American Journal of Applied Psychology
2023; 12(1): 16-27
http://www.sciencepublishinggroup.com/j/ajap
doi: 10.11648/j.ajap.20231201.13
ISSN: 2328-5664 (Print); ISSN: 2328-5672 (Online)

The Factorial Structure of Self-Regulation from Late Childhood to Adolescence: A Gender Perspective

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To cite this article:
Asmaa Mohamed Reyad, Amany Ahmed Yehia, Fadya Zaky Elwan. The Factorial Structure of Self-Regulation from Late Childhood to Adolescence: A Gender Perspective. *American Journal of Applied Psychology*. Vol. 12, No. 1, 2023, pp. 16-27.
doi: 10.11648/j.ajap.20231201.13

Received: January 31, 2023; **Accepted:** March 13, 2023; **Published:** March 28, 2023

Abstract: The present study aimed to examine the factorial structure of self-regulation across three different groups (i.e. late childhood, early adolescence, and middle, adolescence) within male and female samples. Two theoretical models were tested. The first is the unidimensional model which assumes that self-regulation is a domain-general ability without clear differentiation between its components (cognitive, emotional, and behavioral). The second model implies that self-regulation is conceptualized as a multidimensional construct that's composed of cognitive emotional, and behavioral components. Objective: The current study examined the validity of the unidimensional model and the multidimensional model of self-regulation across the 3 age groups separated by gender. In addition, the study sought to identify gender differences in the factorial structure of self-regulation in children and adolescents. Materials and methods: The participants comprised 584 participants aged 8 to 19 years. They were enrolled in Elementary, middle and high schools in Egypt. The participants completed a self-regulation scale consisting of three subscales designed to evaluate emotional, cognitive, and behavioral self-regulation. Results: The results favored the multidimensional model across all different age groups. The difference between the two models was statistically significant favoring the multidimensional model over the one-factor solution. The results also revealed within genders t differences in the developmental course of self-regulation.

Keywords: Structure of Self-Regulation, Gender Differences, Late Adulthood, Adolescence

1. Introduction

Self-regulation is defined as the internally directed ability to regulate attention, and behavior to respond successfully to both external and internal pressures [2].

Self-regulation has drawn a lot of attention in recent years as a crucial indicator of several outcomes, including obesity, adolescent academic success, long-term health and educational outcomes, and readiness for school. Even though different theoretical perspectives on self-regulation have been taken by researchers [22].

There is a consensus that self-regulation has important implications for individual trajectories of health and well-being across the life course. Indeed, over a decade ago, it was suggested that "understanding self-regulation is the single most crucial goal for advancing the understanding of development" [26].

At all stages of life, self-regulation is essential to accomplishing adaptive developmental tasks successfully transitions and, turning points for the development of these skills. [20]

The early childhood years represent a crucial milestone in the life course because they constitute a sensitive period for the development of self-regulation and underlying executive function skills. This makes it especially important for children's early biological, cognitive, and social-emotional development [7].

Adolescence, represents another sensitive period of development, especially for self-regulation. Adolescence is characterized by extraordinary biological and social changes. [20] The skills required for advanced, adult-like self-regulation may mostly develop during adolescence due to cognitive and social development. This is in large part due to the gradual maturation of the prefrontal context. In particular,

as the frontal lobe develops, so does higher-order, regulation-relevant cognition, such as metacognition and internalized control. [39] In turn, these skills enable adolescents to make better interpretations, choices, and decisions about how to interact with their environment, especially in accordance use of long-term goals [19] Results of studies examining self-regulation development in adolescence have shown that adolescents master the ability to pay attention to more complex situations and to focus on tasks for longer periods. In addition, they acquire the skills to plan future behavior in the long term and to monitor and control thoughts emotions, and behavior. Individuals grow in their self-regulation over a long period of adolescence there are substantial individual differences in the pace at which this skill improves. [83]

All previous results imply that both children and adolescents show significant differences in the pace of developing their regulatory skills. Given the importance of such differences. It's interesting to explore similar differences among other groups for example gender differences in the development of self-regulation have been documented in various studies. In one study girls showed higher than boys on multiple measurements of behavior. In the same vein Shield and Spinneys (2002) found that boys tended to be poorer than girls in both aspects of self-regulation in early and late childhood. In addition, similar results have been found in adolescence. Meta-analytic studies have shown that girls have higher motivation and ability to engage in behavior than boys [30, 31, 89] girls to also tend use strategies that aim to feel better. In contrast, boys tend to be emotionally disengaged from stressful situations. [41, 44, 86]

The idea that male and female adolescents behave differently during adolescence is further supported by research on gender differences in the occurrence of behavior problems as well as in self-regulation [38, 68] In fatal accidents, gambling, and criminality, adolescent males outnumber adolescent females. Lower levels of self-regulation are increasingly shown to be a risk factor for the emergence of these psycho-social behavioral problems. [8, 37, 88] Such results provided a basis for examining gender aspect in the development of self-regulation. More precisely the present study aims to investigate the developmental course of the factorial structure of self-regulation in males and females aged 9 to 18 years old.

2. Literature Review

2.1. Theoretical Models of Self-Regulation

Self-regulation is defined as the ability to monitor and modulate our emotions, behavior, or cognition to allow us to achieve goals and adapt to changing circumstances [4] It is the internally-directed capacity to regulate effect, attention, and behavior to respond effectively to internal and environmental demands [34] which implies that Self-regulation involves both the initiation and maintenance of behavioral change in addition to inhibiting undesired behaviors or responding to environmental demands. [35]

Self –Regulation has been conceptualized in diverse ways in the developmental literature, reflecting implicit or explicit assumptions about the construct and its components. [63]

Two different perspectives of the structure of self-regulation on can be found. The first one, suggests that self-regulation is a domain general ability without clear differentiation between components such as emotional and behavioral self-regulation. From this perspective, "similar processes are common across all self-regulation domains. Self-regulation is regarded as a limited resource shared across behavioral, emotional, and cognitive domains" [21, 35].

Consistent with this theoretical approach, a longitudinal study with 646 children aged 4 to 12 conducted by Raffaelli, Crockett, and Shen (2005) examined the developmental course of self-regulation in a cohort of children who were 4 to 5 years old and who were followed up at ages 8 to 9 and ages 12 to 13. Levels of self-regulation. Comparisons of 1-, 2-, and 3-factor models suggested that the different aspects of self-regulation are highly interrelated, and support the adoption of a single-factor model leading to the conclusion that a single factor is efficient and sufficient. [63]

The second, more popular perspective assumes that self-regulation is a multidimensional construct composed of emotion, cognition, and behavior with specific developmental trajectories. Even though the behavioral and emotional regulatory processes, are interrelated, they may be representations of developmentally distinct systems. Related to this point of view, some empirical studies have indicated that emotionality and regulation although conceptually distinct, that highly related empirically (Eisenberg, Bernzweig, Karbon, Poulin, Hanish, 1993) Several cross-sectional studies have replicated the multidimensional structure of self-regulation. [4]. For instance, Kalpidou, Power, Cherry, and Gottfried (2004) examined the relationship between the emotional and behavioral components of self-regulation during the preschool period among children from two age groups (3-year-olds, and 5-year -olds). These results demonstrated the distinctiveness of the emotional and behavioral components of self-regulation. In addition, the relationship between the two components becomes stronger with age [42]. Similar results were obtained in a study conducted by Shields, Cicchetti, and Ryan (1994) on two groups of children aged 8 and 12 years. [81]

Worth noticing that most of the previous studies have been conducted on early and late childhood. Yet, little research has examined the validity of both models in late childhood and adolescence. The transitional stage from late childhood to adolescence deserves further elaboration. In adolescence, children experience a sensitive period of development in physical social, and cognitive capacities. Moreover, adolescence represents the second decade of life; starting almost from 12 years of age through at least 21 years. This period of life is characterized by three different phases; early, middle, and late adolescence. It is possible that differences

between males and females differences in self–regulation is related to differences in developmental changes occurring during this period. The present study aims to tackle such an issue. [49]

Furthermore, this study examined the possible gender aspects in the development of the construct of self–regulation in three separate age groups. Several studies suggested that the factorial structure of self–regulation does not vary across gender [74]. A general review of the research on gender differences in the development of self–regulation shows that females typically exhibit higher levels of self–regulation than males across the lifespan. In addition, one of the limitations of such studies is that gender is studied as a covariant in the analysis rather than assessed separately.

The current study addressed this problem by examining the validity of the unidimensional model and the multidimensional model across the 3 age groups separated by gender.

2.2. A Review of the Construct of Self-Regulation

Several components of self–regulation have been developmentally studied, early research studies focused primarily on emotion–related regulation in infancy and early childhood as well late childhood [54]. Later, scholars emphasized the fluid cognitive processes that self-regulated action (i.e. attentional processes, inhibitory control, and working memory. Still, other investigators draw attention to the behavioral components of self–self-perception as reflected in inhibition and effortful control processes. A brief review of the theoretical and empirical literature on each aspect of self–regulation is followed.

2.2.1. Emotional Self-Regulation

Because of its importance across the life span, the study of emotion regulation constitutes an area of research in itself. Emotion regulation refers to children's ability to appropriately regulate their emotions well as the behaviors influenced by such emotional reactions [9].

Emotion regulation is a process that becomes more automatic and improves with practice, which enables the child to manage increasingly complex and stressful environments. Emotion regulation emerges within early social relationships and takes different forms at various points in development [10] Emotion regulation is thought to develop as a function of multiple dynamic processes that occur at all levels of th*e* relational person ←→ context system, from the neuronal to the societal [61].

In infancy, early regulatory tasks are tied to regulating children's attention and affective, temperament-based reactions to stimuli and information in the environment. These actions most clearly relate to emotion regulation in early childhood when children must exert considerable effort to regulate their overt behaviors. Different types of emotion regulatory strategies have been proposed to help young children effectively manage their affect and emotions [35, 94].

Zimmerman (1999) describes four types of emotion-regulatory strategies: instrumental or trying to change the situation (e.g., bidding for caregiver attention), comforting or soothing oneself without changing the situation (e.g., thumb-sucking), distraction or redirecting attention elsewhere (e.g., looking away), or cognitive, which is thought to be the most sophisticated and includes reframing the situation in a positive light, bargaining, or compromising. Importantly, children use different strategies depending on their individual characteristics as well as the situational context. This line of work demonstrates that the regulation of attention and emotion is closely interrelated [95, 96].

Development of emotion regulation proceeds from regulation by others to increasing self-regulation as children mature This transition occurs as children's representations of emotion and situational appraisals become more sophisticated, brain maturation promotes the growth of executive functions and other self-regulatory capacities, socialization processes increasingly support and reward children's emotional self-control, and children's emotion goals increasingly integrate cultural values concerning the expression of feelings. [25, 36, 84]

Individual and developmental differences in emotional reactivity and self-regulation are also results of developing neurobiology and how it is influenced by the experience of stress and the social buffering of stress provided caregivers support. Consequently, biological, relational, and representational processes influence the development of emotion regulation and individual differences in self-regulation. This results in changes not only in children's use of emotional self-control strategies, but also in other characteristics of emotional responding that reflect these developmental influences. These include increased flexibility in managing emotional challenges, the ability to balance and prioritize different emotional goals in social settings, proactive efforts to mobilize emotions in pursuit of one's goals, and growing context specificity of the goals and strategies underlying emotional regulation. [72]

Adolescence is a developmental stage characterized by rapid and fundamental changes in biological, cognitive, social, and emotional domains. During this developmental stage, many aspects of life are accompanied by intense negative emotions in daily life as well as unstable peer and romantic relationships and a decline in perceived parental support. Nevertheless, there is variation within the teenage years. Compared to late adolescence, early adolescence is characterized by a higher rate of conflicts with parents and a greater variability of negative emotions. In contrast to early adolescence, conflicts with parents become more emotional during middle adolescence, while agreeableness and conscientiousness both decrease and neuroticism increases. [71, 85]

In recent years, research on emotion regulation from infancy to adolescence has increased revealing a surprisingly rich repertoire of emotion regulation strategies in childhood. Studies suggest that there are fewer age-related changes in the use of emotion regulation strategies during middle childhood compared to the general increase in strategy

effectiveness. There is also no consistent developmental pattern during adolescence. Silk, Steinberg, and Morris (2003) found no age differences in the use of emotion regulation strategies from early to middle adolescence, whereas Zeman and Shipman (1997) found that 14-year-olds used emotion regulation more than 11- and 17-year-olds. For expressive suppression, there are no age differences during early adolescence, a small decrease for girls during middle adolescence, or an increased use only for sadness and only during middle adolescence compared to early and late adolescence. Middle adolescence, late adolescence, and adulthood are characterized by an increase in the use of all cognitive emotion regulation strategies. [15, 62, 63]

2.2.2. Attentional and Cognitive Self-Regulation

Attentional and Cognitive self-regulation is a part of Executive functions. "Executive function is theorized to be a group of higher order cognitive abilities that enable individuals to orient towards the future, demonstrate self-control, and successfully complete goal-directed behavior [11, 49] Many researchers consider inhibitory control, working memory and attentional shifting, also referred to as cognitive flexibility, as the foundational cognitive processes that are thought to be especially relevant to executive function and, in turn, self-regulated action **[**5, 31, 46].

(i). Inhibitory Control

Inhibitory control (one of the core EFs) involves being able to control one's attention, behavior, thoughts, and/or emotions to override a strong internal predisposition or external lure, and instead do what's more appropriate or needed. [5, 12] Attentional flexibility refers to the ability to voluntarily focus on a task and shift attention when needed [32] Research suggests that children begin to display inhibitory control by approximately Age 3 a period that also corresponds with the development of endogenous attention. Inhibitory control develops throughout childhood, increasing throughout adolescence and into early adulthood [5, 79] inhibitory control implies an increased level of personal effort and future orientation accordingly enables individuals to be more active producers of their own development. Inhibition also plays a major role in other conceptualizations of self-regulation such as effortful control and delay of gratification [31] Inhibitory control of attention enables children and adolescents to selectively attend, focusing on what they choose and suppressing attention to other stimuli. It also enables them to c se voluntarily to ignore (or inhibit attention to) particular stimuli and attend to others based on their goals or intention [23].

Welsh et al. (1991) suggest that the ability to resist distraction is the first executive skill to be acquired around the age of 6, reaching adult levels of impulse control around 10 years of age. [92] A curious increase in impulsivity has been found by some authors to occur around the age of 11, although, in general, children at this age are able to regulate and monitor their actions well. [1,] Studies investigating the progression of executive functions through adolescence have demonstrated an increased attentional capacity and speed of processing during this period. A study by Anderson et al. (2001) proposed the possibility of a growth spurt in these domains around the age of 15. [94] Gender effects were also present with boys showing better performance than girls in tasks life during childhood, with this pattern reversing during early adolescence. This crossover was found to occur around the age of 11, and further studies into the gender differences in executive development are required [28, 43. 54. 82]

(ii). Working Memory

Working memory is another aspect of executive function and is closely related to inhibitory control [31]. Working memory includes actively working on and processing information and is demonstrated by the child's ability to remember and follow instructions in a multitasking activity. The ability to hold information in mind develops very early; even infants and young children can hold one or two things in mind for quite a long time. [17] Infants of only 9 to 12 months can update the contents of their WM, as seen on tasks such as A-not-B (Bell & Cuevas 2012, Diamond 1985). However, being able to hold many things in mind or do any kind of mental manipulation (e.g., reordering mental representations of objects by size) is far slower to develop and shows a prolonged developmental progression [12] Moreover, working memory constitutes a skill set that is related to intentional self-regulation. It enables children and adolescents to hold information in mind while they work and consider the best solution or strategy. [33] Working memory develops rapidly in childhood and adolescence with a substantial increase in capacity seen during these periods of the life span [14] A variety of tasks document improvement in WM during the preschool years [24] Best and Miller reported that by age 6, the executive component of WM is sufficiently developed to be used during complex tasks that require coordination of WM subcomponents. In addition, the same researchers found that simple and complex WM tasks had similar developmental trajectories—a linear increase from ages 4 to 14 and a leveling off between ages 14 and 15 across nearly all tasks examined. [6] A body of cognitive research concluded that individuals of high working memory capacity are more successful in enacting control goal-directed processing in attention-demanding circumstances. Conversely, among those low in working memory capacity controlled processing breaks down and less appropriate or undesired responses emerge [17].

(iii). Attentional Shifting

The third core EF is the ability to shift between mental states, rule sets, or tasks [48]). There appears to be a substantial need for inhibition and WM processes for shifting. [6] Attention shifting plays a major role in self-regulation as a gestalt phenomenon and aspects of attention are especially intertwined with emotion regulation in infants and children [48] Attentional flexibility or shifting refers to the ability to voluntarily focus on a task and shift attention when needed [52] Attentional control and flexibility enable children to selectively focus goal relevant environmental inputs, implicating attention in the vast majority of developmental regulations. In addition, the function of

attention in self-directed intentionality and responsiveness implicates attentional control as a mediator of agent-driven interactions between individuals and their environments. Therefore, attentional control serves as a key to lifelong self-regulation. In the first few years of life, research on the development of attentional control depicts the transition from basic arousal to fully endogenous attention. [13, 16] And subsequent development of attentional capacities from childhood to old age [48].

Attentional processes have a significant role in self-regulated activity [48] and may be particularly associated with emotion regulation in infants and children [53] the ability to successfully shift between task sets follows a protracted development through adolescence. It appears that preschool-aged children can handle shifts between simple task sets and later can handle unexpected shifts between increasingly complex task sets.[91] Both behavioral and physiological measures indicate that during adolescence, monitoring of one's errors is evident, and by middle adolescence, task switching on these complex shift paradigms typically reaches adult-like levels. Because of greater need for multiple cognitive processes, mature shifting likely involves a network of activity in many Prefrontal cortex regions. [29, 87]

All aspects of executive function develop rapidly during early childhood, which may be a sensitive period for developing self-regulation [13] the integration of these components are most relevant for school-related demands, enabling children to control their behavior, remember instructions, pay attention, and complete tasks. Moreover, successfully navigating the demands of the classroom requires integrating all three processes [34].

2.2.3. Behavioral Self-Regulation

McClelland et al. (2014) define behavioral self-regulation as "deliberately applying multiple component processes of attentional or cognitive flexibility, working memory, and inhibitory control to overt, socially contextualized behaviors" and identified it as especially important for early academic achievement due to requirements for children to manage their behavior in the classroom [56, 62]. A growing body of research revealed that Children's ability to manage their behavior has been identified as one of the most important prerequisites to school success [57].

Delay of gratification and effortful control are two major temperamental characteristics that underlie behavioral self-regulation. Both constructs involve inhibiting conflicting thoughts or behaviors in order to achieve long-term goals and are thought to rely on internal, or self-controlled, processes that allow a child to overcome the tendency to respond to stimulus-driven impulses [13].

(i). Delay of Gratification

To function effectively, individuals must voluntarily postpone immediate gratification and persist in goal directed behavior for the sake of later outcomes. [49]

A Delay of gratification is the resistance to the temptation of an immediate pleasure in the hope of obtaining a valuable and long-lasting reward in the long-term. In other words, delayed gratification describes the process that the subject undergoes when the subject resists the temptation of an immediate reward in preference for a later reward. [27, 61]

Generally, delayed gratification is associated with resisting a smaller but more immediate reward to receive a larger or more enduring reward later. A growing body of literature has linked the ability to delay gratification to a host of other positive outcomes, including academic success, physical health, psychological health, and social competence. [12]

Children under the age of five demonstrate the least effective strategies for delaying gratification, such as watching the reward and actively considering its attractive features. By age 5, the majority of children are able to accomplish greater self-control by recognizing that focusing on the reward is counterproductive. Five-year-olds frequently choose to actively distract themselves or even use self-instructions to remind themselves that waiting may result in a greater reward. Between the ages of 8 and 13, children develop the cognitive ability to differentiate and employ abstract versus arousing thoughts to redirect their attention away from the reward, thereby prolonging the delay. Once delay strategies are developed, the ability to resist temptation is relatively stable throughout adulthood. [81, 90] The performance of preschoolers on delayed gratification tasks correlates with their performance as adolescents on tasks designed to measure similar constructs and processing, paralleling the development of willpower and the frontostriatal pathways that connect the frontal lobe to other brain regions). [21]

(ii). Effortful Control

Rothbart and Bates (1998) defined effortful control as "The ability to inhibit a dominant response to perform a subdominant response" (p. 137) [21, 78].

Effortful control has been conceptualized as a biologically based mechanism that is an aspect of temperament that develops throughout childhood as the brain matures and interacts with the environment [55] it is involved in the process of problem-solving as well as behavior regulation due to the top-down processing involved. Effortful control often interacts with and is central to other forms of control such as emotional control and inhibitory control [66].

From very early in life, children greatly differ in their EC abilities. During infancy, caregivers provide much control over children's behavior until the end of the first year of life when forms of self-regulation start to develop. Subsequently, the capacity for effortful control increases markedly in the preschool years and may continue to develop into adulthood. However, despite the progressive development due to maturation, EC appears to show within-subject stability from toddlerhood through preschool and into early school-age years. Strong increases in this function are observed during early childhood followed by a more progressive development during late childhood and adolescence, as brain processes related to executive control become progressively more refined and efficient. Efficiency of regulation is partially determined by the genetic endowment of the individual and

is also affected by environmental factors such as parenting and education. [22, 51, 67]

Given that effortful control relates so closely to attentional control and the flexible regulation of behavior (such as choosing a particular action under conflicting conditions, detecting errors, and planning), it is not surprising that it relates to academic adjustment; effortful control relates closely to academic competence and outcomes and increasingly serves as a concept central to understanding processes of learning and social adjustment in schools. [47]

Available evidence indicates, then, that effortful control provides a useful construct for the adolescents Psychological and social adjustment. [45]

3. Methodology

3.1. Sample

The study was conducted on a total sample of 584 participants aged 8 to 19 years. They were divided into three age groups:

1) Late childhood group (69 males: mean age = 10,01 years, SD =,99; 95 females mean age = 01,01 years, SD =1.07)
2) Early adolescence group (69 males: mean age = 10,01 years, SD =, 62; 95 females mean age = 01,01 years, SD =,06)
3) Middle adolescence group (69 males: mean age =00,01 years, SD =, 6, 95; females mean age = 00,61 years, SD =58)

They were enrolled in Elementary Middle school and high national Egyptian schools.

3.2. Measures

The self-regulation scale designed by the researchers consisted of 61 items distributed as follows:

1) Cognitive self-regulation (20 items)
2) Behavioral self-regulation (25 items)
3) Emotional self-regulation (16 items)

The 61 items were selected from various original self-regulation measures [64, 65]. The items were adopted (i.e. slightly reworded and translated in Arabic) from the cognitive, emotional, and behavioral subscales of the original scales. In addition, some new items were developed. The total score of the 61 items scale represents a proximal score of self-regulation. Responses were gathered on a 5- point Likert scale ranging from one to five. Where 1- means (never or very rarely true) and 5 - (very often or always true).

Examples of items in each subdomain

1) Behavioral self-regulation
   a) I can be patient until what I want is achieved.
   b) I continue with my work until it is finished.
2) Emotional self-regulation
   a) I can control my emotions when there is a disagreement with my friends.
   b) I control my anger when I am upset by people‘s actions.
3) Behavioral self-regulation
   a) I can be patient until what I want is achieved.
   b) I continue with my work until it is finished.

The measure is reported to have good reliability (measured via test-retest and Cronbach’s alpha) and internal consistency validity (Table 1).

Table 1. *Reliability and validity of tests (cognitive, emotional and behavioral self-regulation.*

Variable	Test – retest reliability (N=119)	Alpha Cronbach Reliability (N=119)	Internal consistency validity (N=584)
Cognitive self-regulation	0.80	0.6	**0.81
Emotional self-regulation	0.63	0.34	**0.60
Behavioral self-regulation	0.74	0.7	**0.88
Total self-regulation	0.83	0.81	

Table 1 Indicates that validity and reliability coefficients were reasonably moderate to high.

3.3. Data Collection

Before completing the measures, the participants reviewed the consent form and were informed that participation was voluntary. Furthermore, they were assured of anonymity and confidentiality about to they were not required to write their names on the forms. The tests were completed in group sessions. The data were gathered from Octobert 2017 to December 2017.

3.4. Data Analysis

Before conducting the major statistics (confirmatory factor analysis) 12 items have been chosen from the 61 items reflecting cognition reflecting self-regulation of cognition emotion and behavior. The criteria for selecting such items were the high intercorrelation between each item and the total score of the subdomain.

Data were analyzed using two-group confirmatory factor analysis (i.e. male and female) within each age group to examine the validity of both models (the Unidimensional model and the multidimensional model) of the factorial structure of self-regulation.

The Unidimensional model assumes that the various aspects of self-regulation are tightly interwoven, indistinguishable and inseparable.

On the other hand, the multidimensional model specifies that three aspects of self-regulation, cognition, emotion, and behavior, are separable and distinguishable, thought moderately interrelated. The two models were tested using confirmatory factor analysis with different indices; the goodness of fit index (GFI), the comparative fit index CFI and the normed-fit index (NFI).

It is generally accepted that GFI, and CFI, values greater

than .90 indicate a good fit. Finally, the means mean error of a means examination (RMSEA) is an analysis of the residual. The criterion for good fit ranges from 10.05 to 10.08.

4. Results

The results of the present study give evidence to favor the multidimensional model across all different age groups. The difference between the two models was statistically significant favoring the multidimensional model over the one-factor solution.

The same analysis was repeated to assess whether significant differences exist between the two models within each age group (i.e. late childhood, early adolescence, and middle adolescence for each gender group). In late childhood statistics showed a different pattern (see Tables 4 and 5) specifically both the unidimensional and the multidimensional models showed poor fit to the data however a significant difference was found between the two models. Again such a result gives evidence for the multidimensional model over the unidimensional one in both samples.

In early adolescence, similar results were noted (see Tables 6 and 7). when all parameters were constrained to be equal for male and female samples the GFI chi-square index indicated a moderate fit to the multi-dimensional model (i.e. the GFI=.89 in both the male and female sample. More interestingly, in middle adolescence, significant differences were found between the unidimensional and the multidimensional models favouring the multidimensional model, (see Tables 8 and 9) the GFI value for the multidimensional model in the female sample .90 compared to .83 in the unidimensional model. A Similar pattern was also revealed in the male sample. Such results justify the adoption of the multidimensional model over the unidimensional one.

Table 2. *Confirmatory Factor Analysis of Self–Regulation Scale in Self–Regulation).*

Measure	One factor model (Unidimensional Model)	Three factor model (Multidimensional Model)	Between 1 and 3 factor Model
χ2	129,413	110,697	0,0003***
Degree of freedom (Df)	54	51	
X2 ÷ (Df)	2,39	2,17	
GFI	,91	,94	
CFI	,74	,89	
NFI	,64	,82	
RMSEA	,07	,05	

Table 3. *Confirmatory Factor Analysis of Self–Regulation Scale in Self–Regulation).*

Measure	One factor model (Unidimensional Model)	Three factor model (Multidimensional Model)	Between 1 and 3 factor Model
χ2	209,99	72,662	0,000***
Degree of freedom (Df)	54	51	
X2 ÷ (DF)	3,88	1,42	
GFI	,89	,95	
CFI	,71	,92	
NFI	,66	,80	
RMSEA	,09	,04	

Table 4. *Confirmatory Factor Analysis Of Self –Regulation Scale in late childhood males (N= 69).*

Measure	One factor model (Unidimensional Model)	Three factor model (Multidimensional Model)	Between 1 and 3 factor Model
χ2	112,19	73,347	,000***
Degree of freedom (Df)	54	51	
X2 ÷ (DF)	2,07	1,43	
GFI	,83	,86	
CFI	,54	,83	
NFI	,42	,64	
RMSEA	,10	,08	

Table 5. *Confirmatory Factor Analysis Of Self –Regulation Scale in late childhood females (N=95).*

Measure	One factor model (Unidimensional)	Three factor model (Multidimensional)	Between 1 and 3 factorModel
χ2	117,503	106,077	0,009***
Degree of freedom (Df)	54	51	
X2 ÷ (DF)	2,17	2,08	
GFI	,78	,84	
CFI	,54	,56	
NFI	,42	,45	
RMSEA	,13	,10	

Table 6. *Confirmatory Factor Analysis Of Self –Regulation Scale in early adolescence males (N=95).*

Measure	One Factor Model (Unidimensional)	Three Factor Model (Multidimensional)	Between 1 and 3 Factor Model
χ2	146,82	67,429	0,000***
Degree of freedom (Df)	54	51	
X2 ÷(DF)	2,71	1,32	
GFI	,84	,89	
CFI	,59	,85	
NFI	,50	,63	
RMSEA	,11	,06	

Table 7. *Confirmatory Factor Analysis Of Self –Regulation Scale in in early adolescence females (N=132).*

Measure	One factor model (Unidimensional Model)	Three factor model (Multidimensional Model)	Between 1 and 3 factor Model
χ2	71,906	94,109	0,000***
Degree of freedom (Df)	54	51	
X2 ÷(DF)	1,33	1,84	
GFI	,89	,89	
CFI	,84	,81	
NFI	,60	,68	
RMSEA	,05	,08	

Table 8. *Confirmatory Factor Analysis Of Self –Regulation Scale in in middle adolescence males (N= 71).*

Measure	One Factor Model (Unidimensional)	Three Factor Model (Multidimensional)	Between 1 and 3 factor Model
χ2	132,491	83,988	0,000***
Degree of freedom (Df)	54	51	
X2 ÷ (DF)	2,45	1,64	
GFI	,84	,85	
CFI	,70	,69	
NFI	,60	,52	
RMSEA	,11	,09	

Table 9. *Confirmatory Factor Analysis Of Self –Regulation Scale in middle adolescence females (N=122).*

Measure	One factor model (Unidimensional Model)	Three factor model (Multidimensional Model)	Between 1 and 3 factor Model
χ2	103,725	86,006	0,000***
Degree of freedom (Df)	54	51	
X2 ÷ (DF)	1,92	1,68	
GFI	,83	,90	
CFI	,54	,86	
NFI	,41	,74	
RMSEA	,11	,07	

5. Discussion

The present study was designed to examine the factorial structure of self-regulation across three different groups (i.e. late childhood, early adolescence, and middle, adolescence) within male and female samples, two models were tested. The first is the unidimensional model which assumes that self-regulation is a domain-general ability without clear differentiation between its components (cognitive, emotional, and behavioral).

The second more prominent model implies that self-regulation is conceptualized as a multidimensional construct that's composed of cognitive emotional, and behavioral components. Results revealed that significant differences exist between the unidimensional model and the multidimensional one in both male and female samples as well as the total sample g. Such findings are consistent with some previous research studies which support the perspective of the multi-facet of self-regulation construct.

For example, Hammer, Melhuish, and Howard (2015) tested whether the cognitive, emotional, and behavioral facets of self-regulation are developmentally unified or separable constructs across two cohorts from birth to kindergarten. Kindergarten results supported the perspective that the three facets are interrelated yet distinct self-regulatory systems. Similarly cross-sectional studies have replicated the multidimensional structure of self-regulation. [37] In general, our results are in line with previous research studies and indicate that both males and females exhibited similar factor structures.

Regarding gender differences in self-regulation, although the present study doesn't aim to examine whether males and females differ in the mean level of self-regulation, the results reveal a differentiated developmental trajectory of the multidimensional model within each gender group. For example, the GFI values of the multi-dimensional model reflected incrementally better fit to the data from late

childhood through middle adolescence. However, this developmental pattern wasn't clear in the male sample. It is likely that there may be within-sex differences in the developmental course of self-regulation. Further research is still needed to examine the potential genetic and environmental contribution in both between and within gender differences in self-regulation.

Overall the results of the present study provide evidence to favor the multi-dimensional in both male and female samples as well as across different age groups. Moreover our results shed light on the differences within genders in the developmental course of self -regulation. The current findings from a cross-sectional study necessitate the execution of a longitudinal design to gain a deeper insight into the developmental trajectories of gender differences in self-regulation.

6. Conclusion

The researchers propose that understanding self-regulation cannot be undertaken by only using self-report measures which are mainly based on the participants' self-perceptions of their self-regulatory abilities rather than their actual self-regulation. In Parents' and teachers' ratings, the possibility of inaccurate responses cannot be dismissed. These responses may be a function of stereotypic beliefs about gender that participants hold, rather than of gender itself. The contextual aspect of self-regulation may be more relevant to the study of gender differences in the development of self-regulation. Naturalistic contexts are often highly complex but may be of greater practical significance than self-report measurement. Furthermore, the evidence that individual characteristics such as gender predict self-regulation in some contexts, but not in others justifies the need for refinements in the measures of and theories about context-specific self-regulation.

7. Limitations and Future Research

Although the study contributes to the extant literature, it has two limitations. First, the findings may not apply to other Egyptian children and adolescents because a nonrandom sample was employed. Second, various factors such as reading ability, parenting styles, and socioeconomic status may have influenced the results.

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