORK	(ref: Never or almost never)																		
		Less than once a week							3.597	0.011	0.604	3.164	0.009	0.637	-3.236	-0.010	0.640	-0.238	-0.001	0.971
		1 or 2 times a week							-0.203	-0.001	0.973	-0.618	-0.002	0.914	-7.589	-0.029	0.213	-4.790	-0.018	0.397
		3 or 4 times a week							-0.242	-0.001	0.964	-1.432	-0.007	0.775	-8.478	-0.043	0.118	-6.053	-0.030	0.221
		Every day							16.866	0.131	<.001	15.136	0.118	<.001	7.048	0.054	0.107	8.672	0.067	0.025
	HELP CHILD WITH HOMEWORK	(ref: Never or almost never)																		
		Less than once a week							3.616	0.018	0.377	3.676	0.018	0.363	2.246	0.011	0.576	2.587	0.013	0.514
		1 or 2 times a week							-8.243	-0.046	0.038	-8.326	-0.047	0.030	-8.381	-0.048	0.032	-8.454	-0.048	0.025
		3 or 4 times a week							-14.917	-0.082	<.001	-16.082	-0.088	<.001	-14.070	-0.078	<.001	-14.924	-0.082	<.001
		Every day							-15.537	-0.133	<.001	-17.792	-0.152	<.001	-14.721	-0.127	<.001	-16.670	-0.143	<.001
	REVIEW CHILD'S HOMEWORK TO MAKE SURE IT IS CORRECT	(ref: Never or almost never)																		
		Less than once a week							-1.011	-0.005	0.827				-2.511	-0.012	0.580			
		1 or 2 times a week							-0.396	-0.002	0.925				-0.813	-0.005	0.844			
		3 or 4 times a week							-3.300	-0.021	0.432				-3.065	-0.019	0.458			
		Every day							-4.660	-0.040	0.221				-5.000	-0.043	0.181			
	R Square			0.038			0.042			0.022			0.021			0.058			0.060	
	Adjusted R Square			0.036			0.041			0.018			0.019			0.052			0.056	

Dependent Variables: Average Reading Scores

Note 1. B= Unstandardized Coefficient; Beta= Standardized Coefficient;

Note 2. Because some values are small and differences between values cannot be seen by retaining only 2 decimal places, all values are retained to a uniform 3 decimal places in this table.

Table 9. Linear Regression Models for Categories A1/B1/C1/D1 on Reading scores

Linear Regression Models for Catergories A1/B1/C1/D1 on Reading scores

	B	Beta	p-value
Constant	563.76		0
ref: D1			
C1	2.481	0.021	0.442
B1	14.101	0.070	0.001
A1	18.217	0.153	<.001
R Square		0.019	
Adjusted R Square		0.018	

Dependent Variables: Average Reading Scores

Note. B= Unstandardized Coefficient; Beta= Standardized Coefficient.

5. Discussion

5.1. Findings of the Research

5.1.1. What is the Relationship Between Parental Involvement in Early Literacy Activities and Children'S Reading Achievement?

According to the results of this study, Reading books, Telling stories, Reading aloud signs and Playing word games are the parental involvement in early literacy activities associated with children's reading achievement. With the increase in the frequency of parental involvement, children's reading achievement improves, consistent with previous findings that early childhood involvement positively contributes to children's reading skill development. In particular, parental involvement in reading books and storytelling in the early years of children's life have the most significant effect on the children's reading scores, with participation in reading being the most effective activity. Wing-Yin Chow & McBride-Chang also concluded that early family reading activities significantly impacted children's reading skills development based on a study on parent-child reading of preschool children in Hong Kong [60]. Moreover, other researchers in America have also come to similar conclusions, for example, Deckner et al. demonstrated that mothers' participation in reading with their children was more effective in improving their children's language and reading skills than other forms of accompaniment [61].

5.1.2. What is the Relationship Between Parental Involvement in Academic Concerns and Tutoring in Primary School and Children'S Reading Achievement?

Parental Involvement in Academic Concerns and Tutoring in Primary School can be more specifically categorised into - Parental Involvement in Academic Concerns in Primary School and Parental Involvement in Academic Tutoring in Primary School. Among them, as the frequency of parents' concern for their children's academics (e.g., asking if their children's homework is completed) increases during primary school, children's reading scores also increase. A similar result was found in El Nokali et al.'s study of American primary school parents' participation - a significant positive correlation exists between parental concern for their children's academics and their children's reading performance [15].

However, the other aspect of parental involvement in primary school - Academic Tutoring - negatively correlates with children's academic achievement, and with the increase in the frequency of parental participation, children's reading scores may decline more obviously. Academic tutoring includes helping the child with homework, reviewing the child's homework to ensure it is correct, and so on. This result may be due to overly frequent parental involvement in directing children's academic work will limit the development of children's independent thinking and self-learning skills, diminish their self-confidence, and raise tension and anxiety levels.

Firstly, Excessive parental help with homework may reduce the time children have to think independently and learn to read, thus lowering their reading levels [62]. Too much parental help may cause children to become dependent on their parents to complete tasks or even treat learning as a parental task without having the opportunity to learn how to solve problems on their own, and this limited independent learning may be reflected in lower reading comprehension scores. Schnee and Bose found in their study that excessive parental intervention diminished children's self-directed learning and motivation to learn [63]. Pomerantz, Moorman, and Litwack's study also noted that over-involvement of parents leads to dependency, which can diminish children's motivation and performance [64].

Also, if parents invest too much help in their children's academics, it can make children feel stressed and anxious, which can negatively affect their enthusiasm for learning and lead to lower reading scores. In a study on homework, Cooper et al. found that excessive parental tutoring can cause anxiety in children in learning and may not be conducive to children's academic achievement [65]. Hill and Tyson also revealed in their article that due to psychological effects such as stress, parental over-involvement does not improve students' academic achievement but may be harmful [66].

In addition, overly involved homework help can make children feel as though they are unable to complete tasks, which may lower their self-confidence in learning, and may have a stronger negative impact on activities such as reading, which requires a more robust self-driven approach [67]. Robinson and Harris have found through a study of over sixty parental involvement levels that excessive parental engagement can have side effects on children's academics, such as lowering the children's self-efficacy and leading to lower academic performance [68]. Gonida and Cortina also found in their study that parents' over-involvement in their children's homework can negatively affect their children's self-efficacy and grades [69].

Overall, many studies have found that excessive parental involvement in their children's academic tutoring may diminish the role of homework in helping children develop independent thinking, self-learning, self-confidence, and self-efficacy. This may explain the findings in our study that parents' frequent help with homework during primary school may lead to lower reading scores.

5.1.3. Does Parental Involvement in Early Literacy Activities Have a More Significant Impact on Children'S Reading Achievement Than Academic Concerns and Tutoring in Primary School, And Does a High Degree of Academic Concerns and Tutoring in Primary School Have an Impact on Children'S Reading Achievement When the Degree of Parental Involvement in Early Literacy Activities Is Low?

The study found that parental involvement in early literacy activities significantly impacts children's reading achievement more than academic concerns and tutoring in primary school. When the degree of parental involvement in early literacy activities is low, a high degree of academic concerns and tutoring in primary school does have some degree of help on children's reading achievement, but it is far less effective in helping children's reading achievement improve than early parental input. Despite the importance of parental involvement during children's school years, parental involvement in preschool has a more significant impact on children's academic achievement [70]. Niklas et al. also reported similar findings in their article, illustrating that parental involvement in their children's reading activities at an early age has a greater impact on the children's reading skills than involvement at a later stage, suggesting that parental involvement in the early stages of children's reading activities is important and irreplaceable [71].

5.2. Practical Significance of This Study

Firstly, based on the findings of this study, parents and educational policymakers should recognise the importance of early parental involvement in children's future academic development. Parental involvement in children's early education, especially in reading and storytelling, can significantly improve their vocabulary and language comprehension, laying a solid foundation for their future reading and writing skills [72]. Therefore, Parents should involve more in educating and accompanying their children during their early developmental years, laying the foundation for the development of reading skills and language literacy in later years. This proactive involvement is the crucial groundwork for cultivating reading proficiency and linguistic literacy in subsequent years. Education policymakers should proactively offer programmes and resources to facilitate parental involvement in their children's early education. These initiatives may include providing home visiting services, organising parent-child activities, and conducting family education workshops [73]. The aim is to support parents in improving their capacity to actively and consistently participate in early literacy activities with their children.

Secondly, when children enter primary school, parents should learn to let go of their children appropriately and not over-help them with their homework. Positive inquiry and care over children's schoolwork can increase their confidence in their studies. However, excessive academic assistance and counselling may inhibit the development of self-directed learning and problem-solving abilities, perhaps leading to worry and declining self-confidence among children. Parents can provide the necessary support, such as showing interest in their children's learning, encouraging them, and helping them organise their study time. However, they should avoid direct involvement in the completion of homework. Parental encouragement and support can help children build up self-confidence in learning. According to Porumbu and Necşoi, children's belief in their ability to succeed in academic pursuits can positively influence their willingness to take on challenges and persist in their efforts, ultimately leading to notable advancements in their future academic accomplishments [74]. Simultaneously, education policymakers also need to pay attention to the design of family participation policies and provide more resources and opportunities to help parents understand their role in their children's education, for example, by promoting the provision of family education workshops in schools to enable parents to understand how to support their children's learning effectively, and so on [75]. At this stage, teachers also need to establish an effective communication mechanism between home and school, regularly sharing with parents their children's learning progress, and reminding parents to avoid over-intervention while keeping a close eye on their children's learning, as well as providing parents with ways to guide their children to solve problems on their own, for example, how to guide their children to solve problems on their own.

Finally, when parents have missed out on the early years of their children's education due to reasons such as physical problems, financial pressures, work pressures, and skill deficits, it is important to pay more attention to academic care and counselling for their children after they start primary school. Because participation in the right way and at the right frequency during the children's school year can still help children's reading skills to improve. Parents can talk to professionals, such as teachers, to identify areas where they may need to invest more help and support for their children. Parents can show concern and interest in their children's learning by communicating with them, encouraging children to share their learning experiences, and praising their efforts and progress. They also need to emphasise the importance of developing their children's self-directed learning and problem-solving skills rather than completing tasks for them. It is also vital for parents at this stage to help their children develop independent learning and problem-solving skills, rather than completing tasks for them, to help children build confidence, develop their independent thinking skills, and help them to go further in their academic paths. Education policymakers should also do more to provide parents with suitable educational resources, including books, websites and workshops, to help parents understand how to support their children's learning [76]; there is also a need to set up a family support policy and formulate a policy on flexible working hours and family holidays, to enable parents to devote more time and energy to their children's education, for example, by setting up paid parental leave and school activity leave; and there is a need to support low-income families through a wide range of subsidies and services, so as to help low-income families to resolve the financial pressure, to enable them to have more resources for dedicated to the education of their children.

In conclusion, education requires the cooperation and efforts of the government, parents, and teachers. Because of the importance of early academic activities for children, parents need to devote extra time and effort to their children in their early years of development, and the government has the responsibility to support parents and families through the implementation of appropriate policies. Also, parents, teachers and the government need to provide reasonable protection for children's learning after they have entered school, to create an environment most suitable for children's development. Through this multifaceted cooperation, we can better support children's learning and development and provide them with a future full of opportunities.

5.3. Limitations of This Study

This study has some limitations in terms of sample size, insufficient evidence of causality and too single evaluation criteria. Firstly, the limited sample size, especially the relatively large number of missing cases related to Parental Involvement in Academic Concerns and Tutoring in Primary School may have had an impact on the correlation analysis as well as the linear regression analysis in the study. In addition, since deleting all variables containing missing values would have resulted in a significant reduction in the available sample size, some data containing missing samples were retained in this study, so it was impossible to use the same sample size in all analyses. Missing values may have decreased the model's predictive performance, which could have resulted in an inaccurate estimation of the model's parameters.

Secondly, the research results can only show the correlation between parental involvement and their children's reading performance, but cannot prove causality. Just verifying the correlation between two variables does not mean that the change of one variable will lead to the change of the other [77]. One or more unobserved variables may affect parents' participation and children's reading performance, and some of these factors may interact. Additionally, a reverse causal link might exist. For example, children's reading ability may

encourage parents to participate more in their education rather than vice versa.

Thirdly, only average reading scores were used in this study as the only criterion for assessing students' reading level, which is too homogenous a test. If only one measure is used to assess a complex concept or phenomenon, this may result in other important aspects of the concept or phenomenon being overlooked [78]. The assessment of reading proficiency should not be confined to the single criterion of grades, and students' reading proficiency is not measured only by the single criterion of grades. For example, a student may be less adept at taking tests but possesses a wide range of reading interests and good reading habits, which may be conducive to his long-term learning and development; and reading proficiency does not only include the ability to comprehend and memorise the content of a text but also to think critically, logical reasoning, vocabulary comprehension, and many reading skills are not necessarily adequately reflected in tests [79].

5.4. Suggestions for Future Research

This study selected only two major categories - parental involvement in early literacy activities and parental involvement in academic concerns and tutoring in primary school - as independent variables. However, many other influences were not taken into account, such as the home educational environment, the parents' own knowledge level and level of education, income, religious background, and the children's gender. Therefore, the influence of other relevant factors on children's reading achievement can be further considered in subsequent studies. Meanwhile, this study found that excessive parental help at the primary school level can negatively affect children's reading achievement, so what threshold of frequency and degree of help is the most appropriate? What is the most powerful way for children to develop by allocating the proportion of concern and help for children's academics in primary school? These questions could all be included in further research.

6. Conclusion

Taking Hong Kong as an example, this study analyses PIRLS 2016 data set to investigate the relationship between parental involvement and children's reading achievement. Based on the three questions of this study, we can draw the following conclusions by combining the research results: First, parents can help their children improve reading by taking part in early literacy activities like reading books, telling stories, reading signs aloud, and playing word games, and their reading scores will improve as parental involvement frequency rises. The two most effective types of involvement among them are reading and telling stories. Therefore, parents should give these two activities as much time as possible. Second, after children enter primary school, parents can participate in education through academic concerns (such as asking children if their schoolwork is finished), which can play a positive role in improving children's reading performance. However, at this stage, when parents have direct involvement in their children's schooling (such as assisting the child with homework, checking the children's homework to ensure it is accurate), it has a negative effect on their children's reading performance. This may be due to the fact that during this period, children already have self-learning ability, and parents' excessive interference in their homework will limit the development of children's independent thinking and learning ability, hit their self-confidence, and add unnecessary anxiety to their children, thus limiting the development of their reading level and reflecting on their reading achievements. Thirdly, parents' involvement in pre-school education will be more helpful to improve children's reading performance than their participation during primary school. Moreover, when the parents are not involved enough during pre-school, the higher participation of parents in primary school periods can make up for it to a certain extent, but this compensation is far less than that of parents in the pre-school stage, which plays a significant role in improving children's reading performance. Therefore, as a critical period of parental participation, parents' involvement during pre-school is irreplaceable.

The results of this study can also provide some reference suggestions for parents, educators and educational policymakers and help them adjust their consciousness and behaviours. Parents should actively participate in their children's early literacy activities in order to create the groundwork for their children's subsequent reading ability development. Furthermore, once children start school, parents should learn to not meddle too much with children's own studies. Parents can show concern for their children's studies by asking about their homework completion, creating an environment for children's independent study, and increasing children's confidence in their studies by encouraging them during school periods. However, they do not help children finish their homework, which will affect their self-study ability and lead to anxiety. Then, teachers need to establish an effective communication mechanism with parents when children are in school, help parents to know the appropriate educational methods to be adopted at this stage, and provide parents with correct educational suggestions. For educational policymakers, they should recognise the importance of pre-school reading education, and provide corresponding educational resources and support policies to promote parents' involvement frequency during the pre-school stage. To sum up, reading is the foundation of subject knowledge learning, thinking development and skill acquisition. Parents, teachers and the government need to work together to adopt the appropriate way at the right time to support children's reading levels to improve and help them achieve better development in the future.

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Appendix

Table 1. Crosstab for Parental Involvement in Early Literacy Activities (New) and Parental Involvement in Academic Concerns in Primary School

Crosstab for Parental Involvement in Early Literacy Activities (New) and Parental Involvement in Academic Concerns in Primary School

		Parental Involvement in Early Literacy Activities (New)		Total
		LOW INVOLVEMENT (<=8)	HIGH INVOLVEMENT (>8)	
Parental Involvement in Academic Concerns in Primary School	LOW INVOLVEMENT (<=4)	414	1285	1699
	HIGH INVOLVEMENT (>4)	280	1167	1447
Total		694	2452	3146

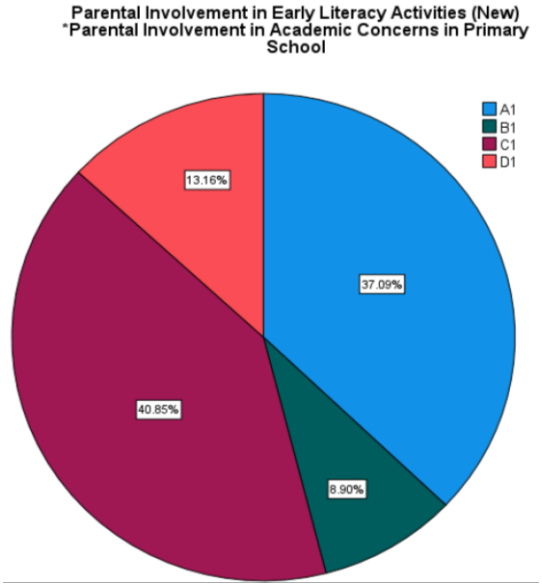

Figure 1. Pie Chart of Parental Involvement in Early Literacy Activities (New) and Parental Involvement in Academic Concerns in Primary School

Figure 2. Normal Q-Q Plot of Regression Standardized Residual Dependent Variable: Average Reading Scores

Table 2. Collinearity Statistics test table for all independent variables

Collinearity Statistics test table for all independent variables

Independent Variables	VIF
READ BOOK	1.50
TELL STORIES	1.52
READ ALOUD SIGNS	1.24
PLAY WORD GAMES	1.17
ASK IF CHILD HAS DONE HOMEWORK	1.43
HELP CHILD WITH HOMEWORK	1.72
REVIEW CHILD'S HOMEWORK TO MAKE SURE IT IS CORRECT	1.85
PARENTAL INVOLVEMENT IN EARLY LITERACY ACTIVITIES (NEW) * PARENTAL INVOLVEMENT IN ACADEMIC CONCERNS IN PRIMARY SCHOOL	1.00