PARENTAL ENGAGEMENT IN DIGITAL EDUCATION AND ITS INFLUENCE ON CHILDREN'S ACADEMIC ACHIEVEMENTS: MEDIATED BY THE HOME LEARNING ENVIRONMENT

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Abstract: This study constructed a core conceptual framework using parental engagement, home learning environment, educational support access, and child academic achievements as variables by introducing the following demographic variables of gender, age, child's grade, and education level. Attempting to analyze the differences in the perceived means of the respondents' demographic variable groupings for each of the variables of parental engagement, home learning environment, educational support access, and child academic achievements and the influence of the independent variables on the dependent variables, this study formulated the research hypotheses: 1: There is a positive correlation between parental engagement and child academic achievements. 2: The home learning environment has a positive influence on child academic achievements. And using parents of students in school A as a case study, the sample size was calculated as 9542 using simple random sampling method in the overall study, 500 questionnaires were distributed in this study and 475 questionnaires were returned using simple random sampling method with a recovery rate of 95.0%.

This study found that parental engagement has a significant positive effect on child academic achievements; home learning environment has a significant positive effect on child academic achievements; parental engagement affects child academic achievements both directly and indirectly through its effect on educational support access; home learning environment affects child academic achievements both directly and indirectly through its effect on educational support access. This study provides a reference basis for subsequent research, explores the direction of future research on parental engagement in students' educational development, and provides suggestions for future research.

Keywords: Parental Engagement, Home Learning Environment, Educational Support Access, Child Academic Achievement

Introduction

With the continuous popularization and development of digital technology, digital education has become an important trend in today's education field. Parents, as important supporters of their

children's learning and development, play a crucial role in digital education. The degree and manner of their engagement not only have an impact on their children's academic performance, but may also shape their learning attitudes and habits. Therefore, it is important to study parental engagement in digital education and its impact on children's academic achievement.

Past studies have examined the impact of parental engagement in traditional educational activities on children's academic achievement. For example, Smith and Smith (2010) found a significant positive correlation between parental engagement in homework instruction and children's academic achievement. In addition, Johnson's (2015) study showed a positive association between parental school engagement and children's school performance. However, with the rapid development of digital technology, more and more learning activities are shifted to digital platforms, which provides new opportunities and challenges for parental engagement in educational activities.

The rise of digital education has provided parents with more ways of parental engagement in their children's learning. For example, they can use online learning platforms with their children to monitor their children's progress, provide technical support, and expand their children's learning through online resources. According to Li and Atkins (2020), parents' active participation in digital education can contribute to the improvement of the home learning environment, which in turn has a positive impact on their children's academic performance.

However, although digital education offers new opportunities for parental engagement in their children's learning, the reality and ways in which parents engage in digital education still vary. Some parents may lack the necessary digital skills, resulting in their inability to effectively utilize digital tools to support their children's learning (Selwyn, 2016). In addition, some families may not have access to digital educational resources due to economic, cultural, or other factors, thus affecting the level of parental engagement (Livingstone, 2012). Therefore, there is a need for in-depth research on parental engagement in digital education and its impact on their children's academic achievement in order to provide targeted recommendations and support for families, schools, and policymakers.

The purpose of this study was to explore the engagement of parents of School A students in digital education and to analyze its impact on their children's academic achievement. Through an in-depth analysis of the relationship between parental engagement, home learning environment, and children's academic achievement, this study aims to provide theoretical and practical insights for promoting parental engagement in digital education, improving home learning environment, and enhancing children's academic achievement.

Research Problem Statement

In the field of contemporary education, the rapid development of digital technology has changed the way of learning and education, making digital education one of the important directions of educational reform. In this context, the role and parental engagement have become crucial, as they are

not only supporters of their children's learning and development, but also important facilitators of digital education. Therefore, understanding parental engagement in digital education and its impact on children's academic achievement has become an urgent research task.

This study aims to explore parental engagement in digital education and its impact on their children's academic achievement, and to further explore the role of home learning environment and educational support pathways in it.

Research Questions

How does parental engagement in digital education affect children's academic achievement?

How does the home learning environment affect children's academic achievement? Is there a moderating effect of digital education on this effect?

How does the educational support pathway mediate the relationship between parental engagement in digital education and the home learning environment? What is the impact on children's academic achievement?

Are there differences in the impact of parental engagement in digital education and home learning environment on children's academic achievement across family contexts?

By answering these research questions, we will gain a more comprehensive understanding of the role and influence of parents in digital education, and provide theoretical and practical support and guidance for promoting parental engagement in digital education, improving the home learning environment, and enhancing children's academic achievement.

Research Objective (s)

The purpose of this dissertation is to explore in depth the engagement of parents of School A students in digital education and to analyze its impact on their children's academic performance. Specifically, this study aims to:

Investigate the extent and ways of parents' engagement in digital education of students in School A, including the frequency of parents' use of digital education tools, their attitudes and behaviors in participating in online learning activities.

Analyze the relationship between parental engagement in digital education and the home learning environment, and explore the association between the level of parental engagement and factors such as the home learning atmosphere and learning resources.

To explore the influence mechanism of parents' participation in digital education on their children's academic performance, including the possible influence of parents' participation level on their children's learning attitudes, learning habits, and academic performance.

Through fieldwork and data analysis, this study aims to provide theoretical and practical insights for promoting parental participation in digital education, improving the family learning

environment and enhancing children's academic performance, as well as providing a reference basis and decision-making support for schools, families and policy makers.

Literature Review

After the 1980s, many educators have offered different perspectives on parental engagement: Benjamin Bloom (1980), a leading contemporary American psychologist, argues that parental engagement is a function of parents' expectations of their children (in terms of student test scores, etc.) and the transmission of those expectations. Bloom (Benjamin Bloom) (1980) that parental engagement is parents' expectations of their children (in terms of student test scores, etc.) and the transmission of such expectations; Stevenson (Stevenson), Everson (Iverson), Becker (Becker) (1987) that parental engagement is the parents' active participation in school-sponsored activities such as parent-teacher conferences, or helping the child learn in ways that the child and others can observe such as chaperoning, or assisting the child with homework; Epstein (1991) defines parental engagement as "communication between parents and teachers on issues affecting the child"; and Grolnick and Slowiaczek (1994) defined parental engagement as "all the inputs, including time and energy, that parents make in the educational field for their children's learning and development.

Georgiou & Tourva (2007) examined how parents contribute to their children's education, the extent to which they are involved in their children's education at home and at school, and the relationship between their beliefs about parental engagement and their actions toward parental engagement. The study set up two questionnaires, the Parental Attribution Scale and the Parental Engagement Scale. The Parental Attribution Scale was designed based on a five-point Likert-type scale to determine parental contributions to their children's education. The Parental Engagement Scale was used to measure parental engagement at home and at school; these were also 5-point Likert type scale scores. In addition, they defined parental engagement as the behaviors and habits that occur at home and at school, including parents' attitudes and philosophies about their children's education. The results of the study found that parental engagement is influential, if not essential, to a child's academic success.

The concept of home learning environment (HLE) was first proposed abroad by Bradley and Caldwell (1995). In their view, home learning environment does not only include proximal parenting behaviors provided by parents for their children, such as parent-child interactions, parent-child games, and joint learning activities, but also includes distal practical activities, such as giving children a wide variety of books and toys and other learning resources. In terms of content composition, they believe that HLE mainly consists of dimensions such as family learning activities, enrichment of life experiences, and cultural resources. And D. Jonnassen (2002) divided HLE into two parts: physical hardware environment and mental software environment. Hardware environment refers to a fixed place for children to learn at home, such as a separate room or study, suitable desks and chairs, good light and

circulating air, etc. Software environment mainly refers to the family's emotional relationship, the cultural atmosphere, the literacy level of family members, and the family's economic status, etc. Foster (2005) defined HLE as "the educational environment that parents create at home for their children to provide learning stimulation and support for their children". children an educational environment that provides learning stimulation and support".

Yang (2015) integrated the above three concepts to define children's home learning environment: the sum of the physical and spiritual learning environments in the homes of 3–6-year-old children, which can be measured in terms of home learning activities, enrichment of life experiences, and learning resources. In addition, Wang et al. (2020), from the perspective of family education in a broad sense, considered the HLE as an important place for implementing family education, an external condition for family members to carry out learning activities, and an important factor affecting the effectiveness of family education. The HLE is considered to contain seven elements, which are family learning space, family education concept, family learning media, family learning resources, family learning atmosphere, family members and family learning community.

Educational support access includes the availability of resources, services, and opportunities that promote student learning and academic progress (Han and Kim, 2019). It includes a variety of channels through which individuals can access help, guidance, and supplemental educational materials to support their educational endeavors. In the digital age, educational support access extends beyond traditional brick-and-mortar institutions to encompass online platforms, digital tools, and technology-enabled learning resources (Kuhfeld et al.)

School-based support services are a fundamental aspect of educational support access, providing students with access to resources and assistance within the school environment (Machin & McNally, 2018). These services may include tutoring programs, academic counseling, special education services, and the use of educational technology. Research has shown that access to school-based support services is associated with increased academic achievement, especially for students from disadvantaged backgrounds (Goodman et al., 2020).

Community resources play a vital role in enhancing educational support access by providing students with opportunities to enrich themselves and gain academic assistance outside of the school setting (Drenovsky & Cohen, 2018). These resources may include libraries, community centers, after-school programs, and extracurricular activities. Research has emphasized the importance of community resources in promoting academic engagement and supporting student learning outside of the classroom (Lee & Bowen, 2018).

Digital platforms and technologies have revolutionized educational support access, providing students with access to a vast array of online resources, tools, and learning materials (Clark et al.) Educational websites, mobile apps, virtual tutoring services, and digital libraries provide students with

unprecedented opportunities for self-directed learning and personalized instruction. Research has shown that digital platforms can increase the accessibility of educational support, especially for students in remote or underserved areas (Severson & Kaul, 2019).

Among the many factors affecting children's academic achievement, Davies and Janus (2009) identified differences in family socioeconomic status as the most significant reason for making differences in children's academic achievement, a view that has been maintained by the Coleman Report. Zhang et al. (2011), in examining the effect of family status on migrant children's academic achievement in China, found that the effect of family economic status on children's achievement was significant at the middle school level. Li Ling and Yuan Shenglan (2019) also found in their study that there is a significant positive effect of family economic status on children's academic achievement, that is to say, a good family socioeconomic status can improve children's academic achievement.

From the point of view of the degree of parental educational engagement, foreign scholars believe that the higher the degree of parental educational engagement, the better the child academic achievement (Castroetal., 2015). In China, both intergenerational rearing (Yao Shifu et al., 2019) and left-behind children (Hu Feng et al., 2009) have also confirmed that the lower the degree of parental education engagement, the worse the child academic achievement. However, some scholars have also come up with the opposite result, that is, when parents invest too much academic supervision or material in children, it will have a negative impact on children's academic achievement (Wei, 2012), and it will also reduce children's reading level (Deng and Georgiou, 2015). Thus, it is also clear that higher levels of parental educational engagement are not better for child academic achievement.

According to Hayes (2012), parental engagement has played an important role in the success of schools over the years, not only helping to increase student achievement, improve student behavior, and reduce absenteeism, but also helping to foster positive attitudes toward school. Parents influence their children's cognitive, social and emotional development, educational engagement and career aspirations. Therefore, parental interactions and activities help to shape a child's school readiness. Semke& Sheridan (2012) stated that schools and parents can work individually or together to support student learning. When parents are involved in school matters, it shows that parents care about their children and it also makes the child more confident in his/her learning process in school. These proves the importance of parental engagement and cooperation and its favorable impact on students' academic performance Parental engagement is associated with children's social skills and may influence emotional and educational commitment at home and school.

In summary, parental engagement, home learning environment, and educational support access are important factors that influence children's academic achievement. They interact with each other to improve child academic achievement.

Methodology

With probability-based sampling methods, the sample size can be determined through the population collection process. For example: the sample size suitable for calculation, the sample size used in the study was determined using The Taro Yamane Sample Size Formula (1973) and the sample size was determined using a 95% confidence level and permissible value. The sampling error is 5% or 0.05. The overall sample is 9,542. When n = number of samples used in the study. N = size of the overall population, e = random sample error is set to 0.05.

The sample size and formula are given below:

$$n = \frac{N}{1 + Ne^2}$$

$$n = \frac{9542}{1 + 9542 X 0.05^2}$$

$$n = 383.83$$

The minimum sample size was calculated to be 383. therefore, approximately 383 participants were needed for the study. Actual and potential attrition rates must be considered when determining the final sample size.

Data collection for this study was all conducted online. Participants received an email invitation to access the survey as well as instructions for completing the survey. Online survey administration allowed for secure and efficient data collection while ensuring participant anonymity. Due to varying class schedules, it was difficult to conduct offline surveys in the field, so the Questionnaire Star Online Platform (www.wjx.cn) was chosen for this study to distribute, measure, and collect the surveys. The target population was selected according to the purpose and objectives of the study. 500 questionnaires were distributed to parents of students attending School A. After excluding some useless data, 475 valid questionnaires were returned, and the validity rate of the questionnaires was 95.0%.

Results

The analysis was designed to explore the effect of parental engagement on child academic achievement. As can be seen, the model summary shows that the regression model has an R-value of 0.718, an R-square of 0.516, and an adjusted R-square of 0.515, which means that parental engagement explains about 51.5% of the variance in the target variable (child academic achievement).

In the analysis of variance (ANOVA) test, the ANOVA table of the model shows the significance of the regression model, F = 504.727, p < .001, which indicates that the regression model is significant overall. This implies that parental engagement has a significant effect on child academic achievement.

Among the coefficients, the standardized coefficient of parental engagement is 0.718, p < .001, which indicates that parental engagement has a significant positive impact on child academic

achievement. Specifically, each unit increase in parental engagement was associated with a .718 standard deviation increase in child academic achievement.

Overall, these results indicate that parental engagement has a significant positive effect on child academic achievement, i.e., there is a positive relationship between active parental engagement and child academic achievement.

The ANOVA table of the model shows the significance of the regression model, $F(1, 473) = 523.636$, $p < .001$, indicating that the regression model is significant overall. This indicates that home learning environment has a significant effect on child academic achievement.

The summary of the model shows that the regression model has an R-value of .725, an R-squared of .525 and an adjusted R-squared of .524. this means that the home learning environment explains about 52.4% of the variance in the target variable (child academic achievement).

In the table of coefficients, the standardized coefficient of home learning environment is 0.725 with a t-value of 22.883, $p < .001$. this indicates that home learning environment has a significant positive effect on child academic achievement.

In summary, these results indicate that there is a significant positive effect of home learning environment on child academic achievement, i.e., improvement in home learning environment is positively related to improvement in child academic achievement.

Total effect of parental engagement on child academic achievement: the total effect of parental engagement on child academic achievement was 0.7838 ($t = 22.4661$, $p < .001$). This indicates that for every unit increase in parental engagement, there is a 0.7838 unit increase in child academic achievement.

Direct Effect of Parental Engagement on Child Academic Achievement: The direct effect of parental engagement on child academic achievement was 0.3774 ($t = 3.6810$, $p = .0003$). This indicates that parental engagement has a significant positive effect on child academic achievement even after controlling for the mediator (educational support access).

Indirect Effect of Parental Engagement on Child Academic Achievement through Educational support access: The indirect effect of parental engagement on child academic achievement through educational support access was estimated to be 0.4064, with a bootstrap standard error of 0.1068. The 95% bootstrap confidence interval for this indirect effect ranged from 0.1976 to 0.6150, which suggests that the effect was statistically significant. The 95% bootstrap confidence interval for this indirect effect was 0.1976 to 0.6150, indicating that the effect was statistically significant. This implies that a significant portion of the effect of parental engagement on child academic achievement is mediated by educational support access.

Total R-squared: The total R-squared value of the model predicting child academic achievement was 0.5162, indicating that the predictors in the model explained approximately 51.62%

of the variance in child academic achievement.

Overall, these results indicate that both parental engagement and educational support access have a significant effect on child academic achievement, with parental engagement having both a direct effect and an indirect effect through educational support access. This suggests that parental engagement has both a direct impact on child academic achievement and an indirect impact on child academic achievement through its influence on educational support access. Total effect of home learning environment on child academic achievement: The total effect of home learning environment on child academic achievement was 0.7404 ($t = 22.8831$, $p < .001$). This indicates that for every unit increase in the home learning environment, child academic achievement increased by 0.7404 units. Direct Effect of Home Learning Environment on Child Academic Achievement: The direct effect of home learning environment on child academic achievement was 0.4078 ($t = 4.8277$, $p < .001$). This indicates that even after controlling for the mediating factor (educational support access), the home learning environment still has a significant positive effect on child academic achievement.

Indirect Effect of Home Learning Environment on Child Academic Achievement through Educational support access: The indirect effect of home learning environment on child academic achievement through educational support access was estimated to be 0.3326, with a bootstrap standard error of 0.0836. The 95% bootstrap confidence intervals for this indirect effect ranged from 0.1635 to 0.4939, suggesting that the effect was statistically significant. The 95% bootstrap confidence intervals for this indirect effect range from 0.1635 to 0.4939, indicating that the effect is statistically significant. This implies that a significant portion of the effect of the home learning environment on child academic achievement is mediated by educational support access.

Overall, these results indicate that both home learning environment and educational support access have a significant effect on child academic achievement, with home learning environment having both a direct effect and an indirect effect through educational support access. This suggests that the home learning environment has both a direct effect on child academic achievement and an indirect effect on child academic achievement through its influence on educational support access.

Discussion

The findings of this study reveal an intricate relationship between parental engagement, home learning environment, educational support access and child academic achievement. The findings lead to several important conclusions that contribute to our understanding of how these factors interact to influence children's educational outcomes, and this section suggests implications of the findings for theory, practice, and future research.

Implications for Theory

The findings of this study have far-reaching implications for existing theoretical frameworks in

the field of education, particularly those related to parental engagement, the home learning environment, and child academic achievement. By providing empirical evidence, our understanding of the complex interactions between these factors is enriched, thereby helping to refine and extend theoretical models.

First, the findings of this study reinforce the relevance of theoretical frameworks such as Bronfenbrenner's ecosystem theory (Bronfenbrenner & Morris, 2006) and Epstein's overlapping spheres of influence model (Epstein, 2018) in explaining the dynamics of parental engagement and its impact on child academic achievement. These theories emphasize the idea that individual development is influenced by multiple environmental factors, and the results of this study provide empirical support for the theoretical frameworks by further confirming the importance of home and school environments on child academic achievement.

Second, the present study extends theoretical understanding by emphasizing the mediating role of educational support access in the relationship between parental engagement, home learning environment, and child academic achievement. This finding adds to existing theories by revealing the mechanisms by which parental engagement and home environment contribute to children's educational outcomes. By including educational support access as a mediating variable, we emphasize the importance of considering environmental factors that promote or hinder children's access to learning resources and support, providing an empirical basis for the refinement of the theoretical framework.

In addition, this study emphasizes the need for a theoretical framework to explain the multifaceted nature of parental engagement and its impact on children's academic success. By revealing the direct and indirect ways in which parental engagement affects child academic achievement, we highlight the complexity of parent-child-school dynamics and call for a more comprehensive theoretical model that captures the various ways in which parents contribute to their children's learning and development. The refinement of such theoretical frameworks will help educators better understand the role of parental engagement in education and provide guidance for designing and implementing relevant policies.

In conclusion, the results of this study enrich theoretical understanding and provide empirical support for existing models, while also prompting us to further refine and extend the theoretical framework to better elucidate the underlying mechanisms of the relationship between parental engagement, home learning environment and child academic achievement. This has important implications for both research and practice in the field of education, helping to promote students' learning and development, improve the quality of education, and achieve educational equity.

Implications for Practice

The findings of this study have important implications for educational practice, providing practical guidance and insights for promoting parental engagement, improving the home learning environment and enhancing child academic achievement.

First, our findings emphasize the importance of parental engagement for child academic achievement. Educators and school administrators can enhance parental concern and support for their children's learning by encouraging and supporting parents' active participation in school and family education activities, thereby improving students' academic performance. For example, schools can organize activities such as parent-teacher conferences and parent training courses to provide opportunities for parents to participate in school education decision-making, establish a good relationship between home and school cooperation, and promote parental engagement in school education activities.

Second, the results of this study emphasize the impact of home learning environment on child academic achievement. Educators and parents can work together to improve the home learning environment to provide children with good learning conditions and atmosphere. This includes establishing good learning habits, providing appropriate learning resources and support, and establishing close communication and interaction with children. For example, parents can create a quiet study space for their children, encourage them to read and explore, and provide regular learning feedback and guidance with them in order to promote their children's academic development.

In addition, our findings emphasize the mediating role of educational support access in the effects of parental engagement and home learning environment on child academic achievement. This provides important insights for educators and policy makers on the need to focus on and enhance the provision of learning resources and support for children to promote parental engagement and improve the home learning environment. For example, schools can establish partnerships with the community, families and other educational institutions to work together to provide students with richer learning resources and support to help them better develop academically.

In summary, the practical significance of this study lies in the provision of effective strategies and methods to help educators and parents better promote parental engagement, improve the home learning environment and enhance child academic achievement. This helps to improve the quality and effectiveness of education, promote the holistic development of students, and achieve educational equity and social progress.

Implications for Future Research

The findings of this study have important implications for future related research, providing new perspectives and insights for further exploring the relationship between parental engagement, home learning environment and child academic achievement.

First, future research can further delve into the multidimensional and multilevel influence mechanisms of parental engagement. This study found direct and indirect effects of parental engagement on child academic achievement, but there are still many unknown factors that need to be further investigated. For example, the effects of different types of parental engagement behaviors on

child academic achievement and the moderating effects of different family background factors on parental engagement could be considered.

Second, future research could delve into the mechanisms of constructs and influences of the home learning environment. This study found positive effects of home learning environment on child academic achievement, but the understanding of the specific components and influences of home learning environment is still limited. Future research could consider exploring the connotations and extensions of the home learning environment, as well as the shaping and influencing of the home learning environment by different factors.

In addition, future research could further explore the mediating role of educational support access between parental engagement, home learning environment and child academic achievement. The present study identified the important role of educational support access in this relationship, but the understanding of the specific mechanisms and factors influencing educational support access needs to be further investigated. Future research could consider exploring the effects of different types of educational support access on child academic achievement, as well as the moderating role of educational support access in different contextual conditions.

In summary, the results of this study provide important references and insights for future related research, and provide new directions and ideas for deepening our understanding of the relationship between parental engagement, home learning environment and child academic achievement. Future studies can build on this foundation to further expand and promote the continuous development of theory and practice in the field of education.

Conclusions

Based on the results of the study, several conclusions can be drawn regarding the impact of parental engagement in digital education, home learning environment and educational support access on child academic achievement.

First, the results of the study indicate that there is a significant positive correlation between parental engagement and child academic achievement (H1). This result suggests that when parents are actively involved in their children's digital education, it tends to have a favorable impact on their children's academic achievement. This finding is consistent with previous research that emphasizes the importance of parental engagement in improving child academic achievement (Jones et al., 2020; Smith & Johnson, 2019).

Second, research shows that the home learning environment plays a crucial role in shaping child academic achievement. There is a positive correlation between the quality of the home learning environment and children's academic achievement (H2), implying that the creation of a supportive and conducive learning environment at home is linked to better educational outcomes for children. This

finding is consistent with existing literature that emphasizes the importance of a stimulating home environment for children's learning and development (Hill & Tyson, 2019; Wang et al.)

Furthermore, findings suggest that parental engagement not only directly affects children's academic achievement, but also indirectly through influencing educational support access. Similarly, the home learning environment has both direct and indirect effects on children's academic achievement by influencing educational support access. These findings emphasize the interrelatedness of parental engagement, home learning environment and educational support access in shaping children's educational outcomes. The study also emphasizes the importance of providing adequate educational support to parents and children to ensure equitable access to learning resources and opportunities. Policymakers, educators and parents should collaborate to develop strategies and measures aimed at increasing parental engagement, optimizing the home learning environment and improving educational support access. By doing so, we can create an educational ecosystem that enables children to realize their full academic potential and succeed in their educational careers.

In summary, the findings of this study highlight the importance of parental engagement, home learning environment and educational support access in influencing child academic achievement. The positive correlation between parental engagement in digital education and child academic achievement emphasizes the need for parents to be actively involved in their children's online and offline learning activities. In addition, the study emphasized the importance of creating a supportive home learning environment characterized by encouragement, resources, and educational opportunities. contributes to our understanding of the complex dynamics between parental engagement, home learning environment, educational support access and child academic achievement. Going forward, we need to continue research and collaboration to further explore these relationships and develop effective interventions to support children's academic success in the digital age.

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