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M.Sc. Dissertation

Relationships between teacher ratings of behavioral adjustment in school and language skills

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Abstract

Behavioral adjustment has been recognized as an essential ability for people to thrive in society, and the inability to properly adjust one's behaviors may lead to life-long harmful consequences. Previous research has identified multiple factors that are believed to affect this ability. For example, the home environment, gender, parenting styles, and Language ability are known to be related to ratings of behavioral adjustment, yet, this relationship was examined primarily on adolescents or children above age 4. This present study aims to investigate whether the association between language skills and behavioral adjustment is present in children during their nursery school year (i.e., around age 3 to 4). In this secondary data analysis, we measured 545 children in this age band on their language skills using three standardized language assessments including LanguageScreen, CELF P-2, and RAPT, and used a teacher-rated questionnaire to evaluate their behavioral adjustment. We also investigated and controlled for effects associated with the participant's age, gender, and family income level. Results revealed that older students and girls tended to receive significantly higher behavioral adjustment scores, which means they displayed fewer behavior problems. However, surprisingly, children from the lowest household income group exhibited significantly fewer behavioral adjustment issues than their peers from the most privileged group, which was in contrast with our hypothesis as well as previously established studies. Language ability, as we expected, was a significant predictor of children's behavioral adjustment and this relationship existed in both boys and girls. This dissertation provides evidence indicating the association emerges as early as at the age of 3. Findings from this dissertation raise the possibility that externalizing problems in young children may be at least partly a reflection of impaired language skills in some children.

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Chapter 1: Introduction

During the early years of life, children spend most of their time learning and exploring in the home setting, and the majority of interactions happen with caregivers and family members. However, at around the age of three, many of them reach the first milestone in life: transition from home to school. Although most of the families could foresee the transition coming, it can still be a challenge since such a transition requires children to adapt to an unfamiliar environment and unexpected situations (Longobardi et al., 2019). This ability to accommodate one's behaviors to meet the requirements of the environment is known as behavioral adjustment (Kitayama et al., 2018). This paper focuses primarily on children's behavioral adjustment in the nursery classroom because it can be seen as the beginning stage for children to transition into a formal school setting and demands substantive adaptations to the new environment.

It is believed that this ability is critical and essential to be equipped since numerous studies revealed that maladjustment in early ages may generate long-term adverse effects on children's psychosocial development, academic performance, and may also lead to higher unemployment rate or lower payment comparing to people who had not experienced problems in behavioral adjustment before (Fantuzzo et al., 2005; Nelson et al., 1996; Vargas et al., 2019). Such problems are likely to appear concurrently with other learning difficulties or socio-emotional problems (Lutz et al., 2002). Also, empirical research found close associations between early-year behavior problems and more severe antisocial problems in later childhood or adolescence (Harden et al., 2000).

Moreover, behavioral difficulties such as deficient self-control, and poor social relationships are one of the most prevalent problems concerning children's psychosocial wellbeing in preschool years (Harden et al., 2000). Campbell (1995) reported data from a wide range of literature and found that up to around ten to fifteen percent of preschool-aged children exhibited mild to moderate problem behaviors. A

more recent analysis of statistics suggested that around 11% of students in preschool years and 31% of primary school children showed some levels of behavioral problems (Annett, 2012) which revealed the high incidence rates of such problems.

Considering the adverse consequences and high prevalence of behavioral problems, understanding what factors may be related to a child's behavioral adjustment can be beneficial in terms of providing recommendations for the development of intervention programs that alleviate possible unfavorable consequences in their later years in life.

Previous researchers have recognized multiple factors from different levels (i.e., individual, family, and teacher/school) that are related to one's behavioral adjustment. Nelson et al. (1996) reported that an individual's disability in coping with social problems and poor self-regulation performance is closely related to the exhibition of disruptive behaviors and maladjustment. A child's temperament has been found to be associated with his/her behavioral adjustment and the frequency of in-class behavioral problems (Mobley & Pullis, 1991). Moving beyond the individual level, researchers also identified that family-related factors such as mother's characteristics, family cohesion, and the quality of parents' relationships are associated with the child's behavioral adjustment (Abidin et al., 1992; Hakvoort et al., 2011; Mckelvey et al., 2015). Student-teacher relationships that are close and supportive can facilitate children's adjustment to the formal classroom setting, while relationships with conflicts and overdependence are tied to poor adaptation (Birch & Ladd, 1998; Pianta et al., 1995).

1.1 The present study

This dissertation focuses on four aspects that are likely to have an impact on one's behavioral adjustment: the individual's age, gender, family income level, and language skills as all these variables have been reported to affect or demonstrate

correlations with a child's behavioral adjustment in multiple empirical studies (Coolahan et al., 2000; Fantuzzo et al., 2003; Kaiser et al., 2002; Singh & Ghandour, 2012).

In this study, we focus on language skills as the primary factor because of the central role language ability plays in children's development. Besides some obvious functions such as to communicate and to interact with others, and to create and exchange information (Sadiku, 2015), language skills have also been shown to be associated not only with one's later academic performance, but also with people's general cognitive ability such as the theory of mind, working memory, and executive functioning (Clegg et al., 2005; Deák, 2014; Henry et al., 2012; Milligan et al., 2007). In addition, researchers also found that language deficits are associated with a higher risk of experiencing psychiatric disorders that are related to emotional and behavioral problems (Clegg et al., 2005; Gordon, 1991). Therefore, we hypothesized that even early in life, a child's general oral language ability is correlated to his or her ability to exert control and adapt one's behaviors.

In short, this dissertation aims to first identify the relationships between children's behavioral adjustment in nursery schools and their age, gender, and family socioeconomic status. More importantly, we set out to examine the association between one's language skills and behavioral adjustment while also controlling for the effects of an individual's age, gender, and family income level (SES).

1.2 Research questions

The study is aimed to answer the following four questions:

1. Can we predict variations in behavioral adjustment in nursery school, based on one's age?

2. Is gender related to variations in behavioral adjustment in nursery-aged children?
3. Is socioeconomic related to behavioral adjustment in nursery-aged children?
4. Do language skills explain additional variance in children's behavioral adjustment after controlling for their age, gender, and socioeconomic status?

These four research questions and their corresponding hypotheses will be further discussed in the methodology chapter.

1.3 Purpose of the study

One purpose of this study is to address knowledge gaps and fill in some pieces of evidence missing on this particular topic in the literature. In addition, we also want to provide empirical evidence to verify previous studies and to resolve discrepancies. As this dissertation has the aim to find out the relationships between children's language skills and their behavioral adjustment at school, the ultimate purpose is to provide some educational implications on the development of interventions in ameliorating one's behavioral adjustment problems. To be more specific, if language skills are a critical predictor of behavioral adjustment, then, it raises the question of whether this association can be further extended to a causal relationship for future studies, and if so, whether language intervention may operate to improve behavioral adjustment.

1.4 Paper structure

This paper has five main sections: introduction, literature review, methodology, results, and discussion and conclusion. Starting from this introduction chapter, this chapter illustrates the primary rationale and structure of this paper as well as a brief introduction of the topic, along with the research questions we are interested in. The literature review chapter contains definitions of key terms and summaries of recent

studies. We have noted some divergent findings as well as limits of their findings that our current study can provide evidence to join for discussion. We also consulted two primary theoretical frameworks for this study which are also included in the second chapter. The next chapter is methodology, which introduces the sample of this study and measures we used when evaluating participants' language ability and behavioral adjustment in school and also statistical approaches we adopted. The results chapter displays major outputs including tables that answered our four research questions. Discussions of the results are presented after, where strengths, limitations, implications, and suggestions for future studies are also included. Finally, a short conclusion session reviews this dissertation and summarizes the key reflections.

Chapter 2: Literature Review

This chapter contains definitions of the two key variables that are going to be constantly discussed throughout the entire paper. We also present related studies and their findings as well as their limitations and literature gaps. Theoretical frameworks are also introduced to better understand this study.

2.1 What is behavioral adjustment

Behavioral adjustment is known as the active change in behavior for the purpose of adapting to the environment and meeting the needs of the new context so that one can function well in the new environment (Kitayama et al., 2018; Piqueras et al., 2019). Crow and Crow (1962) described that people rely on motivations such as the desire to succeed in school or the workplace or to live a happy life in order to make adjustments to their behaviors.

Wentzel (2013) presented a conceptual framework of adjustment using an ecological and competence-based approach, saying that adjustment refers to "engaging in positive forms of social behavior that result in social integration and in positive developmental outcomes for the self." (p.213). In which, she proposed those socially integrated outcomes being the ones that are identified as socially approved positive outcomes which facilitate the smooth operation of the social context. On the other hand, positive self-outcomes should be able to reflect self-achievement or personal competence and self-determination and can lead to feelings of well-being on both social and emotional aspects.

Therefore, adjustment is a notion that relies heavily on the situated context in terms of what the essential requirements of that environment are. People keep seeking for the harmonious stage between their own needs (e.g., being successful in schools and vocations, experiencing a happy life, etc.) and the requirements or demands of the

specific environment they settled. In other words, we constantly change our behaviors and look for the most appropriate pattern of reacting after detecting a significant alteration in the environment in order to maintain the equilibrium between self-needs and social-needs.

2.2 Frustrations in behavioral adjustment

If a conflict occurs between one's ego-satisfying and socio-satisfying desires, and an individual cannot reach the balance point, it is likely for one to go through some inside frustrations (Crow & Crow, 1962). There are multiple reasons that lead to the conflict. For instance, when what we have learned and the way we usually behave do not meet the requirements of the new context, we will need to learn and adjust our behaviors to accommodate and thrive in this new environment. A real-life example would be that someone who grew up and learned how to drive a car in a right-driving country who then moved to the U.K. or other left-driving countries would need to override one's previously learned behavior to satisfy the different requirements of the new environment (Mansouri et al., 2009).

Accordingly, this capacity of adjusting behaviors sometimes requires us to go against our habituated responses (Mansouri et al., 2009). Hence, cognitive abilities such as self-control and regulation may be necessary processes to go through when encountering these conflicts.

2.2.1 Mechanism of handling frustrations

As suggested by Crow and Crow (1962), some frustrations are easy to deal with while others are hard to overcome. For example, when a young child feels frightened in an insecure environment, one may display aggressive behaviors trying to master the circumstance or may start to cry and yell to grasp other's attentions and ask for help

from them. For older kids, delinquent behaviors are sometimes used to attract attention from adults in pursuit of their needs and desires. These actions are simply some tactics that children use to surpass obstacles that prevent them from feeling satisfied or handling frustrations led by conflicts between self-needs and social-needs, yet can be recognized by adults as maladjustment according to social norms and rules of the context.

2.3 Why is behavioral adjustment important?

As outlined previously, behavioral adjustment is an essential skill that relates to future trajectories and outcomes of development. Problematic behaviors in children not only affect school achievement which may be the most direct and obvious consequence that can be observed, but also have adverse consequences for social competence, interpersonal relationships, mental health, professional attainment, and can lead to defiant and violent behaviors (Hukkelberg et al., 2019; Vargas et al., 2019).

McLeod and Kaiser (2004) analyzed a set of longitudinal data and followed the participants from 1986, when participants were around 6 to 8 years old, to 2000. This study revealed that children with a higher level of externalizing problems were less likely to graduate from high school. This relationship was weaker but significant even after controlling for their demographic and maternal characteristics and socioeconomic level. Therefore, this study confirmed the significant association between the level of externalizing problems and later academic attainment.

Fronstin et al. (2005) extended their observation into the labor market by following the life trajectory of around 6000 participants. They found that people who exhibited childhood behavioral problems at ages 7 and 16 were at higher risks of experiencing economic hardships at the age of 33. To be more specific, those people were less likely to be employed or to get high-payment jobs, and one of the attributions

was that they tended to receive a lower level of education. Researchers of this study also found that teacher's ratings of students' behaviors served as a stronger predictor than the ratings from parents on children's education and professional outcomes as teachers are less accommodated to children's behaviors and can compare their behaviors with other students.

On that account, an individual's early behavioral adjustment produces life-long effects on developmental outcomes. Therefore, understanding children's behavioral adjustment can be beneficial in terms of providing adequate and in-time support for those children who have difficulties in behavioral adjustment.

2.4 Behavioral adjustment in school

Incorporating how we have defined behavior adjustment previously, behavioral adjustment in school requires students to meet and follow the requirements of the classroom while individuals are also trying to fulfill the demands of the self. Although scholars concluded that people tend to adjust their behaviors to achieve the maximum satisfaction in life and that adaptation happens according to the individual's understanding of one's goals (Crow & Crow, 1962), social contexts they are in, such as school settings and workplaces, often possess specific requirements or social norms that apply to everyone and need people to adapt with efforts.

Anderson et al., (2002) stated that adjustment always happens after significant life-altering circumstances occur. When it comes to children, entering school is a huge transition for them because before that time point, they have been settled in the home environment, and most of them have learned how to behave at home to fulfill both needs of themselves and the environment. However, there are additional and various requirements that are unique to school settings, for example, following classroom disciplines and teacher's instructions, interacting with teachers and collaborating with

peers, etc. (Shavega et al., 2014) that the child has to adapt to. In addition, the appraisal of one's behavioral adjustment at school depends vastly on whether the school or the teacher values the student's behaviors or whether they consider one's behaviors as promoting the smooth operation of the setting.

2.5 Internalizing and externalizing behavioral adjustment

Many researchers evaluate children's behavioral adjustment from two perspectives: internalizing behaviors and externalizing behaviors (Bornstein et al., 2010; Caspi et al., 1995; Narusyte et al., 2017). Internalizing behaviors are characterized as behaviors that reflect the inward state of a child, which mostly are negative feelings (Liu et al., 2011). Typical problems or disorders related to internalizing behaviors include depression, anxiety, experiencing inferiority complex, and somatic complaints (Bornstein et al., 2013). On the other hand, externalizing behaviors refer to negative outward actions that manifested in the external environment (Liu, 2004). Children with externalizing behavior problems often display aggression, defiance, impulsive behaviors, hyperactivity, as well as difficulties in attention and regulation (Bornstein et al., 2013).

2.6 Behavioral adjustment in the current study

This present study focuses on three primary subcategories of behavioral adjustment: behavioral regulation, hyperactivity, and sociability. Although we use "behavioral adjustment" as the term throughout this paper, what we are referring to is closer to what we have known as externalizing behavioral adjustment. This is because Gallagher (1999) had concluded that externalizing problems, compared to internalizing problems, are more likely to happen in younger-aged children. Therefore, these behaviors deserve more exploration and may lead to more meaningful implications

since we are interested in investigating the relationships between behavioral adjustment and other variables from participants in a younger age group.

2.6.1 Behavioral regulation

Behavioral self-regulation is a construct that reflects a list of skills such as modulating attention, behavioral control, inhibiting dominant responses that rely heavily on one's level of executive functioning, working memory, and cognitive flexibility (Caughy et al., 2018; Wanless et al., 2013). Some researchers also include the regulation of emotions and cognitions into this comprehensive construct (von Suchodoletz et al., 2013).

In this research, we also define behavioral regulation as a broader terminology that takes both emotion and behavior into evaluation.

2.6.2 Attention deficit and hyperactivity

The display of inattentive and hyperactive behaviors are two of the major diagnostic criteria of Attention Deficit Hyperactivity Disorder which is more commonly known as ADHD (Merrell & Tymms, 2001). Some demonstrations of these behaviors include difficulty in maintaining attention, difficulty with following instructions and finishing tasks, inability to stay still, and excessive and often inappropriate amount of verbalizations (Sroubek et al., 2013), which are also the key focuses in our study.

2.6.3 Sociability

A child's sociability often has been measured based on the presence of a range of sociable and unsociable behaviors (Snow et al., 1981), for example, the participation

of group activities, competing behaviors, friendly interactions with peers, and sharing (Snow et al., 1981; Sontag, 1997). We evaluate children's sociability according to their playing and sharing patterns with peers in school.

2.6.4 Summary

Self-regulation of behaviors, focusing on tasks and following instructions, and interacting with peers in a friendly manner are all essential disciplinary rules of school settings and may be new requirements for some of the children. Therefore, students' ability to smoothly adapting to these contextual demands is no doubt a reasonable representation of their capacity in behavioral adjustment and has been chosen to be evaluated in this study.

2.7 Language skills

Language ability as a multidimensional construct includes four major aspects of skills: speaking, listening, reading, and writing (Nan, 2018). This dissertation considers primarily verbal language skills and focuses on one's proficiency in speaking and listening as well as some basic linguistic rules. For example, children's expressive and receptive language, listening comprehension, the accuracy of grammar and information presented when answering questions, etc. This is because children in our study were between 3 to 4 years old and were at the stage that builds the foundation for later literacy development yet relied more on verbal communication instead of written language (Topolavac et al., 1997).

According to Sadiku (2015), speaking and listening are highly interrelated skills that work together in fostering one's oral communication in real life. Therefore, oral language skills have been recognized as essential abilities that contribute to one's development and life achievement. For instance, West et al. (2021) summarized that

language skills serve as a cornerstone for the acquisition of literacy comprehension skills, mathematical skills, as well as socio-emotional development.

2.8 Language skills and behavior

Gallagher (1999) mentioned in her study that there appeared to be a great overlap between children who had been diagnosed with emotional and behavioral problems and those who had certain levels of language difficulties (62% to 95%) and a large portion of children who had language impairment also experienced emotional and behavioral problems (50% to 75%). Therefore, it seems that problems in language ability and problems in behaviors are likely to occur simultaneously, showing an interrelationship between these two problems. Multiple scientific resources have also reported that language deficits are likely to increase the risk for a child to show conduct problems (Van Daal et al, 2007; Tommerdahl & Semingson, 2013) and even more severe violent behaviors (Sanger et al., 2004).

A meta-analysis conducted by Chow et al. (2018) which contains 27 studies and 31,647 participants from four English-speaking countries and also Germany showed a significant negative relationship between one's early language skills and later presence of behavior problems. Another systematic review done by Chow and Wehby (2018) found a similar inverse relationship for both concurrent analyses (N = 8) and predictive analyses (N = 10), suggesting that poorer language ability is related to a higher level of behavioral problems.

As aforementioned, children sometimes display different forms of disturbing behaviors because their needs have not been met or the conflict between their own needs and the requirements of the context were inextricable. One of the possible reasons that leads to these situations is that something went wrong during their communications with the outside world. In other words, children may have difficulties in understanding

the meaning of others' words, such as instructions, or have trouble expressing their thoughts and needs (Royal College of Speech and Language Therapists, 2019; Tommerdahl & Semingson, 2013). In the meanwhile, these inappropriate behaviors can further result in poor relationships between children and their teachers and peers and cause fewer healthy interactions and communications, which then prevents children from receiving adequate oral language practice. In addition, children who are more aggressive produce more non-verbal actions when handling social problems hence constrains their use of language and limits their language development (Bornstein et al., 2013). Therefore, it is not hard to understand the putative existence of associations between poor oral language and behavior problems.

2.9 Theoretical frameworks

Although we have presented much empirical evidence and some analyses based on empirical studies indicating associations between language and behavior regulation, and we have mentioned possible explanations for such an association. However, it is still vital to review some solid theories that are helpful in better understanding the underpinning theoretical structure of this current study.

2.9.1 Vygotsky's theory of speech and behavior

Vygotsky as an influential psychologist has contributed an appreciable number of ideas to the field of developmental psychology. This dissertation references two of them which are the sociocultural theory and the idea of the close connection between one's language and thought (Vygotsky & Cole, 1978; Vygotsky et al., 1987).

2.9.1.1 Sociocultural theory and language

Vygotsky stressed in his works the importance of cultural and contextual influence and their relationships with children's mental development and functioning (Özdemir, 2011). Mahn and John-Steiner (2012) pointed out that in Vygotsky's theory, language and dialogues can serve as a mediational tool, also known as semiotic items, that transfer meaning, information, experiences, and values of that culture from older generations to young children which allows them to fully develop their higher mental functions and to become part of the community. Therefore, children are constantly learning through interactions with experienced adults in the community. While narrowing the cultural context into the smaller proximal setting, we believe that interactions using language and discourses are crucial for young children because by mastering this mediation tool (i.e., language), children will be able to acquire experiences and guidelines from experienced members (i.e., teachers) more efficiently and to adapt themselves better to the context.

2.9.1.2 Language and behavior - social speech, private speech, and inner speech and self-regulation

According to Vygotsky's (1987) general objection to Piaget's theory of 'egocentric' speech which claims that this kind of speech to the self is the start of language development, he believed that social speech is the type of language that develops earliest in life which permits children to communicate with the external world. Vygotsky stated that communicative speech to others eventually will become the silent and hidden inner speech via internalization of the outward speech. However, what we want to discuss here is another form of speech in between that bridges these two stages called private speech.

Private speech is the behavior of talk-out-loud to the self, which often happens when the child is exploring the environment or working on tasks (White & Daugherty, 2009), and the rise of private speech peaks at around 3 to 7 years old (Davis et al., 2013). In an extended version of 'Thought and language' (Vygotsky et al., 2012), private speech has been recognized as a critical element for problem-solving, and the study of private speech has been extended to the exploration of the relationships between verbalizations and cognitive processes that are necessary for executive functions and self-regulation.

White and Daugherty (2009) maintained that based on Vygotsky's sociocultural theory, private speech is the foundation of future development of inner speech and it allows children to self-direct or to control their behaviors. These two authors also believed that private speech reflects children's thoughts and enables them to hear how they think about their actions so that they can select the set of intended behaviors. In Vygotsky et al. (2012), the authors also revealed that children who make greater and faster progress in switching from private speech to inner speech often display better ability in maintaining attentional focus and ignoring distractions and that children who experience learning problems tend to produce private speech that is irrelevant to the task.

To conclude using a quotation from Müller et al. (2009, p.57), "Language leads to consciousness, but then it is the conscious use of language in a self-directed speech that allows children to exercise control over their thoughts, actions, and emotions." Therefore, it seems that the development from social speech to private speech and eventually to the complete internalization of speech has a profound influence in regulating and directing children's behaviors.

2.9.1.3 Summary

Vygotsky's sociocultural theory and the three stages of speech help us understand how language ability is closely related to one's behavior. To fit this theory into our study, we believe that language ability influences one's behavioral adjustment in two ways.

Firstly, Müller et al. (2009) explained that children learn regulatory functions during daily interactions and communications with adults and apply these functions later in their own behaviors. That is to say, children can learn the appropriate ways of behaving in the new contexts through verbal interactions with other experienced members. For example, in a classroom setting, children can learn from having discourses with teachers or listening to teachers' guidelines on what are the rules of the classroom, what are the things they are allowed or not allowed to do, etc.

After acquiring these rules and experiences from adults, children use self-speech as a way to give themselves commands and to direct their own behaviors. Since the transformation from social speech to private speech happens primarily at age 3, which matches our sample's age band, we believe that it should be seen as a crucial theoretical cornerstone of this study. Therefore, language transforms from an external signal (information from others) into an inner construction (self-guide speech), and both functions are related to managing and adapting behaviors in school.

2.9.2 Bloom and Lahey's model of language

Instead of presenting a broad linkage between language and behavior from a cognitive development perspective, Bloom and Lahey (1978) demonstrated how language as a practical tool for communication should be addressed when thinking about the verbal interactions between the child and one's proximal environments (e.g., home and school). More specifically, for those children who displayed problem

behaviors, did they fully understand what they have been told? Did they know how to use verbal language to communicate with others effectively?

2.9.2.1 Three dimensions of language

Bloom and Lahey (1978) proposed a three-dimension language model describing that the content, form, and use of language are three components that form the scheme to understand language and language disabilities. The content of language refers to the information and meanings of the message, or the idea and topic encoded that should be delivered to the listeners. The form of language includes structures of sentences and different features of the language, such as grammar rules, syntax, and phonology. The use of language represents the pragmatic aspect of language, emphasizing the ability to understand social cues and communication conventions, and the selection of appropriate language to reach different goals. Figure 1 uses a Venn diagram illustrating the integration of the three dimensions. The authors evinced that one has to master all three dimensions to become a competent communicator.

Figure 1. Bloom and Lahey (1978), The three-dimension language model



Note: This figure was created based on Bloom and Lahey (1978, p.22, BOX I-5)

2.9.2.2 Content and form of language and adjustment problems

As we have defined before, behavioral adjustment requires individuals' adaptation to the context and meet the demands of the environment (Kitayama et al., 2018). Oral language is likely to be one of the dominant means for adults to convey the requirements of the context, considering the constrained reading ability in young children. That being the case, if the child does not have competent language skills to understand the information given in messages, one may have a hard time receiving correct instructions and guidelines that help one to know how to behave properly in accordance with the environment's demands.

This model is similar to Vygotsky's sociocultural theory: both emphasize the child's ability to understand instructions and rules through verbal interactions. However, Bloom and Lehay (1978) gave more specific details on the exact components that the child has to acquire if one wants to have competent language skills.

2.9.2.3 Bloom and Lahey in our study

Although we did not collect data measuring the communication skills of children in our sample, we have examined students' language ability from multiple aspects related to Bloom and Lahey's (1987) form and content components. For example, receptive vocabularies are words that one can decode and understand and expressive vocabularies are words that one can encode and produce (Burger & Chong, 2011), and these semantic skills of understanding and expressing words are part of the content dimension in this theory. On the other hand, data collected examining the abilities to use correct grammar and sentence structures are closely related to the form component. Hence, according to Bloom and Lahey (1987), if the child has difficulties in these areas, he or she is not yet a competent communicator and may encounter

awkward situations or showing notable disobedient behaviors in the context (Owen, 2014).

2.9.3 Theoretical frameworks summary

In conclusion, Bloom and Lahey's language model, and Vygotsky's sociocultural theory, and three-stage speech scheme underpin our study of the relationships between children's language skills and in-school behavioral adjustment. First of all, children have to possess competent language skills of understanding others' words and producing understandable and meaningful messages so that they can respond in a way that fits the environment and interact properly with teachers and peers. In addition, children first use social communication to guide their behaviors and gradually learn how to self-guide using private speech starting at around age 3 where both stages require basic language skills. Therefore, language ability is important in influencing children's ability to adjust and regulate their behaviors in school.

2.10 Recent studies on the relationships between externalizing behavior problems and language ability

When we look at the more specific type of behavioral problems which is the main focus of our study, a large body of studies have brought to discussions on the associations between externalizing behaviors and one's language skills (Botting & Conti-Ramsden, 2000; Girard et al., 2014; Petersen et al., 2013), and most have found that poor language ability is significantly correlated to high levels of externalizing problems.

Petersen and LeBeau (2021) conducted a longitudinal study, following 1364 students from age 4 to age 10, and assessed their language ability, externalizing behavior problems, and social skills. Results revealed that there was a within-child

association between one's language skills and externalizing behaviors. Based on behavioral ratings from both the teacher and the mother, researchers found that the lower level of language ability at ages 4 and 6 could predict more externalizing behavior problems in two years. Teacher's ratings at age 8 were also significant in predicting later externalizing problems.

Another longitudinal study investigated the relationship between children's receptive language ability and externalizing problems concluded after analyzing data from 615 observations since kindergarten to grade four that, at all age levels, children's externalizing behaviors increased if they had poorer receptive language skills while decreased if they received higher scores in the receptive language assessment (Menting et al., 2011).

However, both of these studies only measured one's receptive vocabularies representing one's language ability. According to the theoretical frameworks we adopted, understanding other's words is not the only aspect that may affect one's behaviors (e.g., expressive vocabularies). Therefore, these studies only revealed relationships between the child's receptive language skill (i.e., receptive vocabulary) and one's externalizing problems which may not be adequate in understanding the association.

Results from Dionne et al. (2003) revealed a moderate correlation between expressive vocabulary and physical aggression in 562 19-month-old young twins which proposed the linkage between expressive vocabulary and aggressive behaviors using empirical research. Another study conducted in Dutch with a larger sample (N = 5,497) also found that after adjusting for potential covariates such as demographics as well as receptive vocabulary delay, a higher risk of internalizing and externalizing problems at age 3 were associated with expressive vocabulary delay at 18 months (Henrichs et al., 2013).

Two independent studies carried out in the United States with a total participant of 224 (N = 85; N = 139) children generated similar results using data provided by teachers and parents (Bornstein et al., 2013). The first study measured children's language ability and behavior problems at ages 4.5 and 7. Negative concurrent relationships were found between one's language skills and externalizing behaviors but not with internalizing behaviors. The second study extended their observations to a later stage, collecting data at ages 4, 10, and 14. Significant negative co-occurrence relationships at all three stages revealed that externalizing behaviors are correlated to poor language skills when participants were at each age level of study. Internalizing behaviors also possessed significant negative relationships with language ability variables at ages 4 and 10 but not at age 14.

Brownlie et al. (2004) reported some interesting findings indicating that after controlling for one's verbal IQ and other demographic and family factors, there was no significant difference in behavior problems between girls with language impairments and girls without language impairments. However, boys who had language impairments at age 5 had more delinquent behaviors, according to their parents' ratings, during early adulthood. Therefore they concluded that the association between language impairments and behavior problems only existed in boys. However, other research did not report similar findings. For instance, Petersen and LeBeau (2021) did not detect significant sex differences in this association, and Monopoli and Kingston (2012) found that the prediction of externalizing behaviors based on language ability was only significant in girls. One possible explanation provided by Brownlie et al. (2004) was that they have a relatively constrained sample size where only 58 girls had been included for analysis; although this is not a statistically inadequate sample, authors believed that it still restricted the statistical power of that research (Columb & Atkinson, 2015). Thus, larger sample size was sought by the authors to examine this sex difference in the association. Therefore, it is necessary to investigate whether our sample would

show this sex-related difference and to provide scientific evidence for this inconclusive question.

2.10.1 Gaps and limitations in the literature

Although most studies in this area, especially longitudinal studies, have addressed a wide age range when studying the relationship between language skills and behavioral adjustment, few of them have included children as young as 3 years old. For example, most studies presented in this chapter only recruited participants older than 4 years old (e.g., Bornstein et al., 2013; Brownlie et al., 2004; Menting et al., 2011; Petersen and LeBeau 2021). Since behavioral regulation-related skills, as well as corresponding brain structures, start to develop rapidly at around age 3 (Karreman et al., 2006; Montroy et al., 2016), children often start to engage in some school or classroom settings during this age. Hence, studying behavioral adjustment in children around 36 months is important as it may produce educational implications that can benefit a great portion of the population.

One exception of the age range was Girard et al. (2014) who included children from 17 months to 71 months and found reciprocal associations between physical aggression and language skills from 17 to 41 months. However, this study only explored the relationship between aggressive behaviors and language skills, it did not include other aspects of behavioral adjustment such as social interaction and hyperactivity. Also, this study utilized different measurements for language skills and aggressive behaviors across different stages of development to meet the applicability of assessing children from different age groups. Therefore, these assessments may measure different aspects of language skills and physical aggression or adopt different scales for evaluations and may lead to inaccurate results.

In addition, not all existing studies have considered the effects of age, gender, and SES altogether. Socioeconomic status had been controlled for in Bornstein et al. (2013), Brownlie et al. (2004), and Menting et al. (2011). However, the sample used in Bornstein et al. (2013) had elevated levels of SES and maternal education, and their findings may not be generalizable to the larger population due to this advantaged sample group. Gender was only addressed and controlled in Girard et al. (2014) and Menting et al. (2011), and both studies found results in line with previous studies showing that boys often display more behavior problems than girls. Yet, as mentioned before, Girard et al. (2014) only focused on one single aspect of externalizing problems, which was physical aggression. This can be especially biased when considering gender-related differences as overt aggression is more typical in boys (Dodge et al., 2003) but this pattern may not display in other aspects of externalizing problems.

To summarize, many studies have explored the associations between children's language proficiency and behavioral adjustment, yet, there were limitations and gaps in these studies. Considering these shortcomings and gaps, our current study provides the opportunity to investigate the relationship between children's general oral language skills and their behavioral adjustment in classroom settings at a younger age while also controlling for the possible confounding effects of age, gender, and SES. Ratings of children's language skills and behavioral adjustment included multiple aspects so that the evaluation would be more comprehensive. Additionally, we can look into whether the gender-related differences in the association between the two variables would appear in our sample with larger sample size.

Chapter 3: Methodology

This chapter includes five main sections, introducing the research design, research sample, critical measures, research questions and hypotheses, and methodological approaches.

3.1 Secondary data analysis

Secondary data analysis is an empirical analysis approach that uses pre-existed data obtained by another research team to answer a new question (Smith, 2008). Carrying out analysis with secondary data has both apparent advantages and limitations. For example, it enables the researcher to have access to a relatively large-scale sample of excellent quality while minimizing possible costs such as funding, time, and human resources (Miller & Brewer, 2003). This advantage, in particular, is valid for this study as the possibility is immensely low for a master's student to collect high-quality data from around 3,000 students in 60 schools nationwide in half a year. In addition, unlike many other secondary studies using data that had been collected a long time ago and had been analyzed thoroughly, our data was recently gathered and had great potential to be further investigated.

On the other hand, analyzing secondary data has its own limitations. First of all, the data was collected for another purpose which means some variables that are desired by the current study may not be available in the dataset (Smith, 2008). In addition, it is possible that the dataset is not fully available to the researcher, and given only partial access might also cause problems and difficulties during analysis (i.e., dealing with missing values). These two limitations will be further discussed in the limitation section. Besides, it can consume the researcher a great amount of time trying to understand the variables and data (Miller & Brewer, 2003). Fortunately, this study does

not have such a concern as the data was collected by researchers in the department who provided necessary contextual information about the data during analysis.

The decisive reason to adopt this method was that under the unprecedented situation of the global pandemic, it was impossible to do in-person fieldwork in England for data collection concerning school and students' availability and individual and community safety. Therefore, after weighing the benefits and possible drawbacks of using secondary data and inspecting the situation, employing a dataset gathered by a professional research team was one of the most rational decisions to make.

3.2 Ethical approval

The original study had been granted ethical approval by the University of Oxford. All the participants had been anonymized before being used in the current study. According to the General Data Protection Regulation (GDPR) regarding personal data, secondary data with no identifiable information do not need to go through the Central University Research Ethics Committee (CUREC) scrutiny (*Research ethics glossary*, n.d.). Therefore, no additional ethical approval of this current study had to be obtained.

3.3 Original sample

The sample being used in this study was collected by a research team led by a professor at the University of Oxford. The original study was a cluster randomized control trial aimed to evaluate the efficiency of a language intervention program and to facilitate children's language development.

The study initially included 1534 children in nursery classrooms from around 70 classrooms in 62 schools in England, and data of 2027 students from these 62

schools in their reception year were collected a year later. Among all the children, 636 participated in both phases of data collection. Therefore, after deleting the overlapped participants, a total number of 2925 children was encompassed in this original dataset.

3.3.1 Procedures

Before the intervention started (i.e., the nursery group), all of the students had taken a language screening test (LanguageScreen) while only some had been administered in-depth language assessments (i.e., CELF and RAPT; N = 630) or had been rated on their behavioral adjustment (N = 694).

Even though the intervention had been terminated nine weeks after it started due to the outbreak of the Covid-19, researchers went back to those schools a year later and finished their second phase of data collection. During this stage, students only attended the LanguageScreen test and the BESSI test.

3.3.2 Final sample and missing values

Although the original study contained about 3000 participants, only a few hundred fulfilled the requirements of fitting in the targeted age band and attending all the language tests while also having a teacher-rated behavioral adjustment score.

Since we are interested in investigating behavioral adjustments in nursery school children who were 3 to 4 years old, we have excluded all observations of the reception group as well as those aged above 50 months as they are not the group of interests of this study. We also had to drop a large number of students who did not take in-depth language tests and those who did not have behavioral adjustment scores as there was a lack of data to be analyzed, which then brought the total case number down to 586. Lastly, there were 30 observations that contain missing values in either BESSI

behavioral adjustment or language assessments. Since the data used listwise deletion in the first place, and we did not have complete access to the observations with missing values, hence could not adopt other potential techniques such as imputation to adjust for missing values. Fortunately, 30 takes up around 5% of the total data, which is an acceptable portion to use listwise deletion without resulting in significant consequences (Bennett, 2001; Schafer, 1999). Another ten observations had been excluded since they had been identified as outliers, and a more detailed elaboration will be given in section 3.6.5.

The final participants of this study were 545 children from around 70 nursery classrooms in 62 schools in England. Children were from 37 to 50 months old (M = 42.63 months, SD = 3.43 months), and we have 252 girls and 293 boys. About half of the sample had English as an additional language. Students were from a wide range of socioeconomic backgrounds as there are children from all ten IDACI intervals indicating their family deprivation level ranged from the least to the most. All the children have completed scores of both language assessments and behavioral adjustment. Table 1 includes descriptive data of all participants' demographic information.

Table1: Descriptive statistics of children's demographic information

Variable		M and SD	N	Percentage (%)
Age (Mon)	Mean	42.63		
	SD	3.43		
Gender	Male		293	53.76
	Female		252	46.24

School No		62	100.00
EAL	EAL	251	46.05
	Non-EAL	291	53.39
	Unknown	3	.55
IDACI (decile)	1	36	6.61
	2	39	7.16
	3	39	7.16
	4	77	14.13
	5	66	12.11
	6	55	10.10
	7	70	12.84
	8	83	15.23
	9	40	7.34
	10	40	7.34
N		545	

Note: Age range: 37-50 months; IDACI: 1 represents the most deprived ten percent families while 10 is the least deprived ten percent.

3.4 Measures

3.4.1 SES - Income Deprivation Affecting Children Index (IDACI)

IDACI is one of the indices measuring the percentage of children from the age band of zero to 15 whose household is experiencing income deprivation (Communities and Local Government, 2011). It was created by the Department for Communities and Local Government allowing residents to use postcodes to identify the level of

deprivation of that area and can be treated as an indicator of a child's socioeconomic status (Crawford & Greaves, 2013).

To make the level of deprivation more intuitive and comparable, we use the 'deprivation decile' demonstrating the relativity of the family's income deprivation. 32,844 neighborhoods nationally have been ranked on poverty from the least to the most. Then, these neighborhoods were evenly fractionated into ten groups, each containing ten percent of the neighborhoods (Ministry of Housing, Communities, and Local Government, 2019). The most deprived ten percent (1% to 10%) would be numbered as one, while the least disadvantaged ten percent (91% to 100%) was ten. To put it in a simple way, the lesser the decile is, the greater the severity of deprivation that area is.

3.4.2 Behavioral adjustment - Brief Early Skills & Support Index (BESSI)

Students' behavioral adjustment was rated using the Brief Early Skills & Support Index (BESSI), which is a teacher-rated questionnaire developed to assess children's readiness to school (Hughes et al., 2015). The original scale comprises 30 questions measuring four different aspects: behavioral adjustment, language and cognition, daily living skills, and family support. Although researchers collected data from the complete questionnaire, this present study would only use the behavioral adjustment subscale for analyses. This subscale consists of 12 items that reflect a child's behavior in the past seven days, which can be further divided into three subtests: behavioral regulation (7 items), attention-deficit/hyperactivity (3 items), and sociability (2 items). Behavioral regulation contains questions regarding children's ability to regulate their emotions and to calm down under frustrating situations; being patient when they are required to do so, and being respectful to adults and peers. The attention deficit and hyperactivity subscale focus on whether the child can concentrate on the

task and not interrupting conversations. Sociability refers to the ability to maintain appropriate peer interactions.

The scoring scale of BESSI ranged from one to four, and reversed scoring was utilized for negatively worded items so that the rating is consonant for all the items where the higher the score is, the more risk the child has. However, in our analyses, we took into account all reversed items and amended the final scores to zero to three. In our case, higher scores signify better behavioral adjustment, and a zero would be the worst score a child can receive. This re-code of data is meant to accord with people's common sense, where a higher score represents better performance. The highest score a child can get is 36, indicating no difficulty in behavioral adjustment from the teacher's point of view. Table 2 shows the means, standard deviations, standard errors, skewness, and kurtosis values of each subscale in the BESSI behavioral adjustment questionnaire. The complete questionnaire is presented in the appendix (Appendix A).

Table 2: Means, standard deviations, standard errors, skewness, and kurtosis values for BESSI behavioral adjustment subscales

Subscale	Mean	SD (SE)	Number of items	Skewness	Kurtosis	N
Attention-deficit/hyperactivity	4.56	2.15 (.92)	3	-.27	-.37	
Behavioral regulation	12.68	4.30 (.18)	7	-.41	.07	
Sociability	3. 63	1.38 (.06)	2	-.28	-.01	
			12			545

Note: Attention-deficit/hyperactivity ranges from zero to nine; Behavioral regulation ranges from zero to 21; Sociability ranges from zero to six.

3.4.3 Language skills

In order to assess children's comprehensive language ability, researchers collected test scores targeting various language skills using three language assessments: LanguageScreen, the Renfrew Action Picture Test (RAPT fifth edition), and the Clinical Evaluation of Language Fundamentals - Preschool 2 (CELF P-2). All tests were administered in schools by well-trained research assistants following provided guidelines. Table 3 includes the score ranges, means, standard deviations, standard errors, skewness, and kurtosis values of each language subtests that had been referred to in this study.

Table 3: Score ranges, means, standard deviations, standard errors, skewness, and kurtosis values for language assessments subtests

Assessment	Subtest	Range	Mean	SD (SE)	Skewness	Kurtosis	N
LanguageScreen	EV	0-24	5.91	4.45 (.19)	.50	-.50	
	RV	0-23	9.92	4.03 (.17)	.09	-.50	
	SR	0-14	3.59	3.44 (.15)	.81	-.35	
	LC	0-16	2.19	2.91 (.12)	1.44	1.36	
CELF	EV	0-40	8.33	6.10 (.26)	.62	-.24	
	RS	0-36	5.48	6.29 (.27)	.12	.92	
RAPT	Information	0-41	14.73	8.67 (.37)	-.07	-.97	
	Grammar	0-39	9.53	7.64 (.33)	.49	-.64	
							545

3.4.3.1 LanguageScreen

LanguageScreen is a phone/tablet-based language assessment that is suitable for children aged 3 to 8. This computerized assessment tool allows researchers and educators to precisely evaluate young students' overall language skills in a short period of time. It includes four areas of subtests that are Expressive Vocabulary (EV), Receptive Vocabulary (RV), Sentence Repetition (SR), and Listening Comprehension (LC).

Expressive Vocabulary requires children to name a set of 24 objects on different pictures where each picture is worth one point, and children can score up to 24 points. Receptive Vocabulary needs children to listen to words and to choose the corresponding picture from four options. This subtest contains 23 items, and the maximum score a child can get is 23. In the Sentence Repetition session, children have to listen to 14 sentences in sequence without looking at the screen and then repeat them to the administrator. Participants need to repeat the sentence verbatim with no single error to get the point. Finally, Listening Comprehension contains three short stories which children need to listen to and then answer 16 comprehension questions (four to six questions for each narrative). Questions target both implicit and explicit information of the story, and children get one point for each correct answer.

3.4.3.2 The Clinical Evaluation of Language Fundamentals - Preschool 2 (CELF P-2)

The Clinical Evaluation of Language Fundamentals - Preschool 2 (Wiig et al., 2004) is a standardized language test available for children from three to 6-year-olds. It adopts a list of subtests measuring young children's expressive and receptive language abilities. However, our data only includes Expressive Vocabulary (CELF EV) and Recalling Sentence (CELF RS) subtests, which will be used in this current study.

CELF Expressive Vocabulary includes 20 pictures of objects, people, and activities that children have to name each of them. Each item can be scored from zero to two, following the scoring guideline leading to a raw score range from zero to 40. CELF Recalling Sentence consists of 13 sentences, and like LanguageScreen SR, participants receive points (two or three points for each sentence) if they repeat sentences verbatim. Thus, one's raw score can range from zero to 37.

3.4.3.3 Renfrew Action Picture Test (RAPT fifth edition)

The fifth edition of the Renfrew Action Picture Test (Renfrew, 2019) enables educational professionals to assess children from 3 to 8.5 years old on their spoken language. To be more specific, this assessment contains ten picture cards and related questions that the child needs to answer orally.

Answers will be graded focusing on information (RAPT Info) being delivered and grammar (RAPT Gram) being used. The former considers words used in each response that convey the correct information of each picture (i.e., nouns, verbs, and prepositions), while the latter considers grammatical structures (i.e., different tenses, atypical plurals, sentence structures, and passive voice). A total raw score can range from zero to 80 (a maximum of 41 for the information score and a maximum of 39 for the grammar score).

3.4.4 Reliability and validity

Research reliability and validity are two important concepts to consider in educational research as they can increase the quality and rigor of a study (Singh, 2014). Reliability is about reproducing consistent results under the same procedures, while the latter refers to the accuracy of measurement in terms of measuring the thing that it claims to measure (Fitzner, 2007).

Internal consistency reliability, test-retest reliability, and inter-rater reliability are three indicators that are often used to indicate a scale's reliability. Internal consistency considers whether different items on the same test measure the same underlying construct and are frequently measured using Cronbach's coefficient alpha, which tells the intercorrelations among the items (Pallant, 2016). The test-retest reliability refers to the degree of accordance with obtained scores when administering the same test to the same respondents at two different time points (Salkind, 2010). It can be measured by the correlations between the two scores and a high correlation suggests higher test-retest reliability. Inter-rater reliability is the consistency of scores given by multiple raters when rating the performance of the same participant (Frey, 2018). Similar reliability regarding graders is intra-rater reliability which concerns whether the same rater can produce similar interpretations of data and scoring decisions (McHugh, 2012). Cohen's Kappa, Spearman Rho, and Pearson R are all well-used statistics calculating inter-rater and intra-rater reliability.

A number of main indicators such as criterion validity, content validity, and construct validity are relevant to educational research (Pallant, 2016). This paper primarily focuses on construct validity and one type of criterion validity. Construct validity is about how well this measure is related to the theoretical base of the construct being assessed (Carmines & Zeller, 1979). This validity is often time theory-based and can be confirmed by investigating correlations between the current measure and a set of associated measures (Westen & Rosenthal, 2003). Concurrent validity is a type of criterion validity, which can be determined by looking at correlations between the new instrument and other existing measures with a common underlying concept (Frey, 2018).

3.4.4.1 BESSI

Hughes et al. (2015) provided detailed data demonstrating BESSI is both reliable and valid. BESSI behavioral adjustment had a reliable internal consistency as Cronbach's alpha was .88 (Taber, 2018). The intra-rater reliability had also been demonstrated using the Kappa statistic, values ranging from .29 to .78 (M = .60) indicating fair to substantial agreements when the same observer rate twice under the same phenomena (McHugh, 2012). The test-retest reliability of behavioral adjustment had an intraclass correlation of .81 over a one-month period of time which was with good test-retest reliability (Matheson, 2019). Construct validity was also corroborated as the findings of predictors on each subscale were in line with previous literature.

3.4.4.2 CELF P-2

According to a report written by Wiig et al. (2005), among all subtests and composite scores, CELF P-2 maintained test-retest reliability from .78 to .94, and the internal consistency reliability ranged from .79 to .97, suggesting acceptable reliability and consistency for subtests while has composite scores to be excellent. It also reported high correlations with other standardized language assessments, which implied a high concurrent validity. Hence, CELF P-2 is considered as an assessment with both reliability and validity.

3.4.4.3 RAPT

The Renfrew Action Picture Test does not have an official report of its validity and reliability. As discussed in Gute (1998), the grammar subtest had been informally mentioned to have high test-retest reliability and inter-rater reliability while also have high validity as it showed high correlations with another standardized test (Carrow Elicited Language Inventory, 1974), yet, no specific data had been provided. Also,

Howlin and Cross (1994) compared participants' scores on different language assessments, including the second edition of RAPT. Results suggested that the intercorrelation coefficient was .81. The correlations of age scores between RAPT Info and the other four standardized tests ranged from .56 to .84 and .59 to .81 for RAPT Grammar, informing adequate concurrent validity (Horrevorts et al., 2017).

3.4.4.4 LanguageScreen

For the LanguageScreen test, West et al. (2021) demonstrated concurrent validity of this assessment by testing the correlation between two language latent variables, one of which was derived from four subtests of LanguageScreen and the other was combined by CELF P-2 and RAPT. A Pearson coefficient of .95 was obtained, which indicates excellent correlation thus high construct validity. It also showed a strong correlation between pre-test and post-test scores on the same set of tests (rs = .88), representing a high test-retest reliability.

In conclusion, these measures being used in this study had been shown to be reliable and valid for empirical studies.

3.5 Research questions and hypotheses

All the key measures being used to assess children's language skills and behavioral adjustment in this study have been introduced and explained. These measures will then help us answer our research questions. As already being presented in the introduction chapter, we have four research questions in this study. All four questions were raised based on reviews of previous studies, and the hypothesis associated with each question is also underpinned by research outcomes.

3.5.1 Research question 1: Can variations in a child's behavioral adjustment in nursery school classrooms be predicted based on one's age?

According to Montroy et al. (2016), children experience rapid development in behavioral self-regulation from the age of three to seven with the help of qualitative growth in executive skills such as attention and inhibitory control. A similar result was found in Lutz et al. (2002), where younger preschool children showed more inattentive behaviors than older ones. It is also known that compared to younger children, older ones display more interactive plays with peers and also higher levels of interpersonal skills (Coolahan et al., 2000). That is to say, there might be an apparent shift and significant difference in the ability to adjust behaviors from age 3 to 4 and age groups above. Since the BESSI behavioral adjustment questionnaire contains subscales that touch on behavioral regulation, children's inattentiveness, and hyperactivity, and sociability, which older children tend to be more mature in all three aspects. Therefore, we hypothesized that age can predict variations in a child's behavioral adjustment, and older children would gain higher scores in behavioral adjustment than their younger peers.

3.5.2 Research question 2: Is the child's gender related to variations in one's in-school behavioral adjustment?

The impact of a child's gender on one's behavioral adjustment and behavior problems has been widely addressed in related studies. For example, Lutz et al. (2002) demonstrated that boys displayed higher levels of aggressive and overactive behaviors and manifested more problems in attention than girl preschoolers did. Gender was also identified as a unique and significant contributor to problem behaviors in Kaiser et al. (2002), and researchers observed more behavioral issues significantly in boys than in girls. Abdi (2010) conducted research involving scoring from both teachers and parents.

Results showed that girls received higher scores in social skills in both ratings from teachers and parents while boys scored higher in problem behaviors (i.e., hyperactive behaviors). However, some research brought up conclusions in contrast where gender did not appear to be a significant variable and did not contribute to individual differences in behavioral adjustment (Stallard, 1993). Therefore, this study was interested in whether gender played a significant role in explaining nursery students' functioning of behavioral adjustment. Although past studies exhibited inconsistent results, the hypothesis for this question was still that gender is related to behavioral adjustment scores of children, and boys would display more behavioral-related problems hence receiving lower scores from the teacher's rating.

3.5.3 Research question 3: Is family's socioeconomic status related to behavioral adjustment in nursery-aged children?

Current available studies suggest that behavioral problems and household socioeconomic background are highly correlated to each other. For instance, Patterson et al. (1990) found that children from low-income households are more likely to develop behavioral problems in both sexes and income level was also a significant factor in predicting peer relationships for both boys and girls. A similar conclusion has been made by Singh and Ghandour (2012) that adverse community conditions and disadvantaged family socioeconomic status were significantly correlated with greater risks of behavioral problems. Accordingly, we hypothesized that household income level is related to behavioral adjustment in nursery-aged children in our study, and children from less deprived families would out-perform their peers from lower-income families in behavioral adjustment.

3.5.4 Research question 4: Can language skills explain a significant amount of additional variance in children's behavioral adjustment in nursery school after controlling for their age, gender, and socioeconomic status?

As previously introduced in section 1.1, language ability has been recognized as a critical factor that produces profound impacts on one's development from different facets. The effects exerted on behavioral regulation and adjustment have been recognized by plenty of studies as some of them have been presented and discussed in the literature review chapter. Given the evidence to date, although our age group is relatively young compared to previously selected participants in other research, we hypothesized that one's language skills can explain a significant extra amount of variance in the child's behavioral adjustment even after adjusting for his or her age, gender, and family income level. In addition, children with higher language skills would also receive a higher behavioral adjustment score.

However, since Brownlie et al. (2004) suggested that there was no significant relationship between girls' language impairments and their externalizing behavior problems, we should first determine whether this is also the case in our sample before running the analysis as a single combining group. This is because if this association were only significant in one sex group, combining observations from both sexes into one sample would lead to a biased result.

3.6 Statistical approaches - Factor analysis, independent-samples t-test, and linear regression analyses

With the aim of investigating the relationships between variables, we integrated eight variables from different language assessments into one language latent factor and three behavioral related subtests into one behavioral adjustment latent factor using exploratory factor analyses. This is because both language skills and behavioral

adjustment are less likely to be observed or measured using one single measurement. However, other variables such as one's age, gender, and family income level were measured directly using either raw values or indicating index. An independent-samples t-test has been carried out to find out whether there was a mean difference between behavioral adjustment scores in boys and girls. In addition, two types of linear regression models were utilized to examine the relationships between selected variables: the simple linear regression model and the hierarchical regression model. The former one was adopted when investigating the relationships between single independent variables (i.e., age and SES) and the dependent variable (i.e., behavioral adjustment), while the latter one added one's language skills into the analysis while controlled for one's demographic conditions. Also, to consider possible effects produced by sex-related differences, we also checked whether there was a difference in the pattern of associations between language ability and behavioral adjustment in boys and girls using hierarchical regression models separately for both sexes.

3.6.1 Latent variables

Researchers named variables that cannot be observed directly, for example, one's level of depression, or happiness as latent variables (Field, 2018). When measuring such variables, we can assess effects brought by more observable facets that each can partially reflect that latent variable and there should be multiple measures of that variable as any sole aspect is not sufficient (Salkind, 2010). Since we wanted to treat language skills and behavioral adjustment as two general concepts, instead of splitting one latent variable into various measurable indicators, we constructed two latent variables in this present study.

The first one reflects the child's language ability, and the other represents behavioral adjustment. The language latent variable was assembled by different

measures of language covering multiple features of one's language skill, for instance, expressive vocabulary, receptive vocabulary, linguistic comprehension, sentence recalling, grammatical structure, and information delivery. Subtests of BESSI including behavioral regulation, attention-deficit/hyperactivity, and sociability converged and produced the behavioral adjustment latent variable.

3.6.2 Exploratory factor analysis (EFA)

One well-known technique to obtain latent variables is through conducting factor analyses (Salkind, 2010). According to Yong and Pearce (2013), exploratory factor analysis is a widely used statistical method that can explain a great amount of common variance of a group of measures while using the minimum number of interpretable factors. In other words, when a set of variables have a shared variance, factor analysis enables them to be simplified to fewer factors (i.e., latent variables). Another advantage is that it reduces the effects brought by measurement errors (Zhang & Wang, 2017). This is because it is more likely to reveal the actual "value" of that construct when you use multiple measures to assess different dimensions of one construct and extract their common variance shared by them (Salkind, 2010), which is usually what factor analysis usually does. In particular, we chose principal axis factoring over principal component analysis as the former generates more accurate extraction and correlations among variables by only analyzing common variances and excluding unique variance (Kim, 2008).

Factor analysis also requires the use of standardized scores with a mean of zero and the standard deviation to be one (Child, 2006). The standardization of scores allows each variable to be used on the same scale, alleviating the problem of producing less reliable factor scores (Distefano, Zhu & Mindrila, 2009) because it avoids the result being dominated by one particular variable.

We have extracted two latent variables as introduced in the previous session, the language latent variable, and the behavioral adjustment latent variable, using factor analyses. As a result, the correlations of eight language subtests were high and condensed into one final variable. This was also the case for behavioral adjustment, where three subscales were significantly correlated and combined into one latent variable. Therefore, the number of variables decreased from 11 to two which not only facilitates one's interpretation of data (Yong & Pearce 2013) but also enables later analyses to be more feasible.

3.6.3 Independent-samples t-test

An independent-samples t-test is often used by researchers who want to investigate whether a statistically significant mean difference can be found between two unpaired groups (Mishra et al., 2019). This statistical test works well when we have a two-level categorical independent variable, which in our study is the student's gender, and one continuous dependent variable, which is a child's behavioral adjustment score. In our study, we wanted to use this approach to see whether boys and girls received significantly different mean scores of behavioral adjustment.

3.6.4 Regression models

Regression models are often employed when researchers want to define relationships between the predictor variables and the outcome variables (Field, 2018). As we can see from the naming of the predictor variable, linear regression models allow predictions of the dependent variable based on the mathematical equation that is associated with the specific model (Schneider et al., 2010).

Simple linear regression:

$$Y = a + bx$$

Multiple linear regression:

$$Y = a + b_1X_1 + b_2X_2 + \ldots + biXi$$

Our analyses used simple linear regression determining relationships between one single independent variable and one dependent variable. In addition, we chose hierarchical linear regression, which is a type of multiple linear regression, to investigate whether adding a new variable would predict a significant additional amount of the dependent variable after accounting for effects brought by other independent variables (Pallant, 2016).

3.6.4.1 The simple linear regression model

The simple linear regression is one of the most fundamental regression models being adopted to explore the relationship between two variables. This model provides an estimated line that is believed to best demonstrate the relationship of all the data points (Marill, 2004). We ran two simple linear regression analyses to determine the relationships between a child's age and household income level, and one's behavioral adjustment skill, respectively.

3.6.4.2 The hierarchical linear regression model

In order to investigate the relationships between a child's language skills and one's behavioral adjustment after controlling for the subject's age, gender, and socioeconomic status, we employed a hierarchical regression model. This is because

carrying out a hierarchical regression analysis can examine if adding the targeted predictor variable can improve the ability to explain the variance in the dependent variable after taking into consideration other independent variables. In our case, it allows us to find out whether one's language skills could add a significant amount of additional contributions in explaining a student's behavioral adjustment in school after controlling for all the other dependent variables (i.e., age, gender, and socioeconomic status). The gender variable has been dummy coded into numerical values where "1" represents female and "0" represents male so that gender could be selected as an independent variable in linear regression models.

When deciding what variables should be allocated in which block following what sequence, it is necessary to consult previous literature related to the dependent variable (To & Mandracchia, 2019). To be more specific, variables that had been found to affect the criterion variable should be placed into the first block while the variable we are interested in shall be entered into the subsequent block so that an extended model will disclose whether this new variable can predict addition variance above and beyond previously placed variables.

As formerly outlined in the first chapter, age, gender, and socioeconomic status are likely to be related to behavioral adjustment, hence should be taken into account in our analysis. Therefore, we placed the child's gender, age, and socioeconomic status (i.e., IDACI) into the first block to control for the variances attributed to these variables. We also dummy coded IDACI as it has more than three levels of categories, and we used the least deprivation interval (i.e., 91% to 100%) as the baseline group. This operation allowed us to identify different income levels as a binary variable and compare each level with the reference group, and better incorporate the variable into the regression model (Field, 2018). The language latent variable was in the second block so that we can know whether there was a significant portion of contribution brought by it.

To prevent possible biases brought by the sex-related difference in the relation between language skills and behavioral adjustment and to discover whether this difference existed in our sample, we decided to conduct two hierarchical analyses for boys and girls separately before combining them for the final analysis. In these two analyses, we included age and IDACI but not gender in the first block because observations were of the same sex. The language factor was in the second block.

3.6.5 Check for assumptions

Before running statistical analyses, we performed several essential assumption checks to assure that we have met the requirements of conducting factor analyses and the simple and multiple linear regression analyses. Specifically, we looked at the sample size and sample adequacy, distribution of independent variables and residuals, relationships between the criterion variable and each predictor variable (i.e., linearity), outliers, multicollinearity, and homoscedasticity (To & Mandracchia, 2019; Strand et al., 2011, section 3.3; and Yong & Pearce, 2013). All the statistical performances were conducted using IBM SPSS Statistics 27.

As Yong and Pearce (2013) stated, for exploratory factor analysis, we should look at the sample size and sampling adequacy of data and the number of variables being used to extract factors. A preferred sample has a minimum requirement of 300 observations and at least three variables for each factor. Our study contains more than 500 observations and includes three or more variables for extraction, which perfectly meet these requirements. We also carried out the Kaiser-Meyer-Olkin (KMO) test to determine whether the data is suitable for factor analyses with a typical cutoff value to be greater than .50 (Kaiser, 1974). We received a value of .66 for the behavioral adjustment variable latent and .92 for the language latent variable, which both were much greater than the requirement, therefore, asserted the adequacy of this data. Bartlett's Test of Sphericity was used to check whether this sample contains adequate

correlations between variables and is appropriate for reductions (Abdrbo et al., 2011). Both significant values were smaller than .001, suggesting that this dataset was suitable for factor analyses. Also, there should be linear relationships between each pair of independent variables and dependent variables and these relationships had been tested by ANOVAs (Appendix B-1) as it provided the test of linearity. The linear relationships had been confirmed between age and behavioral adjustment ($p < .001$) and between language skills and behavioral adjustment ($p = .001$). Since we have dummy coded the SES variable, both IDACI and gender as binary variables do not need to worry about this assumption. Both univariate and multivariate outliers had been detected using z-scores and comparing the Mahalanobis distance with the chi-square distribution, respectively (Tabachnick & Fidell, 2013). We have identified ten univariate outliers as they had a z-score exceeding ± 3.29 standard deviation from the means, while after excluding these outliers, no multivariate outliers had been detected (for all chi-square distribution values, $p > .001$; Tabachnick & Fidell, 2013). The determinant scores helped with checking the assumption of the absence of multicollinearity. As suggested by Field (2018), determinants smaller than .00001 indicate a violation of this assumption. In our case, the language latent factor has a determinant of .001, and the behavioral adjustment latent variable has a determinant of .26 which means that the variables were not highly correlated hence affirmed the unique contributions of each variable to the factor (Field, 2018).

Besides some of the overlap assumptions shared by the two analyses, we have a few more assumptions to check for running a multiple regression analysis. First, the normal distribution of variables has been automatically met since we have a sample size that is much greater than 30 (Pallant, 2016). Second, the normality of residuals has been corroborated using a P-P plot (Appendix B-2) where though not a perfectly straight line, shows reasonably matches with the diagonal line and has few deviations. The absence of multicollinearity was assured again as there were more variables being

analyzed in the regression model. We checked the variance inflation factor (VIF), which had to be lower than ten, and the tolerance level that needed to be greater than 0.2 (Field, 2018). Data presented in Appendix B-3 proved that we did not violate this assumption. Lastly, a scatter plot had been produced to check the variance of the residuals. The graph in Appendix B-4 shows that the dots appeared to be generally randomly distributed, which signifies that the assumption of homoscedasticity had been met (Strand et al., 2011, section 3.3).

The independent-samples t-test requires normal distribution, unrelated groups, and equal variance in groups (Liang et al., 2019). The normal distribution has been assumed in this large sample size and since students were randomly selected from classes and schools, they were unlikely to be related to each other. Homogeneity of variance was checked using Levene's test where equal variance can be assumed if the p-value is greater than .05 (Kim, 2015). However, as we received a significant p-value ($p < .05$, see Appendix B-5), this assumption has been violated. Thus, we should use values labeled by SPSS at the 'equal variance not assumed' row (Pallant, 2016).

In conclusion, all the key assumptions of carrying out factor analyses and hierarchical regressions were tested, and none were violated and the only violated assumption for the independent-samples t-test has been resolved directly by SPSS. Hence, we then started our statistical analyses.

Chapter 4: Results

This chapter answers the four research questions using measures and analytical methods introduced in chapter 3. We carried out factor analyses creating latent variables and undertook regression models exploring the relationships between variables and whether these variables could predict children's behavioral adjustment. In addition, we also determined whether a child's language skills were a significant predictor of one's behavioral adjustment at school after taking into account an individual's age, gender, and SES. All the results were produced by IBM SPSS Statistics 27.

4.1 Principal axis factoring (PAF)

Principal axis factoring analyses were used to create latent variables as both language skills, and behavioral adjustment could not be measured using a single measurement. By capturing the variance of a set of variables, PAF extracted the smallest number of factors that could be retained for later analyses. We did not need to re-run the analysis for the second time for both variables as the number of elements being extracted coincided with what was suggested by the initial eigenvalues and the scree plots.

4.1.1 Language Latent variable

Eleven language subtests from LanguageScreen, CELF, and RAPT were factor analyzed utilizing principal axis factoring. We first inspected the correlations among all the subtests and found that all correlation coefficients fell into the range from .54 to .86 (Appendix D); hence no variables exceeded the scope of .3 to .9 and did not need to be removed (Yong & Pearce, 2013). Table 4 includes factor loadings, communalities, initial eigenvalue, and percentage of the variance of the one-factor solution for the language subtests. We inspected results from the extracted communalities column and

the initial eigenvalues column (Ellis, 2017). Extracted communalities ranged from .58 to .76, which indicated the portions of shared variance after extraction. The latent variable had factor loadings ranging from .78 to .87, which suggested that this factor extracted a decent amount of shared variance from the subtests (Yong & Pearce, 2013). These values were high enough to be retained (Loewen & Gonulal, 2015). One factor had an initial eigenvalue greater than one, which also matched with the scree plot (Appendix C), indicating that only one factor would be extracted (Field, 2018). Finally, this highly loaded factor accounted for 67.03% of the total variance.

Table 4. Factor loadings, communalities, initial eigenvalue, and percentage of variance based on a principal axis factoring for eight language subtests (N = 545)

Language subtests	Factor loadings	Communalities
LanguageScreen EV	.85	.72
LanguageScreen RV	.76	.58
LanguageScreen SR	.78	.61
LanguageScreen LC	.78	.61
CELF EV	.87	.74
CELF RS	.86	.61
RAPT Info	.87	.76
RAPT Gram	.86	.74
Eigenvalue	5.36	
Percentage of variance (%)	67.03	

4.1.2 Behavioral adjustment latent variable

Three subscales of BESSI behavioral adjustment loaded onto one single underlying factor after conducting the principal axis factoring analysis. Correlations among three variables ranged from .50 to .73 (Appendix D). According to Table 5, communalities ranged from .45 to .97, with factor loadings ranging from .67 to .98, which both met the minimum requirements of factor analysis. It has also been clearly shown in Table 5 that based on the criterion of keeping the factor that has an eigenvalue greater than one as well as the scree plot (Appendix C), one construct has been extracted due to the high loadings, which explained 65.78% of the variance.

Table 5. Factor loadings, communalities, initial eigenvalue, and percentage of variance based on a principal axis factoring for three behavioral adjustment subscales (N = 545)

BESSI subscales	Factor loadings	Communalities
Behavioral regulation	.98	.97
Attention-deficit/Hyperactivity	.75	.56
Sociability	.67	.45
Eigenvalue	1.97	
Percentage of variance (%)	65.78	

Therefore, the language latent variable was the only factor aggregated by the eight language subtests, while the behavioral adjustment latent variable was the single factor formed by the three BESSI subscales. Both of these two latent variables were then being used in later analyses.

4.2 Research question 1: Can we predict variations in a child's behavioral adjustment in nursery school, based on one's age?

After reviewing a body of published literature, we hypothesized that age should explain a unique amount of variances of one's behavioral adjustment and older children would have a better behavioral adjustment in nursery school than their younger classmates. We tested this hypothesis using a simple linear regression model, which investigated whether age could predict the child's behavioral adjustment score. Age was the predictor variable, while behavioral adjustment score was the outcome variable.

The results of this regression analysis implied that there was a weak but significant positive correlation between these two variables ($r = .16$, $p < .001$) and that a child's age predicted 2.4% of the variance of one's behavioral adjustment ($F (1, 543) = 13.36$, $p < .001$). The slope coefficient exhibited in Table 6 ($B = .04$, $p < .001$) suggested that older children, on average, had higher behavioral adjustment scores compared to their younger peers. Children's behavioral adjustment score increased .04 standardized points for each month of age. Since age was the predictor variable, and zero month was not a possible value in our sample, the intercept did not hold practical meaning under this circumstance (Frey, 2018).

To conclude, our hypotheses that age predicted a child's behavioral adjustment in nursery classrooms and that older children manifested lower levels of behavioral adjustment problems were both supported by this model.

Table 6. Simple linear regression summaries of age and SES predicting behavioral adjustment, respectively

Variables		B	s.e.	β	t	Sig. (2-tailed)	95% C.I.	
							Upper	Lower
Age								
	constant	-1.89	.52		-3.64	***	-2.91	-.87
	age	.04	.01	.16	3.66	***	.02	.07
SES								
	91% - 100% (constant)	.02	.15		.15		-.28	.32
	1% - 10%	.54	.22	.14	2.42	*	.10	.98
	11% - 20%	.03	.22	.01	.15		-.40	.46
	21% - 30%	-.23	.22	-.06	-1.03		-.23	.22
	31% - 40%	.10	.19	.03	.51		-.28	.47
	41% - 50%	-.23	.20	-.08	-1.20		-.62	.15
	51% - 60%	-.02	.20	-.01	-.09		-.41	.38
	61% - 70%	-.11	.19	-.04	-.59		-.49	.27
	71% - 80%	-.20	.19	-.07	-1.05		-.56	.17
	81% - 90%	.23	.22	.06	1.04		-.20	.65

Note: R^2 = .024 (age), R^2 = .043 (SES); * p < .05, ** p < .01, *** p < .001

4.3 Research question 2: Is gender related to variations in children's behavioral adjustment in nursery school?

As remarked previously, much of the research has pointed out the sex-related difference presented in children's behavioral problems. Therefore, before running the regression analysis, we wanted to determine whether there was a significant mean difference between behavioral adjustment scores in boys and girls. An independent-samples t-test has been used for the purpose of making the comparison.

Table 7 revealed that there was a significant difference in behavioral adjustment scores between boys (M = -.14, SD = 1.00) and girls (M = 0.28, SD = .94), t(538.59) = -3.53, $p < .001$. The mean-level difference was -.29 (95% C.I. [-.46, -.13]) with a large effect size d = .97 (Cohen, 1988), suggesting that boys had, on average, .29 standardized behavioral adjustment scores lower than girls. One thing to note was that the assumption of equal variance has been violated based on the Levene's test (F = 4.19, $p < .05$) hence we used the alternative adjusted t-value of equal variance not assumed (Pallant, 2016).

As we have confirmed a mean-level difference between boys and girls in their behavioral adjustment scores, we concluded that This test supported both our hypotheses: 1). gender was related to teachers' ratings on children's behavioral adjustment in nursery school, and 2). female students in this study exhibited a lower level of behavioral problems.

Table 7. Gender difference in children's behavioral adjustment scores (N = 545)

	t	df	Sig. (2-tailed)	Mean difference	95% C.I.		Cohen's d
					Upper	Lower	
Behavioral adjustment	-3.53	538.59	***	-.29	-.46.	-.13	.97

Note: Equal variance not assumed; * p < .05, ** p < .01, *** p < .001

4.4 Research question 3: Is a child's family income level related to one's behavioral adjustment in nursery school?

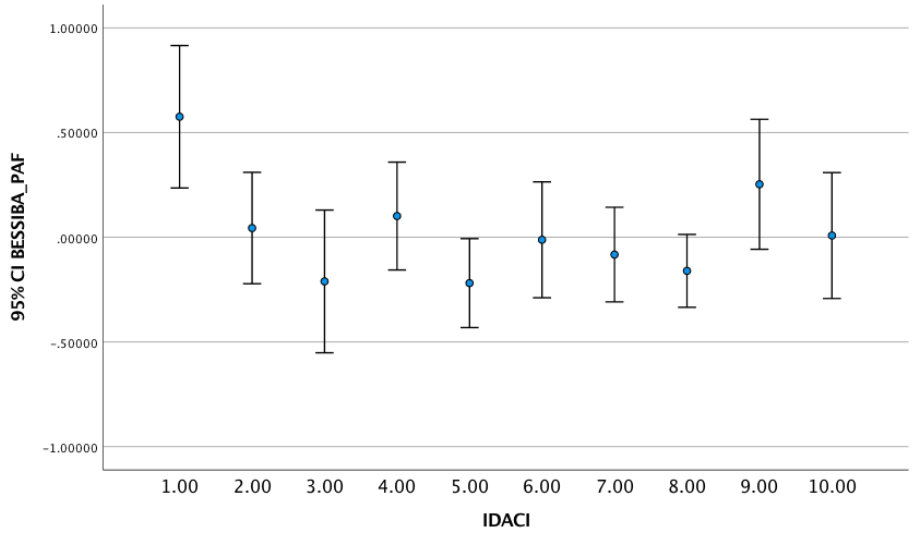
The third research question addressed the possible correlation between one's socioeconomic status and behavioral adjustment. Our study used the household income deprivation level (IDACI) as an indicator of the SES. The hypotheses we have were that one's family income level is related to the child's behavioral adjustment in school and that children from lower SES families performed poorer in behavioral adjustment than those from less disadvantaged families.

As we hypothesized, we found that children's SES and their behavioral adjustment were correlated. According to the regression analysis, IDACI was a significant predictor of behavioral adjustment, which accounted for 4.3% ($R^2 = .043$) of the variance of the standardized behavioral adjustment score ($F (1, 543) = 2.67$, $p < . 005$). However, when scrutinizing the IDACI levels, we found that compared to the reference group (i.e., the least deprived group), only the most deprived ten percent of the family had a significant slope coefficient ($B = .54$, $p < .05$). What was more surprising was that this positive beta-value indicated that children from the most deprived families received .54 more standardized scores in behavioral adjustment than children from the highest income group. This result was completely opposite to our

hypothesis, where we believed that children from wealthier families would have fewer behavioral adjustment issues hence higher behavioral adjustment scores. Table 6 presents more detailed information on the model.

To help better understand the mean-level differences across each IDACI group, we plotted the mean BESSI scores as well as the 95% confidence intervals of each IDACI group as shown in Figure 2. Since we used group "10" (the highest income group) as the reference group, it is clear that the degrees of overlap for 95% confidence intervals are high among group "2" to "10" while only the most deprived group (labeled as "1") has the highest mean scores among all levels and does not overlap much with the highest income level. This is in line with our regression model where we found only students from the least advantaged group received significantly higher BESSI scores compared to students from the most advantaged group.

Figure 2. 95% confidence intervals for the mean BESSI scores across 10 income groups



4.5 Research question 4: Do language skills of nursery-aged children explain additional variances in their behavioral adjustment after controlling for age, gender, and socioeconomic status?

The independent-samples t-test and two simple linear regression analyses showed that most of our hypotheses have been supported and that there were significant associations between age, gender, and socioeconomic status, and behavioral adjustment. Therefore, we would need to control for those variables if we aim to investigate whether children's language skills would add to the prediction of their behavioral adjustment and to know the unique contribution of each block. We hypothesized that language ability would explain a unique amount of variance of behavioral adjustment after controlling for the three independent variables, and children with higher standardized language scores would also possess better behavioral adjustment skills.

4.5.1 Gender-related difference in the association

Two hierarchical regression analyses were conducted beforehand in determining whether the relationship between language ability and behavioral adjustment was only significant in boys or girls. Values in Table 8 showed that after controlling for age and SES, both associations between language ability and behavioral adjustments were statistically significant (girls: $B = .22$, $\beta = .22$, $p < .001$; boys: $B = .17$, $\beta = .17$, $p < .01$). These results implied that the relationships for both boys and girls between the two variables existed in our sample and that we could justify treating them as one combining sample for our final analysis.

Table 8. Summary of associations between language skills and behavioral adjustment in boys and girls after controlling for their age and SES

Variable	Boys (N = 293)						Girls (N = 252)					
	B	s.e.	β	Sig.(2-tailed)	95% C.I.		B	s.e.	β	Sig.(2-tailed)	95% C.I.	
					Upper	Lower					Upper	Lower
Constant	-1.49	.76			-2.98	.00	-1.08	.77			-.26	.43
Language Skills	.17	.06	.17	**	.05	.29	.22	.06	.22	***	.09	.34

Note: * p < .05, ** p < .01, *** p < .001

4.5.2 The associations between language skills and behavioral adjustment

We then carried out another hierarchical regression analysis to analyze whether language skills could explain a significant portion of the remaining variance in behavioral adjustment scores. The first block included individuals' age, gender, and SES, and language skills factor came into the sequential block.

Outputs presented in Table 9 indicated that both models were significant. In block 1, age, gender, and SES altogether explained 7.6% ($R^2 = .076$, $F (11, 533) = 5.08$, $p < .001$) of the variation in behavioral adjustment, and in block 2, language skills explained 11.2% ($F (12, 532) = 6.71$, $p < . 001$) of the variance. That is to say, language skills along with other independent variables as model 2 explained an additional 3.7% of variance ($\Delta R^2 = .037$, $\Delta F (1, 532) = 22.42$, $p < .001$) over and above age, gender, and income level.

In addition, after bringing all predictors into the analysis, we found that age ($B = .03$, $\beta = .11$, $p < .05$) and gender ($B = .27$, $\beta = .14$, $p = .001$) were still significant predictors of children's behavioral adjustment. Also, children from the lowest income-

level families would receive .55 more standardized scores of BESSI BA than students from the highest income group ($\beta = .14$, $p < .01$) while no other groups have shown significant prediction. Language skills as the added variable was also an independent significant predictor ($B = .21$, $\beta = .21$, $p < .001$).

After controlling for one's gender, age, and SES, language skills have been identified as a significant predictor of behavioral adjustment and the positive beta value indicated that children with better language ability received higher behavioral adjustment scores. Therefore, our hypotheses regarding language skills had been supported by this multiple regression analysis.

Table 9. Summary of the hierarchical regression model for age, gender, SES, and language skills explaining variances in behavioral adjustment

Variables	Model 1						Model 2					
	B	s.e.	β	Sig. (2-tailed)	95% C.I.		B	s.e.	β	Sig. (2-tailed)	95% C.I.	
					Upper	Lower					Upper	Lower
Constant	-2.13	.53		***	-3.16	-1.10	-.14	.54		**	-2.45	-.34
age	.05	.01	.17	***	.02	.07	.03	.01	.11	*	.01	.05
gender	.32	.08	.16	***	.15	.48	.27	.08	.14	**	.11	.43
1% - 10%	.56	.22	.14	*	.13	.99	.55	.21	.14	**	.13	.97
11% - 20%	-.08	.21	-.02		-.50	.34	.05	.21	.01		-.36	.47
21% - 30%	-.25	.21	-.07		-.67	.17	-.18	.21	-.05		-.59	.24

31% - 40%	.06	.19	.02	-.30	.42	.10	.18	.04	-.26	.45
41% - 50%	-.28	.19	-.09	-.65	.09	-.21	.19	-.07	-.58	.15
51% - 60%	-.02	.20	-.01	-.41	.37	-.02	.19	-.01	-.40	.36
61% - 70%	-.14	.19	-05	-.51	.23	-.16	.18	-.05	-.52	.21
71% - 80%	-.22	.18	-.08	-.57	.14	-.2-	.18	-.07	-.55	.15
81% - 90%	.24	.21	.06	-.18	.65	.21	.21	.06	-.20	.62
Language skills						.21	.04	.21 ***	.12	.30
ΔR^2						.04		ΔF (1, 532) = 22.42 ***		
R^2	.08	F (11, 533) = 5.08 ***				.11		F (12, 532) = 6.71. ***		

Note: * p < .05, ** p < .01, *** p < .001

4.6 Results summary

An independent-samples t-test, two simple linear regression models and a hierarchical regression model had been conducted to answer the four research questions. According to the results, most of the hypotheses we proposed had been supported. Age was a significant predictor of behavioral adjustment in both models and gender was also correlated to variations in children's behavioral adjustment. Language skills could explain a significant additional amount of variance in behavioral adjustment scores even after controlling for the variance attributed to one's age, gender, and family income level. Furthermore, as we hypothesized, older children and female students had fewer behavioral problems compared to their younger and male peers, according to their teachers' ratings. Children who performed better in language tests

also received higher behavioral adjustment scores, and this association existed for both boys and girls in this current study. However, one's socioeconomic status was not always a significant predictor in our models, where only children from the least deprived families had significant p-values. What is more noticeable was that these children received higher behavioral adjustment scores than children from the least disadvantaged families, which was in contrast with our proposed hypothesis.

Chapter 5: Discussion and conclusion

In this chapter, we will discuss the results we presented in relation to the four research questions and corresponding hypotheses, and whether these findings can further support previous studies or are in contrast with them. In addition, we will also address the limitations and strengths of this study. Implications and possible future directions are also going to be discussed in this chapter.

5.1 The relationship between a child's teacher-rated behavioral adjustment and their age, gender, and family income level

The first step of the investigation was guided by the three research questions exploring the relationships between children's age, gender, and their family SES and their in-class behavioral adjustment performance.

5.1.1 Age and behavioral adjustment

We found that there was a significant positive linear relationship between one's age and behavioral adjustment score, which means that older children tended to receive higher behavioral adjustment scores compared to their younger classmates. Since higher scores in our study represent fewer behavior problems, we concluded that as the child grows older, one displays fewer adjustment problems in school. This finding appears to be in line with both our hypothesis and previously established studies (Coolahan et al., 2000; Fanti & Henrich, 2010; Fantuzzo et al., 2013; Stone et al., 2016).

One of the explanations for the trend of decrease in externalizing problems is that as children get older, they are also experiencing development in cognitive functions such as language skills and self-regulation. Gilliom and Shaw (2004) mentioned that as

children start to have more competent oral problem-solving skills and more parental limitations and guidelines, children's aggressive behaviors decrease as their age increases. Fanti and Henrich (2010) also attributed this diminishing to the development of cognitive skills such as emotion regulations which helps young children alleviate peer conflicts.

5.1.2 Gender and behavioral adjustment

We found that there was a significant mean difference between behavioral adjustment scores in boys and girls and that gender was related to variations in behavioral adjustment scores. Our results indicated that girls got higher scores in the adjustment questionnaire and exhibited fewer adjustment problems than boys. Thus, our hypotheses were supported and these were also what most other researchers have reported (Coolahan et al., 2000; Dishion & Patterson, 2006; Kaiser et al., 2002; Stone et al., 2015), although a slight divergent finding was also presented in Stallard (1993). Boys were found to be more active than girls, but no gender differences were detected in concentration, tantrum, difficult in control, neither in parents' ratings on concerns about their children displaying behavior problems.

Hay (2007) evaluated several possible hypotheses that might be able to justify this sex-related difference and summarized three broad principles: 1). Biologically speaking, girls mature earlier than boys in socialization, and that girl's ability to endure social pressures prevents them from being aggressive easily; 2). Boys are more vulnerable in terms of experiencing emotional and cognitive problems which leads to the larger population showing behavior problems, and 3). In this social context where gender stereotypes apply, adults are more likely to encourage young boys to fight back when they have been bullied while girls tend to use non-behavioral means. Also, as Fanti and Henrich (2010) and Schlack and Petermann (2013) implied, girls present an

increased trend in internalizing problems such as depression. Therefore, it is also possible that whenever girls are facing frustrations or negative life events, they have the propensity to internalize those negative influences instead of bursting out.

5.1.3 Socioeconomic status and behavioral adjustment

Our second simple linear regression model was used to investigate the relationship between children's behavioral adjustment and their family income level. Results revealed that only the least advantaged group had significantly higher behavioral adjustment scores, which means students from lower-income families in our sample displayed fewer behavioral adjustment problems based on teachers' ratings. We also found that though other intervals did not show significant relationships, there was a trend that students from the middle groups (i.e., 41% - 80%) had more problems in behavioral adjustment.

This observation was in contrast with previous pieces of evidence where children from low SES families often exhibited more behavior problems (Basten et al., 2016; Fanti & Henrich, 2010). Although Valera-Pozo et al. (2020) did not receive the same conclusion as we do, their finding was also divergent from what the majority of researchers have found. In their research, there were no significant correlations between children's SES and their externalizing behaviors or adaptive skills, and such observation appeared in both the control group and the children with language impairments group. While we cannot determine the reason behind this counterintuitive finding, there are some educational conjectures.

Firstly, student's IDACI decile matched with their school placement which means students from the same school often shared similar household income levels. Therefore, it may be school-level or teacher-level factors that influenced the scoring of behavioral adjustment. For example, Dusek and Joseph (1983) concluded from a meta-

analysis that teachers often hold lower expectations of students from the lower class compared to those from the middle class. Therefore, teachers may simply give higher scores because the students performed better than they had expected. It is also possible that previous research included multiple indicators representing one's SES such as parents' education levels, exposure to violence, support networks, etc. (Qi & Kaiser, 2003), hence the mere usage of household income level may be insufficient to reach the same conclusion. In addition, only 36 students from three different schools were placed in the most deprived group, which led to the smallest sub-sample, and that this result may not have enough statistical power or be representative enough. Therefore future studies with larger sample sizes should be conducted to explore more on how family income level is related to children's in-school behavioral adjustment.

5.2 Language skills and behavioral adjustment

To investigate the relationships between one's oral language skills and externalizing problems, we controlled for confound effects from one's age, gender, and family income level on the basis of our findings.

5.2.1 Sex-related difference in the associations between language ability and behavioral adjustment

In response to the previous report that the association between children's language skills and behavioral adjustment only exists in boys (Brownlie et al., 2004), we first carried out analyses looking at boys and girls separately. After controlling for children's age and family income level, we found that in this relatively larger sample, language ability was a significant factor in explaining both boys' and girls' behavioral adjustment. In fact, the association appeared to be stronger in girls than in boys. Although this finding was in conflict with Brownlie et al. (2004), it is not unforeseen,

as we have mentioned in chapter two that divergent findings had been generated (Monopoli & Kingston, 2012; Petersen & LeBeau, 2021) where no gender-related difference was identified, or relationships were found to be stronger in girls. It is possible that certain aspects of language skills predicted specific facets of behavioral adjustment, and since different studies examined different skills, divergent results appeared. For example, Monopoli and Kingston (2012) proposed that receptive vocabulary might play a more critical role in developing externalizing problems in girls than in boys. Future studies can pay more attention to clarifying how different features of language skills may result in unique behavior problems.

5.2.2 The association between children's language skills and behavioral adjustment

The final hierarchical regression suggested that children's language ability at around 3 to 4 years old could explain a significant amount of additional variance in children's in-school behavioral adjustment above and beyond their age, gender, and household income level. Both models with or without language skills showed the same pattern. Thus, provided empirical evidence supporting our hypothesis as well as findings from past studies (e.g., Bornstein et al., 2013; Girard et al., 2014; Menting et al., 2011; Petersen et al., 2013; Petersen and LeBeau 2021) that children with higher levels of language skills exhibited fewer behavioral adjustment problems.

This finding was under our expectation following Vygotsky's sociocultural theory, the three-stage of speech theory (Vygotsky & Cole, 1978; Vygotsky et al., 2012; Vygotsky et al., 1987), and Bloom and Lahey's three-dimension language model theory (Bloom & Lahey., 1978). Sociocultural theory emphasizes that language and dialogues as semiotic items are useful mediational tools that allow people to learn meanings, rules, and values of the situated context from more experienced members of the community so that they can better adapt to the context and become a member of it. Therefore, it is

vital for children to possess the ability to understand and communicate with others in order to learn via verbal communication. The transformation from social speech to private speech suggests that children learn from how adults use language to guide children's behaviors and thus gradually transmit this ability into self-speech, which can be used for self-guiding. That is to say, their language ability is not only important for understanding others' words or to learn from others through verbal interactions; it is also required for them to be aware of their behaviors and to further self-regulate their emotions and behaviors.

Bloom and Lahey (1978) helped explain how three major components of language contribute to the theoretical framework. They proposed that the integration of every component leads to the competence of language ability. In their theory, the form (e.g. syntax, sentence structures, phonology) and the content (e.g., information, word meanings) of language are two of the decisive elements that affect one's language competency. The language assessments used in our study covered many aspects of these two components, for instance, receptive and expressive vocabulary, linguistic comprehension, the use of grammar and the presence of information, etc.

Combining these theories together, we believe that if the child has delayed language development or is facing language difficulties, one would have problems in understanding and producing linguistic messages that prevent them from learning rules and following instructions from teachers, as well as using self-speech strategy to guide and regulate their own behaviors and emotions. Therefore, better language skills are associated with fewer behavioral adjustment problems as supported by empirical evidence from an affluent amount of studies including this present one.

In addition, children's age, gender, and the least advantaged group were also significant predicting variables when taking all of them including language skills into consideration. All these factors presented positive relationships with children's behavioral adjustment scores which replicate the findings we obtained when examining

them individually. It indicated that older children, girls, and students from families with the lowest ten percent of incomes tended to demonstrate better behavior adjustment skills in school.

5.3 Strengths of the study

There are two major strengths of this study. First, we used a set of data that was rigorously collected by a professional research team recently. In this secondary data analysis, our sample contained participants from more than 60 schools in England, and a wide range of levels of family incomes was represented. Although our sample size was not as large as many national-level datasets, our results can still provide evidence using a relatively larger sample for researchers (Brownlie et al., 2004) who conjectured that their findings were constrained by their numbers of participants.

In addition, we have adopted multiple well-designed language assessments to evaluate children's language skills in our study and used factor analyses to standardize different measures and to integrate them at the same time. The use of various instruments not only allowed us to measure facets of language skills (i.e. expressive and receptive vocabulary, and sentence recalling/repetition) twice which avoided errors and inaccuracies of using one single language test but also provided a comprehensive evaluation of one's oral language skills from diverse aspects.

5.4 Limitations of the study

Despite the fact that the use of secondary data brought several benefits to the study, secondary data analysis as a research method also carries its own limitations. Firstly, as we have mentioned in chapter three, one of the payoffs of saving time and effort was that we could not decide what variables to be collected as our research topic may not match with researchers' original purpose; therefore, we were not able to

include all interested and demanded factors into our analyses. For example, as we have reviewed before, a child's temperament (Mobley & Pullis, 1991), student-teacher relationships (Birch & Ladd, 1998; Pianta et al., 1995), and some family factors like parents' education level, parents' relationships, and family cohesion (Abidin et al., 1992; Hakvoort et al., 2011; Mckelvey et al., 2015) have all been identified as predictors of a child's behavioral adjustment skill. Hence, if we could include more possible confound variables, we would receive more accurate and unbiased results from the analyses (McNamee, 2005).

Another limitation associated with secondary data analysis was that we did not have access to the complete, accurate dataset. Therefore, when deciding the approach to manage missing values, we could only use the listwise deletion and excluded observations as long as they have any missing value. However, a huge issue was that we could not use the Little's Missing Completely at Random Test to determine whether it was a rigorous operation to use listwise deletion. If values were missing with certain patterns (e.g., Missing Not at Random), although missing observations only occupied around five percent of the total number, it could still lead to biased analyses when using listwise deletion (Newman, 2014).

Moreover, children's behavioral adjustment was completely assessed by teachers' ratings. Although Gresham et al., (2010) suggested that ratings on problem behaviors demonstrated a moderate correlation ($r = .30$) between teachers' rating and parents' ratings, parents can report children's behavioral and social patterns from a wider range of settings while teachers can observe students in a more structured and consistent context where more task-oriented behaviors are required (Wingenfeld, 2002). Therefore, it would be helpful to include parents' ratings when evaluating children's behavioral adjustment to have a more comprehensive understanding of a child's behavioral adjustment.

5.4.1 Restrictions of the results

Like most of the literature we cited in this paper, our sample is predominantly students from England who were raised in a Western context and had English as their primary language at school. Therefore, we are not representative enough and are lacking comparison groups from other contexts speaking different languages or having different cultural backgrounds. Unique findings may be revealed if the study was conducted in another context. For instance, as Asian cultures are more likely to implement higher disciplinary standards and hold higher expectations on children's behavioral performances, they may have different emphases in both home and school settings, or use different ways to implement contextual norms and rules. Choi et al. (2013) suggested that due to the desire to maintain the ingrained Asian cultural values of respecting and being obedient to members that are more experienced or older, a series of strict behavioral rules are often required and practiced at a young age. Corporal punishments, as an example, can be one of the means for adults to implement discipline rules, which may weaken the function of verbal communications in the process of learning how to adjust one's behaviors in school. Therefore, the association between language skills and behavioral adjustment across different cultures may not be identical.

Even in Hong Kong, a region where both Eastern Confucian ideology and Western educational approaches are utilized, Sun and Shek (2012) have found that besides having disruptive conversations, being verbally aggressive, and other misbehaviors that are also considered as problematic behaviors in our study (as followed rating criteria of the BESSI questionnaire), disobedience was highlighted on Chinese (Hong Kong) teacher's list of unaccepted behaviors of students. This was also supported by Hulei et al. (2006), where the authors identified high expectations on Chinese children's obedience, discipline, and their ability to master impulsivity and

self-control. These different standards and emphases may also lead to different conclusions from our study.

Furthermore, our statistical analysis approaches also restrained our findings in terms of being unable to make causal inferences. Although linear regression models along with the support of solid theories have been used by researchers to infer causations (Freedman, 2005), our cross-sectional study with no experimental design prevented us from demonstrating the causality relationship (Constantine, 2012). That is to say, even we have identified in our sample that a child's oral language ability could explain a significant portion of the variance in children's behavioral adjustment at school beyond and above their age, gender, and family income level, being scientifically rigorous, we cannot justify that it was children's poor language skills that led to higher levels of behavioral problems as there may be invisible underlying causes that explained both the externalizing problems and poor language skills.

Last but not least, we did not inspect specific facets of either the child's language skills or one's behavioral adjustment. As we have speculated when discussing the results, it may be a particular feature in language skills that causes a certain type of problem behavior. Snowling et al. (2006) conducted a study using interviews and questionnaires showing that children with attention problems often displayed problems in expressive language and those who experienced social difficulties revealed a profile with impaired expressive and receptive language. Therefore, we can only provide a general conclusion showing the association between language ability and behavioral adjustment in school, while more specific evidence is required to demonstrate whether certain language difficulties are more related to specific behavior problems.

5.5 Contributions and implications of the study

The dissertation reaffirms that a child's in-school behavioral adjustment is associated with one's oral language skills. Beyond that, we extended the age band to children as young as 3 years old, which not many scholars have studied before. We also join the discussion in areas that previously showed divergent findings. For example, researchers presented different conclusions on whether the association between language ability and behavioral adjustment only exists in boys or girls or does not demonstrate the sex-related difference. Our study provides evidence suggesting that this association is significant for both sexes and seems to be stronger in girls. In addition, we also bring up a unique finding that is contradictory to the mass majority of previous research where children from more advantaged children were found to outperform their peers from more deprived families in behavioral adjustment. Our finding implies that we should not intuitively think low income is a definite risk factor of producing more externalizing problems; instead, the specific effect and consequence should be investigated in accordance with the circumstance.

Besides these contributions to current discussions of the topic, our study also produces implications. Although admittedly, what we have done in this study does not allow us to draw any causal conclusion, it raised a new perspective for us to understand children's behavior problems. As we have known that nursery-aged children's language skills are associated with their behavioral adjustment and that impaired oral language skills tended to co-occur with higher levels of externalizing problems, children who display externalizing behavioral problems should also be assessed on their oral language skills and this can be especially helpful if the child is going through some language difficulties that are hard to detect in daily life occasions by parents and teachers.

In addition, if future studies can make causal inferences of these two variables,

professionals should be aware that for children who experience problems in both areas, improving their oral language ability should be considered as a means to alleviating their behavioral problems and the development of interventions for children with behavior problems should also integrate training in enhancing language skills. However, to reiterate, this implication only makes sense if researchers can identify causal relationships between children's language skills and behavioral adjustment.

Last but not least, the legitimacy of using latent variables implies that subskills of oral language and subcategories of behavioral adjustment are highly correlated, respectively (See correlation matrices in Appendix D). Previously established works have raised the notion of describing children's language skills as a unidimensional construct (Klem et al., 2015; West et al., 2021) due to the high loadings of different aspects of language ability. This study supports their postulation and further suggests that although behavioral adjustment is not a simple concept and involves different subskills, we believe that it can also be construed as a unidimensional construct in research.

5.6 Future studies

Considering the limitations of this study, we believe that researchers can replicate or conduct similar studies in other cultural contexts exploring whether these associations are restricted to certain cultures and samples with more representative participants should be involved in future works. Researchers can also collect data from parents' ratings or reports for a more comprehensive evaluation and understanding of children's behavioral adjustment on different occasions.

Future research can also further explore the relationships between children's language skills and behavioral adjustment. Specifically, they can address areas that showed inconsistent conclusions, such as sex-related differences and how family

income level or socioeconomic status is related to a child's behavioral adjustment. Therefore, larger samples that contain adequate numbers of participants from different SES are necessary.

Longitudinal studies are also necessary as this study only touched on cross-sectional analyses. Like our results, a series of research had shown the co-occurrence of language skills and one's externalizing behaviors with scientific evidence. However, some researchers obtained branching findings when considering the predictive effect in longitudinal studies, indicating that this putative relationship still needs to be investigated (Skuban, 2010). For example, in Bornstein et al. (2013), researchers found that longitudinal associations from language to behavior were observed only in internalizing problems but not in externalizing problems though they believed that externalizing problems in early ages are associated with later language development. Hence, whether the associations between language skills and behaviors exist in the longitudinal study, and what are the directions of these associations are still under-investigated. Furthermore, longitudinal designs also help in inferring causal relationships.

5.7 Conclusion

To summarize, this study was aimed to investigate the relationships between young children's behavioral adjustment and language skills. Data was collected in England from more than 60 nursery schools with participants around 3 to 4 years old. We used a teacher-rated questionnaire evaluating children's behaviors in nursery classrooms in the past week and multiple language assessments measuring their oral language ability. We first investigated the relationships between a preschooler's age, gender, and family income level and one's behavioral adjustment so that we could control possible confounds. After we have determined all these associations to be

significant, we then examined the relationships between children's language skills and behavioral adjustment controlled for these variables.

What we have found was that as children grew older, their problems in behavioral adjustment decreased and that girls tended to have fewer behavior problems than boys. However, in contrast with other studies, children in our sample from the least advantaged households in terms of family income displayed significantly fewer externalizing problems. In addition, the concurrent relationship between children's language skills and behavioral adjustment has been identified. Children's oral language skills are negatively correlated with their behavioral adjustment, which means that students with poorer oral language skills tend to display higher levels of behavior problems, and this pattern appears to be stronger for girls than boys.

With both limitations and strengths, this study contributes to the present discussion in the area and provides implications for parents and professionals. Future studies with larger and more representative samples as well as samples from other cultural contexts are needed to further investigate these associations. Longitudinal studies and randomized controlled trials are more demanded to make causal inferences.

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Appendices

Appendix A

BESSI Behavioral adjustment questionnaire

Behavioral regulation:
This child is good at waiting patiently when this is required (e.g., turn taking)
This child has temper tantrums (R)
This child is good at calming down when asked to do so
This child responds poorly to reprimands (e.g., backchat, anger) (R)
This child gets easily frustrated if a task is too difficult (R)
This child grabs other children's belongings (R)
This child is respectful towards adults
Attention-deficit/ Hyperactivity:
This child is easily distracted (R)
This child has trouble sitting still when required (R)
This child often interrupts conversations inappropriately (R)
Sociability:
This child can play with lots of different children of his or her own age
This child is usually happy to share with peers

Note: Scoring from zero to three where zero indicates worst performance and three represents least problems; Questions with "R" at the end are reverse scored.

Appendix B

Statistical assumption checks (results retrieved from IBM SPSS Statistics 27)

B-1: Linearity

Behavioral adjustment & Age

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
BESSIBA_PAF * age	Between Groups	(Combined)	25.148	13	1.934	2.068	.015
		Linearity	14.943	1	14.943	15.978	.000
		Deviation from Linearity	10.205	12	.850	.909	.537
	Within Groups		501.275	536	.935		
	Total		526.423	549			

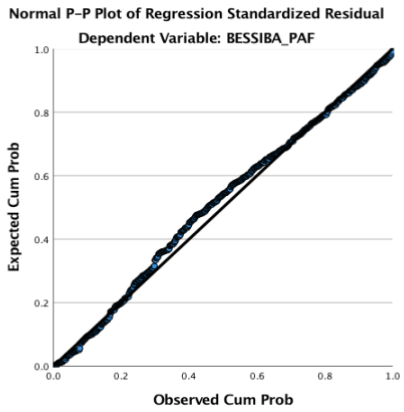
Behavioral adjustment & Language skills

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
BESSIBA_PAF * LanguageSkill_PAF	Between Groups	(Combined)	518.899	542	.957	.891	.653
		Linearity	36.651	1	36.651	34.100	.001
		Deviation from Linearity	482.248	541	.891	.829	.702
	Within Groups		7.524	7	1.075		
	Total		526.423	549			

Both linearity tests were significant ($p < .001$; $p = .001$), suggesting that relationships between behavioral adjustment and age, and behavioral adjustment and language skills were linear.

B-2: Normality of residuals (P-P Plot)



This probability-probability plot demonstrates that the scatters are tightly close to the diagonal line of the normal distribution with minimum deviation, indicating normally distributed residuals.

B-3: The absence of multicollinearity

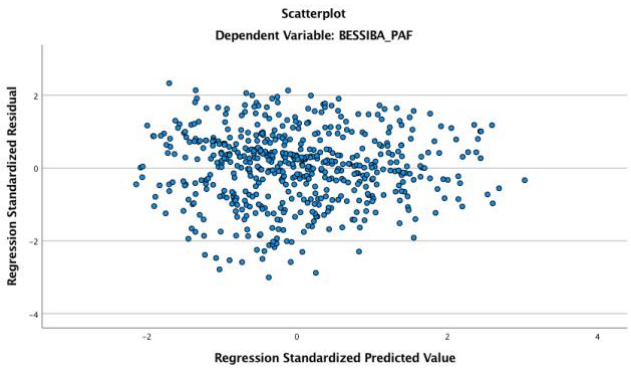
Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-1.499	.539		-2.780	.006					
	age	.048	.012	.166	4.014	.000	.155	.171	.165	.991	1.009
	gendernumeric	-.315	.082	-.159	-3.818	.000	-.149	-.163	-.157	.973	1.028
	1%-10%	.558	.217	.141	2.567	.011	.152	.111	.106	.563	1.776
	11%-20%	-.084	.214	-.022	-.391	.696	.016	-.017	-.016	.540	1.853
	21%-30%	-.252	.213	-.066	-1.181	.238	-.057	-.051	-.049	.545	1.836
	31%-40%	.061	.185	.021	.328	.743	.049	.014	.013	.396	2.523
	41%-50%	-.281	.190	-.093	-1.481	.139	-.079	-.064	-.061	.428	2.334
	51%-60%	-.018	.197	-.006	-.093	.926	.002	-.004	-.004	.468	2.137
	61%-70%	-.138	.188	-.047	-.734	.463	-.036	-.032	-.030	.417	2.398
	71%-80%	-.215	.182	-.079	-1.182	.238	-.075	-.051	-.049	.383	2.608
	81%-90%	.235	.212	.062	1.112	.267	.071	.048	.046	.539	1.854
2	(Constant)	-.857	.546		-1.570	.117					
	age	.030	.012	.106	2.483	.013	.155	.107	.100	.902	1.109
	gendernumeric	-.269	.081	-.136	-3.302	.001	-.149	-.142	-.133	.959	1.042
	1%-10%	.553	.213	.140	2.593	.010	.152	.112	.105	.563	1.776
	11%-20%	.054	.212	.014	.254	.800	.016	.011	.010	.530	1.888
	21%-30%	-.175	.210	-.046	-.836	.404	-.057	-.036	-.034	.541	1.847
	31%-40%	.098	.181	.035	.540	.590	.049	.023	.022	.396	2.528
	41%-50%	-.213	.187	-.071	-1.142	.254	-.079	-.049	-.046	.426	2.348
	51%-60%	-.017	.193	-.005	-.088	.930	.002	-.004	-.004	.468	2.137
	61%-70%	-.156	.184	-.053	-.848	.397	-.036	-.037	-.034	.417	2.399
	71%-80%	-.198	.179	-.072	-1.108	.269	-.075	-.048	-.045	.383	2.609
	81%-90%	.208	.208	.055	1.002	.317	.071	.043	.040	.539	1.855
	LanguageSkill_PAF	.208	.044	.206	4.735	.000	.254	.201	.191	.866	1.155

a. Dependent Variable: BESSIBA_PAF

Looking at the tolerance and VIF columns under the collinearity statistics, all tolerance values are greater than .2 and VIF values are below ten. Therefore, we concluded that the assumption of collinearity has been met. This means that these variables are not highly correlated to each other (they are independent) and that we should be able to disentangle how each variable explains a portion of variance of the outcome.

B-4: Homoscedasticity



The scatter plot though has a tendency to funnel toward the positive side of the x-axis, the data points still demonstrates a fairly randomized distribution and a reasonable spread of residuals, indicating the variability in the residuals at both the higher and lower predicted values are about the same. This means that the assumption of homoscedasticity has been met.

Appendix B-5: Levene's test

Independent Samples Test

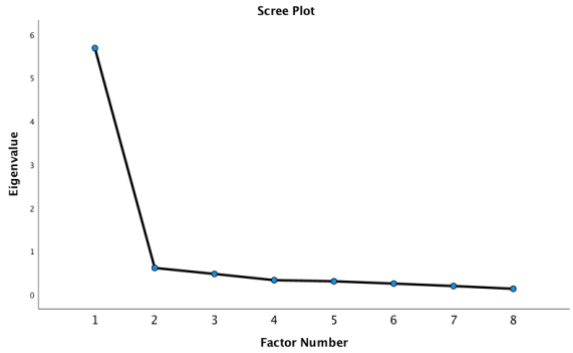
		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
BESSIBA_PAF	Equal variances assumed	4.190	.041	-3.511	543	.000	-.29384727	.08370109	-.45826487	-.12942967
	Equal variances not assumed			-3.527	538.592	.000	-.29384727	.08331968	-.45751864	-.13017590

This table contains results of Levene's test which was used to check the assumption of equal variance. As introduced in the main body, a significant p-value of the test suggests a violation of this assumption which means that equal variances of the two gender groups could not be assumed. Fortunately, SPSS helps to generate outputs (as shown in the second row) using un-pooled variances and the corrected version of the degree of freedom for calculations (Field, 2018; Pallant, 2016).

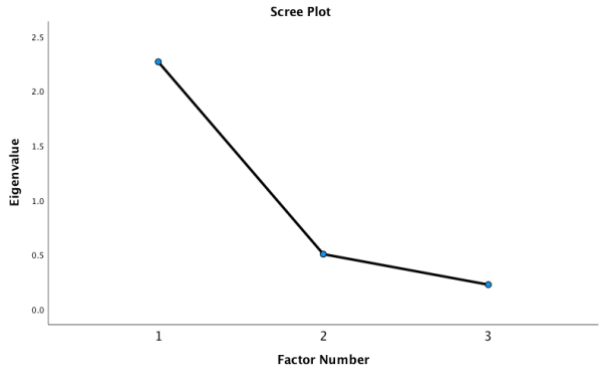
Appendix C

Scree plots

Language latent factor:



Behavioral adjustment latent factor:



The scree plot plots each eigenvalue by the factor that it is associated with which shows the apparent importance of each factor and that a dramatic drop in the slope indicating that it is the cut-off point should be used to decide the number of factors (Field, 2018). Both scree plots showing above suggest that only one factor should be retained for both extractions.

Appendix D

Correlation matrices

Language skills assessments

	LS EV	LS RV	LS SR	LS LC	CELF EV	CELF RS	RAPT Information	RAPT Grammar
LS EV	—							
LS RV	.74***	—						
LS SR	.63***	.57***	—					
LS LC	.66***	.59***	.68***	—				
CELF EV	.78***	.69***	.61***	.66***	—			
CELF RS	.60***	.54***	.70***	.67***	.65***	—		
RAPT Information	.73***	.65***	.64***	.63***	.77***	.65***	—	
RAPT Grammar	.69***	.60***	.68***	.64***	.74***	.69***	.86***	—

Note: LS: LanguageScreen; CELF: Clinical Evaluation of Language Fundamentals - Preschool 2; RAPT: Renfrew Action Picture Test 5th edition; EV: Expressive vocabulary; RV: Receptive vocabulary; SR: Sentence repetition; LC: Language comprehension; RS: Recalling sentence; *** $p < .001$ (2-tailed)

BESSI Behavioral adjustment

	Behavioral regulation	Attention-deficit/Hyperactivity	Sociability
Behavioral regulation	—		
Attention-deficit /Hyperactivity	.73***	—	
Sociability	.66***	.50***	—

Note: *** $p < .001$ (2-tailed)