

# Prediction of Self-Control Based on Cognitive Intelligence and Socio-Emotional Behavior Assessments in Early Childhood

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## Abstract

**Purpose:** The infrastructure core of self-control, as an indicator of future success, is unsettled. To better investigate the nature of self-control, and strengthening it, it is necessary to know to what extent is self-control based on cognitive or socio-emotional abilities?

**Materials and Methods:** The authors measured the cognitive intelligence and socio-emotional behavior of 377 healthy Iranian children (girl=46.1%) by Wechsler Preschool and Primary Scale of Intelligence (WPPSI-III) and Kindergarten Inventory of Social-Emotional Tendencies (KIST) at the age range of 42-66 months (mean=54.86, SD=5.88). Then, they assessed their Self-control competency 18 months later, to know which component of WPPSI or KIST could better predict Self-control.

**Results:** The correlation matrix between all study variables shows that there are more positive significant correlations among Self-control with KIST subsets (5/6) than WPPSI subsets (2/10). The results of automatic linear modelling show that the significant predictors of self-control in the total model ( $R^2=0.161$ ) were Hyperactivity-Maladaptive Behavior (HMB), (coefficient=.137, importance=0.781), and Daily Living Skills (DLS) (coefficient=.127, importance=0.125), so HMB is the best predictor of self-control among the subsets examined in our research. Therefore, self-control is more related to the socio-emotional than cognitive domain.

**Conclusion:** We suggest children who get a low score in socio-emotional assessments, need early supportive intervention and rehabilitation to prevent the maldevelopment of self-control.

**Keywords:** Early Childhood Development; Self-Control; Cognitive Intelligence; Socio-Emotional Behavior; Hyperactivity-Maladaptive Behavior.

## 1. Introduction

Self-control as a regulatory competence has a profound impact on controlling thoughts, regulate emotions, and inhibit impulses [1]. It had always been the focus of attention as an interdisciplinary concept for behavioral and social scientists that help to make healthy life and society [2-4]. Self-control as an indicator of future success [5] and marker of good adjustment [6] is a central function of the self and an essential key to success in life [7]. Self-control is related to diverse areas such as physical health, exercise, substance dependency, crime, finance, social outsourcing, perceived severity of Coronavirus disease 2019 (COVID-19)–mental health problems, prosocial behavior, academic achievement, commitment in online game playing, internet addiction, and even shooting performance! [8–16]. Also, there is a negative relation between self-control and self-reporting stress, anxiety, and depression [17].

Although findings on self-control have increased in recent years, our ignorance is more than our knowledge [13]. There is a significant gap in the self-control literature especially at preschool age that needs deliberate investigation [18-20]. Given that the human psyche is rooted in the basic domains of development in early childhood, the investigation of the initial roots of self-control could be drawn from there. Many researchers consider cognitive and socio-emotional competencies as the basic mental domains of childhood [21–27]. The relation of these competencies with regulation mechanism, well-being, and mental health have been well documented [28–34]. Despite this prominence, when policymakers want to implement related research findings, there are several challenging issues in the literature:

First, only a few studies examine self-control in Early childhood [19]. Second, scientists categorized self-control sometimes as a cognitive, emotional, cognitive-emotional, and sometimes as a socio-emotional ability [31]. Therefore, the infrastructure core of self-control is unsettled. Third, correlational findings do not indicate the directness of relation among domains [35]. Finally, although the interplay among these abilities was investigated in some studies [36, 37], no adequate and specific model has yet been elaborated [38]. To help clarify these issues, the authors conducted the present study to investigate the portion of cognitive intelligence (by WPPSI) and socio-emotional behavior (by KIST) in the prediction of self-control in early childhood development (ECD). Our findings could be

useful in both theoretical and practical ways: first, it can help determine whether self-control's nature is more related to the cognitive or socio-emotional domain to achieve a better interaction model of developmental competencies. Many educational systems, have a specified curriculum for cognitive abilities (for example, memory or calculation) authors could investigate their effectiveness in promoting self-control indirectly. Second, if we can specify the predictive factors of self-control, then we will be able to start early intervention if necessary.

## 2. Materials and Methods

### 2.1. Participants

Our sample was 360 healthy Iranian children (girl=46.1%) from five cities including Tehran (104 persons, 28.9%), Bandar Abbas (80 persons, 22.2%), Mashhad (77 persons, 21.4%), Zarand (62 persons, 17.2%), and Tabriz (37 persons, 10.3%) as the representative provinces of the Iranian population, based on the geographical distribution and socioeconomic status. They were in middle socioeconomic status from the Persian population, and 97.3 % of the children lived with both parents. In the first wave, their age ranged from 42-66 months (mean=54.86, SD=5.88) as the earliest age could assess these domains reliably [39], and in the second wave reassess them at 18 months later, when they become 60-84 months.

### 2.2. Procedure

Participants were recruited from the study of “growing up in Iran” using stratified random sampling. First, the authors target kindergartens from the south, north, west, east, and center of each city, then, in a meeting describe the goals of study for the manager and counselors of kindergarten. From every center, we choose two classes randomly then prepare a list for children aged 42-66 months. Eligibility criteria were: a) the children must be between 42-66 months old (preschool age), b) they must not have cerebral palsy or other developmental or motor impairment, c) they must be living with both parents, and d) they must be in attendance in preschool for at least 3 months. Mothers who were interested in participating in the study were contacted, via phone, to schedule an appointment at home or school, according to their preference. Only parents who were interested in participating in the study and signed the consent form

were included. Before the administration of the assessments, parents were informed about the aims of the study and data collection process and received instructions on how to administer the questionnaire. They could return the form if they did not want their child to participate (although some parents called the research coordinators for additional information, none of the parents returned this form).

Also, parents ensured that confidentiality and anonymity were rigorously respected and the children were informed that no information about specific responses would be shared with teachers or parents. Next, 11 trained interviewers rechecked children for physical and mental health based on interviews and parent reports. Then they collected cognitive and socio-emotional data for 3 months, in the first wave. To gather simultaneous data, assessments were done within the same week. Then 18 months later, they gathered self-control data with the same procedure, in the second wave.

### 2.3. Measures

Because of the nature of emotional experiences, self-reporting is the most preferred and most practical way of assessing emotion in adults. But for younger children, information reported by their peers such as parents and teachers is more appropriate [40, 41]; therefore, the parent report-based tools were used for socio-emotional and self-control domains. Also, we use WPPSI-III because the extensive psychometric data support its application in studying general intelligence levels and broad cognitive abilities in children aged 30-87 months [28, 42].

### 2.4. Self-Control Scale

Humphrey (1982) developed a self-control scoring scale [43] based on the self-assessment tool developed by Kendall and Wilcox [44]. Their method examined the general domain of self-control in two aspects: 1) Cognitive/Personal and 2) Behavioral/Interpersonal.

The questionnaire consisted of 15 questions; eight assessed cognitive/personal dimension, four assessed behavioral/interpersonal dimension, and three assessed both of them. The prediction of the total variance of this questionnaire in the cognitive/ personal dimension was  $\Sigma=.41$ (, in the behavioral/ interpersonal dimension it was  $(\Sigma=.26)$  and in total it was  $(\Sigma=.67)$ . Test-retest reliability for these two tests after two and a half to four weeks interval was: cognitive/personal ( $r=.93$ ), behavioral/interpersonal ( $r=.88$ ), and totally ( $r=.94$ ) [43].

### 2.5. Kindergarten Inventory of Social-Emotional Tendencies (KIST)

The socio-emotional ability was assessed by the Persian version of the KIST, developed by Miller, Michie, and Miller [45]. This inventory consisted of six subsets: hyperactivity-maladaptive behavior (HMB:16 items), social skills (SS:8 items), communication skills (CS:8 items), daily living skills (DLS:6 items), eating behavior (EB:3 items), and separation anxiety symptoms (SAS:5 items) on a 5-point scale (1=never to 5=always). The reliability for the Persian version of this instrument was ( $r=0.86$ ) for total and ranged from ( $r=0.52$ ) (SAS) to ( $r=0.77$ ) (HMB) for subscales [46].

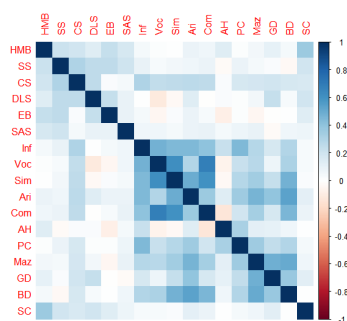
### 2.6. Wechsler Preschool & Primary Scale of Intelligence (WPPSI-III)

The children did the Persian version of the third version of WPPSI-III [47], which was initially constructed by Wechsler and Kodama [48]. It consists of 10 subtests, five of which made up verbal Intelligence Quotient (IQ) (information, comprehension, arithmetic, vocabulary, and similarities), and the other five made up performance IQ (animal house, geometric design, block design, mazes, and picture completion). The verbal IQ and performance IQ made full-scale IQ, which is defined as the average of all cognitive abilities. The reliability for the Persian version of this instrument was ( $r=.83$ ), ( $r=.90$ ), and ( $r=.88$ ), for verbal, performance, and total IQ, respectively.

## 3. Results

Data analyses were performed using the IBM SPSS Statistics 26 package. We calculated partial correlations among cognitive, socioemotional, and self-control domains. The correlation matrix between all study variables shows that there are more positive significant correlations among Self-control with KIST subsets (5/6) than WPPSI subsets (2/10; Figure 1). Then we applied stepwise regression analyses to investigate the effect of WPPSI and KIST on children's Self-control 18 months later. HMB, SS, CS, DLS, EB, and SAS (as socio-emotional domain); information, comprehension, arithmetic, vocabulary, similarities, animal house, geometric design, block design, mazes, and picture completion (as cognitive domain) considered as independent variables, and self-control as a dependent variable.

Stepwise regression was calculated to predict Self-control based on their WPPSI and KIST scores. A significant



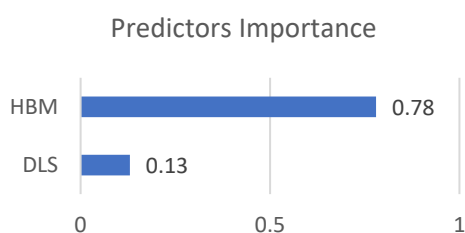
**Figure 1.** Pairwise correlation matrix of the research variables (HMB: hyperactivity-maladaptive behavior, SS: social skills, CS: communication skills, DLS: Daily Living Skills, EB: eating behavior, SAS: separation anxiety symptoms, Inf: information, Voc: vocabulary, Sim: similarities, Ari: arithmetic, Com: comprehension, AH: animal house, PC: picture completion, Maz: mazes, GD: geometric design, BD: block design, SC: self-control)

regression equation was found ( $F(2,357)=34.180, p<.001$ ) with an ( $R^2=.161$ ). Children’s predicted Self-control is equal to  $17.592 + 0.343(HMB) + 0.163(DLS)$ . Self-control scores increased 0.343 and 0.163 score for each score of HMB and DLS, respectively. Both HMB and DLS were significant predictors of Self-control (Table 1).

The results of Automatic Linear Modeling (Best Subsets Method) with 16.1% accuracy, show that the significant predictors of Self-control ( $R^2=0.161$ ) were HMB (coefficient=0.137, importance=0.781,  $p<.001$ ) and DLS (coefficient=0.127, importance=0.125,  $p<0.05$ ; Figure 2).

**Table 1.** Summary of stepwise regression analysis for variables predicting Self-control (HMB: hyperactivity-maladaptive behavior, DLS: Daily Living Skills)

Step	1	2
<b>Predictors</b>	HMB	HMB DLS
<b>B</b>	0.157	0.147 0.157
<b>β</b>	0.367	0.343 0.163
<b>t</b>	7.462***	7.004*** 3.332***
<b>R</b>	0.367	0.401
<b>Adjusted R<sup>2</sup></b>	0.132	0.156
<b>F</b>	55.688***	34.180***



**Figure 2.** Importance of significant cognitive and socio-emotional predictors of self-control in a linear model ( $p<.5$ ; HMB: hyperactivity-maladaptive behavior, DLS: Daily Living Skills)

## 4. Discussion

The first aim of the present study was to investigate the nature of self-control to know to what extent is self-control based on cognitive or socio-emotional abilities? Our results show that the correlation between KIST and Self-control is stronger than WPPSI. Furthermore, more KIST subsets could predict Self-control 18 months later. We, therefore, conclude that self-control has a more insubstantial amount of shared variance with the socio-emotional domain than cognitive. Consistent with this finding, many kinds of research show the relations between SEB and Self-control. A meta-analysis by De Ridder *et al.*, (2012) reported a small to medium relationship between self-control and various human functioning, regardless of the scale of assessment [49]. After Reviewing existing literature, they found that the effect size for the impact of self-control on prosocial behavior was ( $r = 0.25$ ).

Tangney *et al.* (2018) hypothesized that self-control has positive bi-directional relations with interpersonal adjustment [6]. People with high self-control were better adjusted, had better interpersonal skills and relationships, and emotional lives than others [6] and they show better interpersonal accommodation, better dyadic adjustment, and more satisfying relationships [50]. Also, good effortful self-control among preschool children, reported by parents and teachers, predicted more socially competent responses [51]. Teacher ratings of preschools’ self-control predicted later social status as children who had better self-control become more popular [52]. On the other hand, low levels of self-control were strongly related to both behavioral and emotional problems for early adolescents [53], and it is a significant risk factor for a wide range of personal and interpersonal problems [6]. This substantial amount of shared variance could be interpreted in these ways. Self-control appears to facilitate empathy, as the ability to take another person’s perspective instead of one’s point of view and understand someone else’s concerns [6]; in the sympathetic interactions, such as when people suffer from doing hurtful things on impulse and needs to be appeased. It can also be supportive by helping others to achieve their goals, such as by enabling people to resist temptations. People with high self-control do more socially desirable things and become better partners because social desirability involves the overriding selfish interests in doing the best work for the entire community. Better self-control would be correlated with higher relationship quality, enhanced empathy, a willingness to forgive others for their misbehaviors, and a secure attachment style [6].

On other hand, there are also increasing research findings that show poor self-control may cause angry outbursts that lead to aggression and antisocial behavior [6]. Anger can be interpersonally harmful and troublemaking, sometimes causes others to keep their distance. Several studies showed that children who could not regulate their aggressive behavior were more rejected by peers [54, 55]. The final consequence of this poor self-control is problems in sharing emotions with others and extend social bonds. Taken together, these findings highlight the critical relations between socioemotional behavior and self-control. Besides cognitive and socio-emotional competencies, the role of other factors with self-control has been investigated. For instance, the social role of language in the regulation of a child's own and others' actions in Vygotsky's cultural-historical theory [56, 57], the interaction among self-control with children's language competence, social and communicative skills [58, 59], relations of self-control with the positive and dysfunctional family environment [6], and mediating role of resiliency in the relations between effortful control and popularity [60] has been discussed. As result, predicting self-control ultimately needs a multifaceted approach.

The second aim of our study was to examine which one of the WPPSI or KIST subsets could better predict Self-control in ECD. Our results show that HMB is the strongest predictor of Self-control among present subsets. So, although the HMB (with 16 Items) cannot predict Self-control, ultimately observed correlation ( $r=0.367$ ) and prediction power (13.5%) is a remarkable finding. Similarly, Rohde (2000) found that high self-control was linked to adaptive traits and behavior patterns but was not related to intelligence [6]. Because HMB consists of two subsets, i.e., Hyperactivity and Maladaptive behavior, we take a closer look at it. Many findings in clinical settings show relations among hyperactivity, maladaptive behavior, and self-control. One of the well-known related disorders is ADHD, which is associated with inappropriate levels of hyperactivity, impulsivity, and general lack of inhibition [61]. Children diagnosed with ADHD are in danger of poor self-control and related difficulties [62]. People with high self-control have fewer impulse control problems, including binge eating and alcohol abuse [6]. Preadolescent and early adolescent boys with low self-control show an excessive risk for aggressive and delinquent behavior [63, 64].

In explaining these findings, it can be assumed that Hyperactivity leads to overloading working memory. As result, it makes it difficult to consider the details and

outcomes. It leads to failure to think about the consequence of actions (impulsivity) and maladaptive behavior. Besides, concentrations to pursue a goal and persistence on long-lasting plans are fundamental for controlling ability when distractions and temptations make obstacles. As a result, children with well-focused attention on perseverance activities lead to strong self-control ability. On the other hand, the interaction between maladaptive behavior and control competence has been reported in other studies [65–68]. Strengthening emotion regulation skills is useful for individuals who display co-occurring maladaptive behavior [65]. It seems that mastery in regulating adaptive behavior, especially in hyperactive children, requires positive interaction with peers and respect for others' rights. So if one child is not able to adapt to other children, others will not build a constructive relationship with him. As a result, his problematic behavior with others intensifies and it becomes harder for him to control himself, and this vicious cycle continues.

#### 4.1. Limitations and Future Research

Observing and recording children's behavior and thoughts in their natural milieu adds up the study's ecological validity. As Kuppens (2019) points out, it is valuable to measure socio-emotional subsets in real life [69]. Furthermore, investigating childhood abilities developmentally in the real world is so worthy. The present study despite these strengths also had some limitations:

Many factors may influence a child's performance, the most crucial factor of which is how to interpret a child's scores. Performance during the administration of a test may be affected by the rapport between the child and evaluator, social or physical environment, distractibility, off-task behavior, difficulty with prolonged testing, interest in the materials, and motivational and other child-related factors. Parents' attitudes toward their children may have a positive or negative effect on how to complete it. Also, the measurement of structures such as socio-emotional and self-control abilities with a paper-and-pencil and self-report questionnaire has limitations [70] that must be taken into account [69]. Multifaceted interaction and rapid development of these constructs in early childhood is another issue that further complicates the complexity. Finally, there is the ambiguity of the self-control construct and the plethora of nomenclature associated with it [71].

Consequently, studies with a detailed, comparative, and specific operational definition of these structures

can scrutinize the degree of overlap and differentiation within these abilities. Besides, simultaneous measurements of neural correlates of brain functions by using neuroimaging methods, alongside behavioral observations and questionnaires, can reflect other aspects of human abilities [69,72]. Finally, using mathematical and computational tools derived from complex systems, dynamic systems, and control theory [32] is a contributory approach to shed new light on this complicated interplay.

## 5. Conclusion

The results of this study take us one small step closer to better understanding the nature of self-control. The present study is one of the few developmental studies which examine the interaction among socioemotional, cognitive, and self-control abilities in early childhood. This finding shows that although the basis of self-control is more related to the socio-emotional domain, we should look at self-control as a multifaceted competence. Taken together, these findings suggest that parents, caregivers, teachers, and policymakers should choose a multidimensional approach to achieve personal and social well-being and mental health. In particular, because children grow rapidly and nonlinearly [34], early intervention is more effective and less costly than later action [73]. In addition to the current cognitive-based educational curriculum, designing specific programs and early interventions to strengthening SEB and Self-control is a capable junction to achieve a healthier and satisfying life.

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