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The Key for Building the Future of Our Children: A Parent-focused Intervention for Enhancing Executive Function Skills of Young Chinese Children

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Definition of EF

- **EF refers to a broad set of higher-level cognitive processes** that enable individuals to regulate and organize their thoughts or actions to meet adaptive goals (Best & Miller, 2010; Blair & Raver, 2012; Diamond & Lee, 2011). It has been conceptualized as a set of independent cognitive abilities that include **three core EFs**, namely, **inhibitory control, working memory and cognitive flexibility** (Diamond, 2014; Logue & Gould, 2014). Higher-order EFs that are built on these core EFs include reasoning, problem-solving, organizing, and planning (Carlson, 2005; Diamond, 2014).
- Neurodevelopmental psychologists unanimously agree that **EF skills grow rapidly during the preschool years (3-5 years old)** and are central to early childhood neurocognitive development (Masten et al., 2012; Traverso et al., 2015; Zelazo et al., 2008).

Socioeconomic Disparities in EF

- Studies in western societies have consistently found socioeconomic disparities in children's levels and growth of executive functioning (Allee-Herndon & Roberts, 2019; Burneo-Garcés et al., 2019; Conway et al., 2018; Cuartas et al., 2022; Escobar et al., 2018; Fitzpatrick et al., 2014; John et al., 2019; Lawson & Farah, 2017; Merz et al., 2019 ; Rochette & Bernier, 2014), also found among Chinese kindergarteners in Hong Kong (Chan et al., 2016; Chung et al., 2016) relative to their middle-class peers in Hong Kong.
- Blair and Razza (2012) suggested that the intertwined social, physiological and biological development processes adapt to the contexts of poverty and adversity in ways that negatively affect the EF development of economically disadvantaged young children.

Socioeconomic Disparity in EF

- Several cross-cultural studies have found that Chinese preschoolers tend to out-perform their American counterparts on EF measures, probably because Chinese children commonly have more cultural opportunities to practise EF skills, and a lower prevalence of genetic risks associated with poor EF (Lan et al., 2011; Sabbagh et al., 2006). However, these cross-cultural studies have not considered the effect of socioeconomic disparity on Chinese children's EF development.
- **Do the socioeconomic disparities in children's EF skills that are observed in Western societies also occur in Chinese societies among the young Chinese children?**

EF Development and Early School Outcomes

- The negative impact of poverty on EF development implies delays in their neurocognitive development:
  - A lack of school readiness (Cantin et al., 2016, Perry et al., 2018; Escobar et al., 2018)
  - Higher risk of reading difficulties (Cantin et al., 2016; Daucourt et al., 2018; Escobar et al., 2018; Perry et al., 2018)
  - Poor math performance (Morgan et al., 2017; Nguyen et al., 2019)
  - Poor cognitive performance (Blair & Razza, 2007; Duncan et al., 2017; Escobar et al., 2018; Foy & Mann, 2013)
  - More aggressive behaviours (Poland et al., 2016; Seguin & Zelazo, 2005; Willoughby et al., 2011)
  - A higher risk of developmental psychopathology (Pellicano, 2012; Pennington & Ozonoff, 1996; White et al., 2017)
  - Increasing risk of academic difficulties (Morgan et al., 2019)

Parenting and EF Development

- Although conditions of poverty/adversity indirectly affect the EF development of young children, Blair and Raver (2012) suggested that supportive caregiving can mediate these negative influences.
- Other recent studies have focused on the role of positive parenting in supporting the healthy development of EF and in promoting early school success for socioeconomically disadvantaged children (Herbers, 2011; Herbers et al., 2014; Lengua et al. 2013; Lowe et al., 2014).
- With a sample of 306 young children (36-40 months old) from a low-income community, Lengua et al. (2013) found that supportive and non-intrusive parenting practices predicted higher levels of executive functioning of low-SES children in their study.

Parenting and EF Development

- Sarsour et al. (2011, 60 children age 8-12 years) indicated that parental responsivity can mediate the relationship between the disparity of SES and executive function of children.
- In a longitudinal study, Rochette and Bernier (2014; 114 children aged 1 and 3 years) found that higher-quality maternal behavior contributed to EF development relatively low SES children, rather than high SES children.
- Herbers (2011, 58 homeless children age 4-7 years) and Herbers et al. (2014,138 homeless children age 4-6 years) showed that experiences of positive parenting practices were significantly related to the development of EF skills for homeless children.

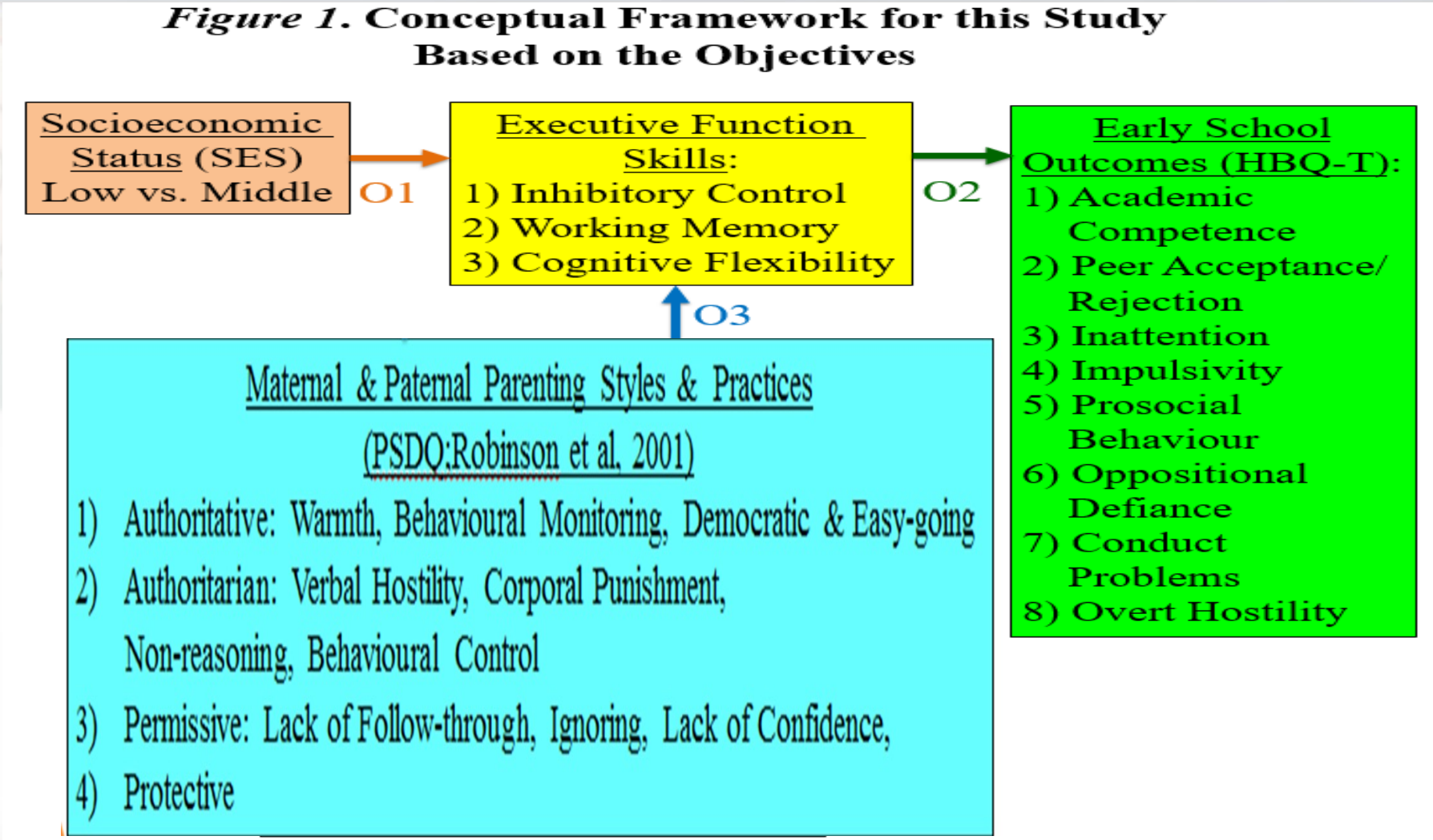
Parenting and EF Development

- Xing et al. (2019; 273 children aged 4 years) also indicated that **inhibitory control of Chinese children was affected by family SES**, and **the effect was positively mediated by maternal warmth and negatively mediated by maternal harsh discipline**.
- **Findings of these previous studies suggested that supportive and scaffolding parenting practices contribute to the healthy development of EF skills and enables school success for children in poverty.**

Research Questions

1. Do children from low-income families show lower levels of EF and slower growth relative to their middle-class peers in Hong Kong?
2. Does better growth in EF dynamically predict early school adaptive outcomes for young children in Hong Kong after controlling for socioeconomic status, and gender?
3. Do positive maternal and paternal parenting practices mediate the negative effect of socioeconomic risk and support positive EF development for economically disadvantaged children?

Conceptual Framework of Study 1



Timeline & Design

138 aged 4-6 children from four local kindergarteners (24 classes)

K2 & K3
(n = 133)
EF tasks

K2 & K3
(n = 131)
EF tasks

24 homeroom teachers

HBQ-T
(n = 24)

HBQ-T
(n = 24)

138 parents of the participating young children

PSDQ
(n = 131)

79.5% completed by the mothers and 20.5% completed by the fathers.

10/15 to 11/15: Main Study T1	4/16 to 5/16 Main Study T2

Measures -EF

EF Core Skill	Measure	Score Range
Inhibitory Control	Head-Toes-Knees-Shoulders (HTKS; (Ponitz et al., 2008)	• 20 trials. • 2 points for a correct initial response; 1 point for a self-corrected response; 0 point for an incorrect response • Score range: 0 – 40
Working Memory	Backward Digit Span (Davis & Pratt, 1996)	• 2- to 15 digits; • 3 maximum trials for each digit span; the highest number of digits successfully recounted backward • Score range: 1 – 15
Cognitive Flexibility	Dimensional Change Card Sort (DCCS; Zelazo, 2006)	• 6 trials for the colour dimension (1 point for a correct response) • 6 trials for the shape dimension (1 point for a correct response) • 12 trials for the broader version (2 points for a correct response) • Score range: 0 – 36

Standardized scores across grades (K2 and K3 to capture the age in EF) were computed for each of the EF measures.

The average standardized scores across the three EF tasks were computed to form the EF composite scores.

EF Skills by SES (in Z scores across grades)

EF Measures (Total Possible Scores)	Low-Income		Middle-Income		*t*	*p*	Cohen's d
	M	*SD*	*M*	*SD*			
T1							
Working Memory (DB)	-.28	.91	.25	1.01	3.18	.00	.55
Cognitive Flexibility	-.18	1.11	.17	.85	2.05	.04	.35
Inhibitory Control	-.15	1.05	.14	.94	1.70	.09	.29
EF Composite	-.21	.79	.17	.75	2.83	.01	.48
T2							
Working Memory (DB)	-.31	.91	.29	1.00	3.51	.00	.62
Cognitive Flexibility	-.14	1.07	.13	.92	1.58	.12	.28
Inhibitory Control	-.20	1.04	.19	.93	2.22	.03	.39
EF Composite	-.22	.73	.20	.68	3.37	.00	.60
Residuals (T1 to T2)							
Working Memory (DB)	-.16	.97	.15	1.00	1.78	.08	.32
Cognitive Flexibility	-.10	1.05	.09	.95	1.06	.29	.19
Inhibitory Control	-.14	1.06	.13	.92	1.53	.13	.27
EF Composite Residual	-.18	1.09	.17	.88	2.00	.05	.35

Prediction of Early School Outcomes by the EF Composite Scores at T1

At T1, EF composite scores consistently and significantly predicted:

1. Academic competence ($\beta = .24$, $t(133) = 2.82$, $p = .006$)
2. Inattention ($\beta = -.23$, $t(133) = -2.68$, $p = .008$)

Table A.6

Regression for T1 School Outcomes Predicted by SES, Child's Gender and T1 EF Composite

	Academic Competence		Peer Acceptance		Inattention		Impulsivity		Pro-social Behavior		Oppositional Defiant		Conduct Behavior		Hostility	
	β	*t*	*β*	*t*	*β*	*t*	*β*	*t*	*β*	*t*	*β*	*t*	*β*	*t*	*β*	*t*
Step 1																
SES	-.27	-3.22**	-.17	-1.93	.16	1.83	-.06	-.68	-.18	-2.05*	-.11	-1.33	-.10	-1.12	-.16	-1.88
Step 2																
SES	-.21	-2.43*	-.19	-2.04*	.05	.61	-.14	-1.54	-.12	-1.30	-.15	-1.71	-.15	-1.66	-.21	-2.37*
Gender	-.01	-.13	.11	1.24	.19	2.27*	.25	2.89**	-.10	-1.12	.23	2.67**	.19	2.17*	.24	2.75**
EF composite	.24	2.82**	.03	.29	-.23	-2.68**	-.07	-.80	.14	1.59	.07	.83	-.03	-.32	.04	.48

* $p < .05$

** $p < .01$

Prediction of Early School Outcomes by the EF Composite Scores at T2

At T2, EF composite scores consistently and significantly predicted:

Table A.7

Regression for T2 School Outcomes Predicted by SES, Child's Gender and T2 EF Composite

	Academic Competence		Peer Acceptance		*Inattention*		*Impulsivity*		*Pro-social*		*Oppositional Defiant*		*Conduct Behavior*		*Hostility*	
	β	*t*	*β*	*t*	*β*	*t*	*β*	*t*	*β*	*t*	*β*	*t*	*β*	*t*	*β*	*t*
Step 1																
SES	-.18	-2.05*	.06	.64	.05	.59	.01	.07	.00	.02	-.04	-.46	-.09	-.99	-.04	-.48
Step 2																
SES	-.12	-1.22	-.01	-.15	-.06	-.68	-.09	-.92	.04	.40	-.11	-1.16	-.16	-1.66	-.14	-1.47
Gender	.05	.57	.17	1.90	.25	2.78**	.21	2.33*	-.06	-.68	.23	2.55*	.25	2.71**	.32	3.65**
EF composite	.28	3.16**	-.09	-.96	-.18	-1.96	-.13	-1.41	.07	.76	-.03	-.27	-.01	-.14	-.02	-.27

* $p < .05$

** $p < .01$

Prediction of Residuals in Early School Outcomes by EF Composite Residual

Overall, Growth in EF composite scores significantly predicted:

1. **Changes in academic competence ($\beta = .23$, $t\,(127) = 2.57$, $p = .011$)**
2. **Changes in impulsive behaviors ($\beta = -.19$, $t\,(127) = -2.14$, $p = .034$)**

Table A.8

Regression for School Outcomes Residual Predicted by SES, Child's Gender and EF Residual

	Academic Competence		Peer Acceptance		*Inattention*		*Impulsivity*		*Pro-social*		*Oppositional Defiant*		*Conduct Behavior*		*Hostility*	
	β	t	β	t	β	t	β	t	β	t	β	t	β	t	β	t
Step 1																
SES	-.05	-.55	.14	1.58	-.05	-.56	.05	.53	.13	1.45	.03	.29	-.07	-.78	.03	.35
Step 2																
SES	-.02	-.18	.10	1.03	-.12	-1.29	-.01	-.08	.11	1.15	-.03	-.29	-.13	-1.39	-.04	-.38
Gender	.03	.35	.13	1.36	.17	1.87	.08	.85	.02	.20	.12	1.29	.20	2.146*	.24	2.60*
EF Residual	.23	2.57*	-.06	-.66	-.13	-1.44	-.19	-2.14*	-.09	-.97	-.12	-1.34	-.04	-.49	-.01	-.10

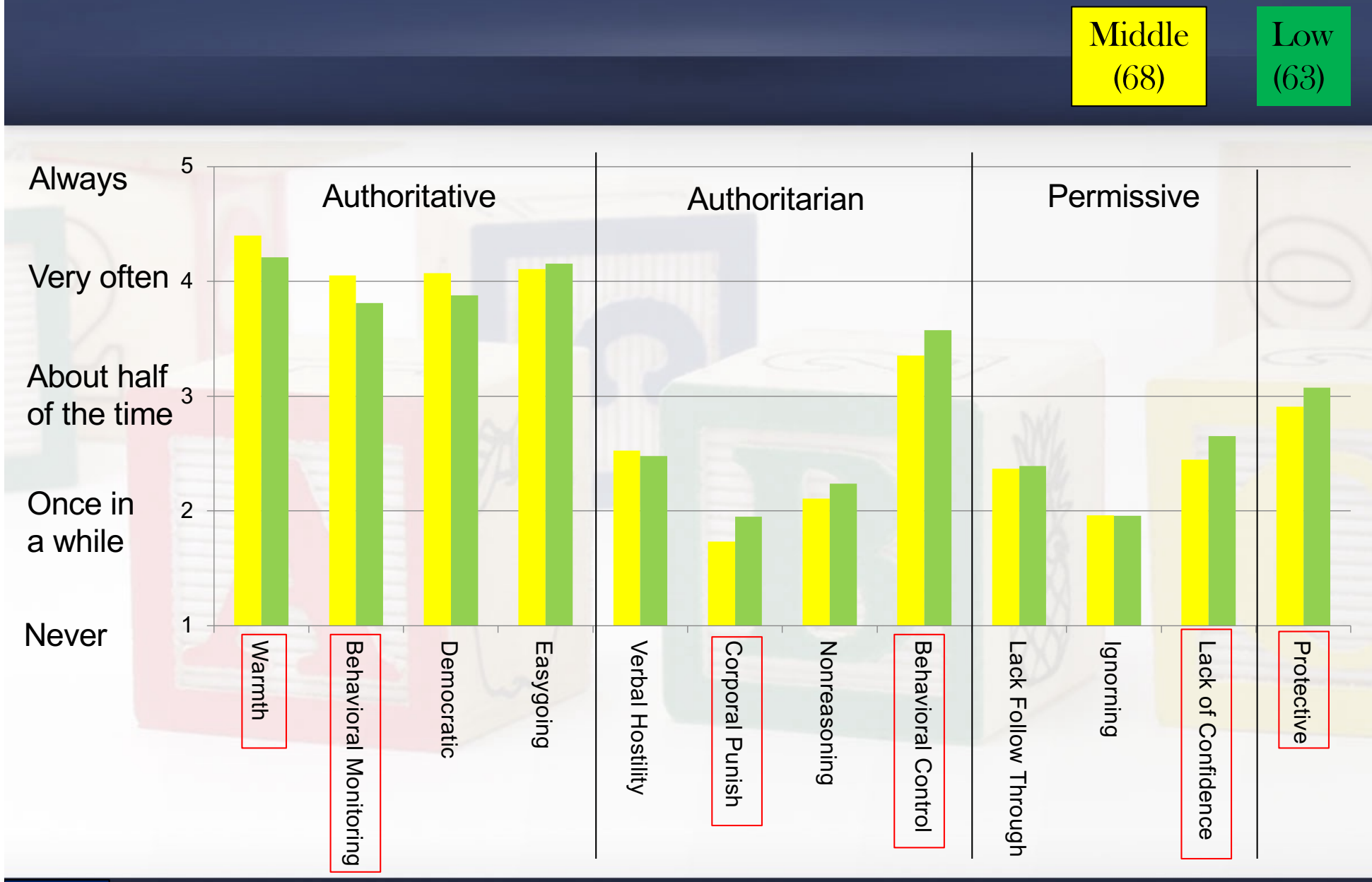
* $p < .05$

** $p < .01$

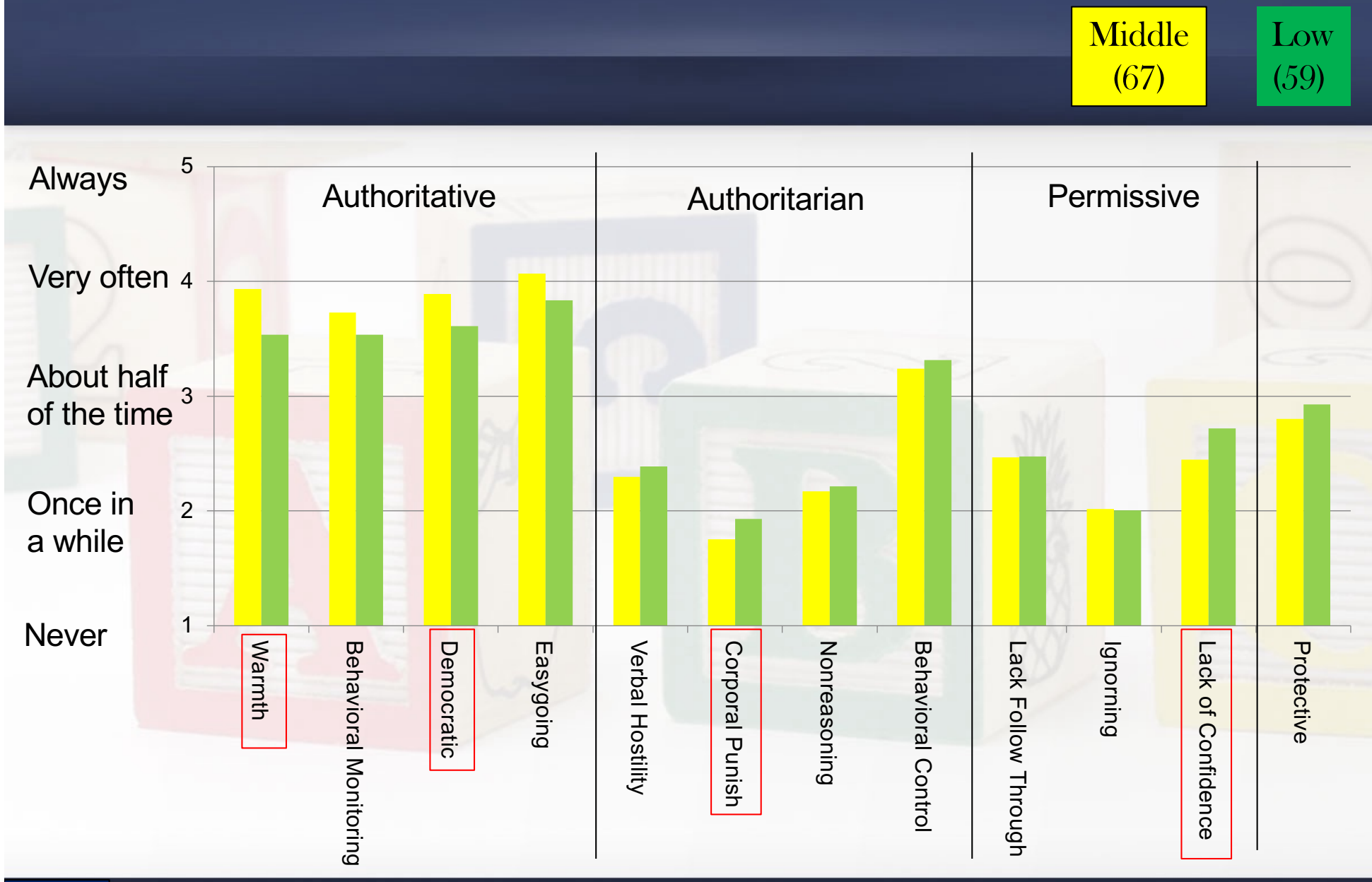
Summary of Early School Outcomes predicted by EF controlling for SES & Gender

	EF Composite at T1	EF Composite at T2	Growth in EF Composite
Academic Competence	✓ (+ve)	✓ (+ve)	✓ (+ve)
Peer Acceptance	X	X	X
Inattention	✓ (-ve)	X	X
Impulsivity	X	X	✓ (-ve)
Pro-social Behavior	X	X	X
Oppositional Defiant	X	X	X
Conduct Behavior	X	X	X
Hostility	X	X	X

Maternal Parenting Practices by SES



Paternal Parenting Practices by SES



Prediction of EF Composite by SES, Gender, Maternal/Paternal Parenting Styles at T1

At T1,

- **Father's authoritative parenting style** significantly predicted **higher EF composite scores** ($\beta = .20$, $t(124) = 2.33$, $p = .021$) and partially mediated the negative effect of SES on EF.

Table A.9

Regression for T1 EF Composite Predicted by SES, Child's Gender and Parenting Styles

	Maternal Parenting								Paternal Parenting							
	Protective		Authoritative		Authoritarian		Permissive		Protective		Authoritative		Authoritarian		Permissive	
	β	*t*	*β*	*t*	*β*	*t*	*β*	*t*	*β*	*t*	*β*	*t*	*β*	*t*	*β*	*t*
Step 1																
SES	-.25	-2.97**	-2.53	-2.97**	-.25	-2.97**	-.25	-2.97**	-2.45	-2.80**	-.25	-2.80**	-.25	-2.80**	-.25	-2.80**
Step 2																
SES	-.22	-2.50*	-.24	-2.62*	-.23	-2.61*	-.24	-2.67**	-.22	-2.37*	-.19	-2.14*	-.23	-2.48*	-.21	-2.36*
Gender	-.06	-.67	-.05	-.06	-.05	-.57	-.05	-.60	-.07	-.75	-.06	-.62	-.06	-.66	-.07	-.79
Parenting Style	-1.32	-1.54	.03	.34	-.04	-.51	-.04	-.51	-.14	-1.59	.20	2.33*	-.03	-.36	-.13	-1.49

* $p < .05$

** $p < .01$

Prediction of EF Composite by SES, Gender, Maternal/Paternal Parenting Styles at T2

At T2,

- **Mother's over-protective parenting style** significantly predicted **lower EF composite scores** (β = -.21, t (119) = -2.43, p = .017)
- **Father's authoritative parenting style** significantly predicted **higher EF composite scores** (β = .22, t (119) = 2.46, p = .015)
- And partially mediated the negative effect of SES on EF.

Table A.10

Regression for T2 EF Composite Predicted by SES, Child's Gender and Parenting Styles

	Maternal Parenting								Paternal Parenting							
	Protective		Authoritative		Authoritarian		Permissive		Protective		Authoritative		Authoritarian		Permissive	
	β	t	β	t	β	t	β	t	β	t	β	t	β	t	β	t
Step 1																
SES	-.27	-3.17**	-.27	-3.17**	-.27	-3.17**	-.27	-3.17**	-.26	-2.91**	-.26	-2.91**	-.26	-2.91**	-.26	-2.91**
Step 2																
SES	-.26	-2.93**	-.28	-3.13**	-.29	-3.18**	-.29	-3.22**	-.26	-2.74**	-.24	-2.59*	-.27	-2.93**	-.27	-2.88**
Gender	.06	.63	.07	.79	.07	.79	.07	.77	.04	.40	.05	.57	.05	.50	.04	.47
Parenting Style	-.21	-2.43*	.05	.61	-.04	-.47	-.02	-.25	-.12	-1.29	.22	2.46*	.04	.41	-.03	-.30

* $p < .05$

** $p < .01$

Summary of Maternal & Paternal Parenting Styles on EF Composite

	Types of Parenting	EF Composite at T1	EF Composite at T2	Growth in EF Composite
Maternal Parenting	Over-protective	X	✓ (-ve)	X
	Authoritative	X	X	X
	Authoritarian	X	X	X
	Permissive	X	X	X
Paternal Parenting	Over-protective	X	X	X
	Authoritative	✓ (+ve)	✓ (+ve)	X
	Authoritarian	X	X	X
	Permissive	X	X	X

Parent-based & EF-focused Programs

- There are some large-scale and multi-level positive parenting programmes are available as well (e.g. Incredible Years (IY) Parenting Program; Karjalainen et al., 2019; Positive Parenting Skills Training; Wessels et al., 2016; Program-Guide to Develop Emotional Competences; Martínez-González et al., 2016; Sinovuyo Caring Families Programme; Wessels et al., 2016; Triple-P; Sanders et al., 2014). Yet, these programmes are not EF-focused. Also, these programs focus more on changing parenting practices and cognitions to manage children with behavioural problems (target children with mild to serious behavioural problems)

Parent-based & EF-focused Programs

- Shuai et al. (2017) combined traditional EF training for ADHD children with parent intervention, in which parents were coached to support and promote EF of their children by involving in real-life activities. **Improvement in EF measures and less problematic behaviors were found in those ADHD children after the intervention.**
- Yao et al. (2022) examined the effects of thirteen 2-hour sessions behavioral parent training (BPT) on ADHD children and their parents. **A decrease in inattentive behaviours** (which is related to inhibitory control) **and negative parenting were found after the BPT training.**

Parent-based & EF-focused Programs

- Spruijt et al. (2019) also provided a psycho-educational programme to parents of 148 children (aged 4 to 8 years), which targeted on improving parent-child interactions and fostering children's attentional control (AC) and EF. **Significant improvement on supportive and non-intrusive parenting were found after the intervention. Although immediate results reported no mediation effect in child AC and EF through parental support and intrusiveness, improvement on AC and EF was also found in children whose parents improved after the programme.**

Parent-based & EF-focused Programs

- The conceptualisation of the current study is inspired by the **theory of change** for promoting EF intervention in early childhood (Carlson et al., 2013; Casey et al., 2014; Zelazo & Carlson, 2012), **the developmental psychobiological model of experiential canalisation** and how quality of caregiving mediates adverse effects on the EF-related skills of young children (Blair & Raver, 2012), and the existing literature on the importance of **supportive parenting** in enhancing the EF development of economically disadvantaged children (Herbers et al., 2014; Lengua et al., 2013).
- A **localised parent-based EF-focused intervention** (with training and guidance) is more feasible and worthwhile for supporting the EF development of low-SES children.

Significance of this Study

- First, **providing a feasible and practical opportunity** to enhance and sustain EF growth in economically disadvantaged children at younger ages and beyond.
- Second, **emphasizing** on parent-focused intervention enables **parents from low-income families to play a primary and active role in empowering their own supportive parenting practice and their children's EF development.**
- Third, **adopting an intervention design and mixed-methods approach** allows researchers to rigorously investigate the effectiveness, sustainability, and fidelity of this parent-focused intervention targeting EF development of economically at-risk young children.

Objectives of this Study

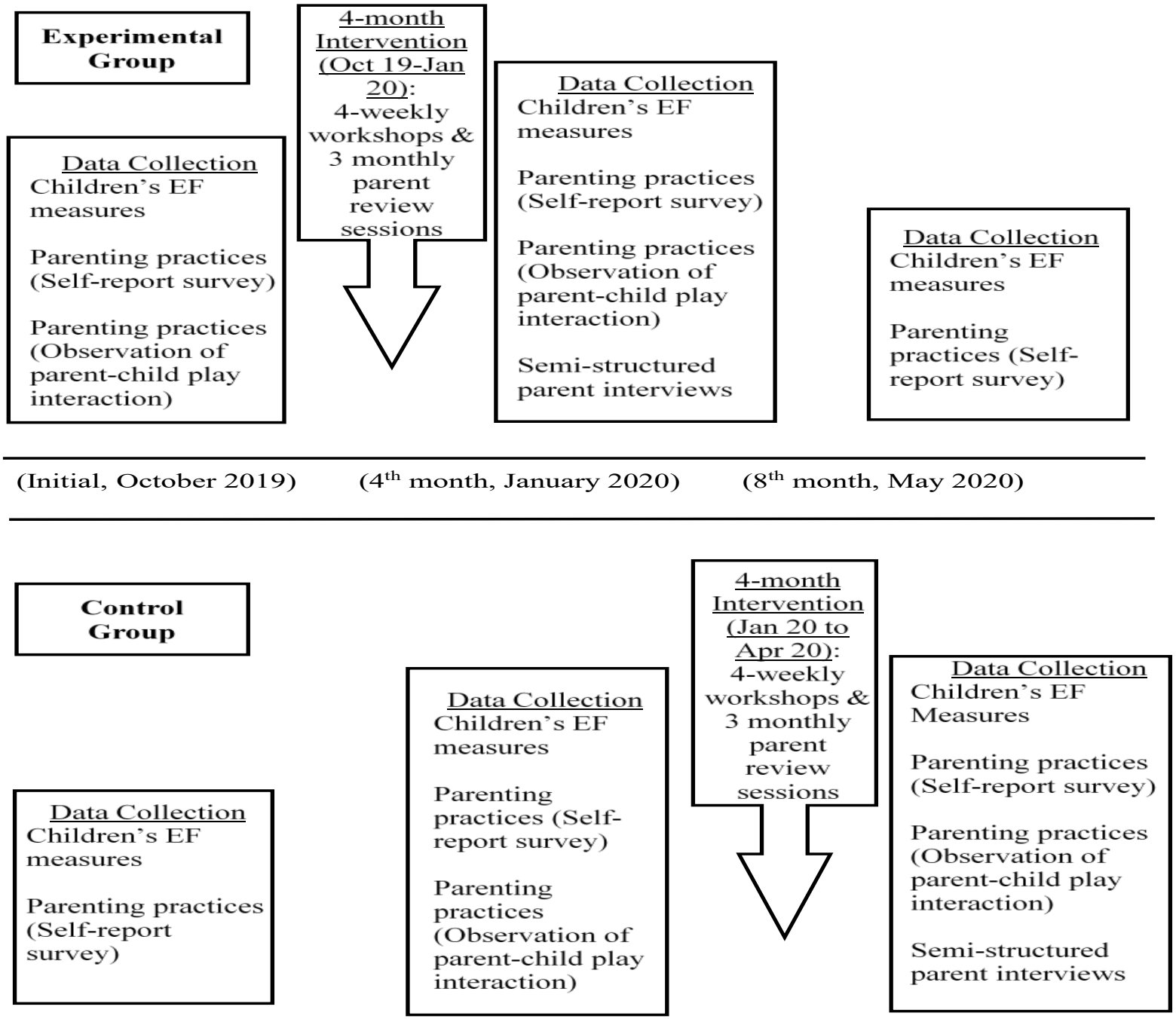
1. To design and develop a parent-based EF-focused intervention program to teach and empower parents from low-income families supportive parenting practices through psychoeducational workshops, take-home practice activities and monthly progress reviews to enhance the EF development of their children.
2. To examine the effectiveness of this parent-based EF-focused intervention programme using quantitative data (measures of parents' supportive parenting practices and children's EF) collected from the wait-list control intervention design and observations of parent-child play interaction, and field notes of monthly parent review sessions.
3. To investigate the fidelity of the implementation of this parent-focused intervention program by analyzing field notes from monthly individual parent review sessions and semi-structured parent interviews after the intervention.

Research Methods (UGC/FDS15/H01/17)

1) For this pilot study, 29 Chinese parents and their children aged 4 to 6 years from two local kindergartens were recruited and were randomly assigned to either the experimental group or the wait-list control group.
2) There will be two key components of this parent-focused intervention: 1) four 2-hour (two extended) weekly parent workshop sessions about children's EF development and supportive parenting practices along with the teaching of tangible EF-specific daily activities for parents to practice at home, 2) 12-week take-home practice toolbox with EF boosting activities, and 3) three 20-minute monthly individual parent review sessions to discuss their daily EF-boosting practice, to address their concerns, and to further build their efficacy and competence in supportive parenting.

Research Methods & Designs for the Present Study

Figure 1. Design for the Wait-List Control Intervention Study (8 months, October 2019-May 2020)



Parenting Workshop Sessions

#	Content
#1	provided an overview of the programme, introduced the concepts and functions of EF, relations of brain development and EF skills, relations of EF skills and emotional regulation.
#2	discussed the short-term and long-term benefits of good EF development for behavioral, cognitive, moral and social development as well as what could be helpful in building young children's EF skills.
#3	introduced supportive parenting practices (scaffolding, non-intrusive, structuring, democratic and responsive), supportive parent-child communication skills, and discussed the importance of these parenting practices to children's EF development.
#4	distributed an activity box and demonstrated some tangible EF-boosting daily activities (e.g. dialogic reading, pretend play, toy cleaning, card games, artworks, music and dance) to parents to practice at home

Parents-Child EF-Boosting Activity Toolbox

1) Dialogic Reading
2) Board Game (with cards)
3) Kindness & Mindful Activities
4) Sing & Dance
5) Little Games

Parents-Child EF Activities Recording Book & Handbook

Parents-Child EF Activities Recording Book

Checklist, Time Spent & Reflection

填寫方法:

1) 請先填寫日期。
2) 記錄每天的親子錦囊活動項目。
3) 記錄每天進行親子錦囊活動的親子時間(以分鐘為單位)。
4) 在右方「完成」空格將完成的項目加上「✓」，將沒有完成的項目加上「✗」。

例子:

日期	活動	時間(分鐘)	完成
2/10	仁愛專注力訓練:	15	✓
3/10	親子閱讀: 書名: OOOO	0	✗
4/10	親子小遊戲: 名稱: OOOO	15	✓

EF Picture Books Series

東華學院
TUNG WAH COLLEGE

Kindness & Mindful Activities

https://youtu.be/fCzeR6APvKo

香港樹仁大學
幼童執行能力技巧研究計劃
(UGC/FDS15/H01/17)

東華學院
TUNG WAH COLLEGE

EF · 腦力

遊戲人數:2-4人　適合年齡:7歲或以上　遊戲時間:大約20分鐘

遊戲配件

52張咭牌

•36張號碼卡(共六組，每組不同顏色，標有數字1-6)

•16張功能牌(6張停止咭，6張回收咭，4張轉換咭)

版圖

兩個股仔

EF · 腦力

建立孩子未來的鑰匙 培育幼童的執行功能技巧

− 有人說：「小朋友腦筍都未生埋」，但從腦研究科學的研究結果來說又是否合理呢?

A: 非常合理。最近一個研究把大腦前額葉及執行功能技巧的成長軌跡描繪出來。他們發現在嬰孩出生後不久，執行功能便開始發展，在三至五歲時更顯著地迅速發展，並在孩童及早期青少年階段持續發展，之後在15至23歲再有一次較明顯的增長，在成年期則保持平穩，之後隨年齡增長，緩緩地有些微下降。因此，大腦前額葉及執行功能技巧的成長要到三十歲才完全成熟。

+ 執行功能技巧有什麼類別?

+ 有那些基本的執行功能技巧對幼童成長及學習特別重要?

+ 良好執行功能技巧發展如何提升幼童早期的學習能力?

Participants (Pilot Study)

- During September 2018 to January 2019, 26 young Chinese children from two kindergartens (30.8% girls and 69.2% boys; $M_{age\text{-}in\text{-}months}$ = 63.70, $SD_{age\ in\ months}$ = 3.99) and their parents were recruited to participate in the intervention program. There were 26 parent-child dyads from low-SES families. Only one child per family was selected.

Procedures (Pilot Study)

- About half of the parent-child dyads (from one kindergarten) were randomly assigned to the experimental group and the other half to the wait-list control group (from another kindergarten).
- The 12-week pilot intervention for each group included four 1-hour weekly parent educational workshops on positive parenting practices and child's EF development before the intervention, and three 10-minute monthly individual parent review sessions during the intervention period (4th, 8th, and 12th weeks) for both the experimental and wait-list control groups.

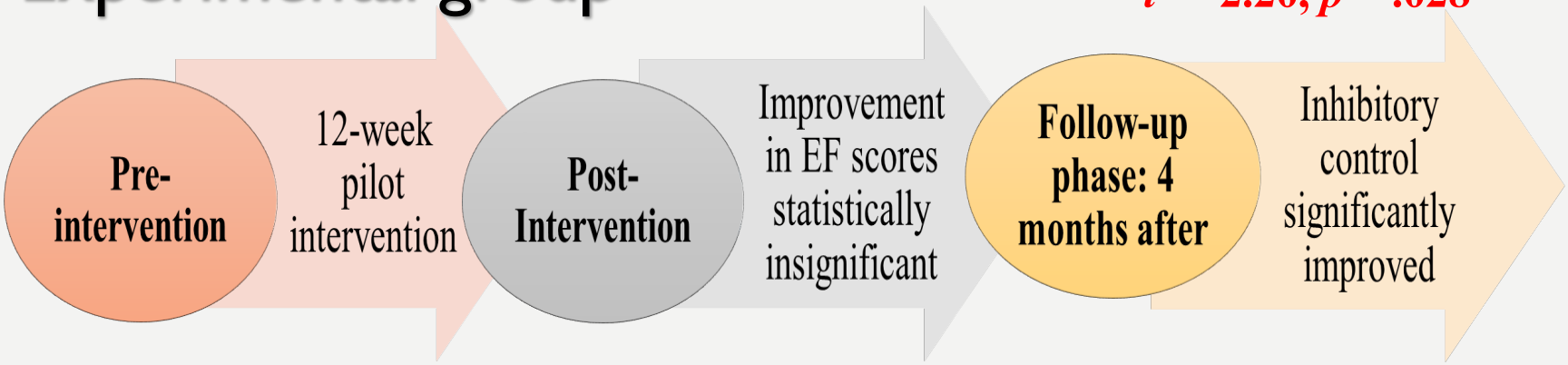
Procedures (Pilot Study)

- Each child was administered with three EF tasks to measure their working memory, inhibitory control, and cognitive flexibility three times.
- The maternal and paternal parenting practices were measured by The Parenting Styles and Dimensions Questionnaire (PSDQ; Robinson, 2001).
- Two 15-minute direct observations of parent-child interaction were conducted at the beginning and at the end of the intervention to capture the changes in supportive and scaffolding parenting practices.

Results (Quantitative)

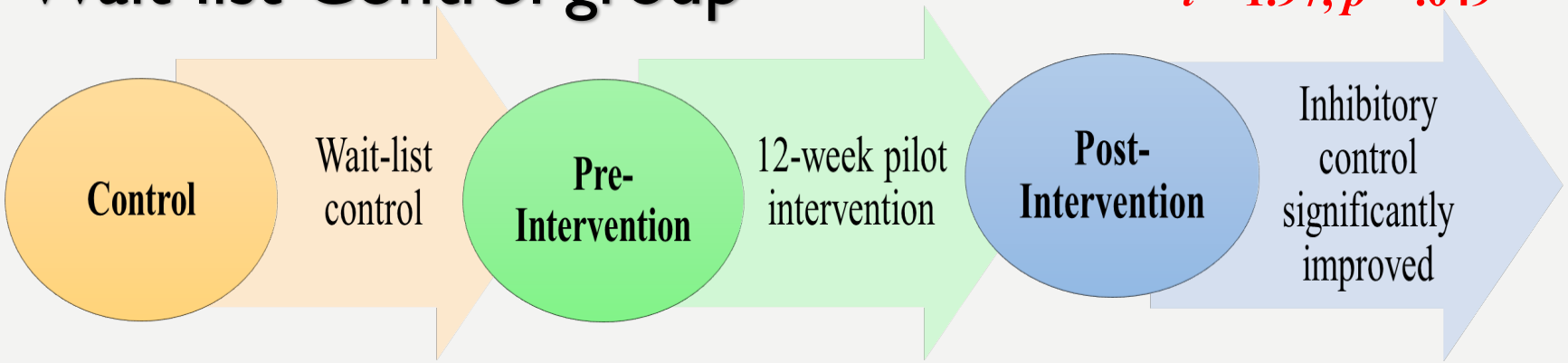
Experimental group

$t = -2.20, p = .028$



Wait-list Control group

$t = 1.97, p = .049$



- 65% of children had improvement (value-added) in their overall EF composite scores after the intervention.

Results (Qualitative)

- 71% of parents had significant improvement in their supportive and scaffolding parenting,
- 78% of parents indicated improvement in their parent-child communication, and
- 73% of parents perceived improvement in their parent-child relationship.

Discussion

- This study piloted a parent-based EF-focused intervention for low-SES children in Chinese families. Improvement in inhibitory control of children was found in the post-intervention and follow-up tasks.
- Besides, the intervention improved parents' supportive and scaffolding parenting, parent-child communication, and parent-child relationship.
- The findings offered preliminary support for this intervention for empowering low-SES parents with supportive and scaffolding parenting practices so as to enhance their young children's EF development.

Participants (Main Study)

- During September 2019 to January 2021 (interrupted by COVID-19), 72 young Chinese children from seven kindergartens (45.9% girls and 54.1% boys; $M_{age\text{-}in\text{-}months}$ = 64.22, $SD_{age\ in\ months}$ = 4.36) and their parents were recruited to participate in the intervention program. Only one parent (87.8% mothers & 12.2% fathers) and one child per family were selected.

Procedures (Main Study)

- Due to the interruption of COVID-19 and budget limitations, the research team could only conduct the pre-test and post-test for all 72 participating parent-child dyads (3 schools in 2019-20, and 4 schools in 2020-21).
- The 12-week pilot intervention for each group included two 2-hour weekly parent educational workshops (conducted onsite/online) on positive parenting practices and child's EF development before the intervention, and three 10-minute monthly individual parent review sessions (conducted onsite/online) during the intervention period (4th, 8th, and 12th weeks).

Summary of Paired-Sample T-test Results on EF Components

EF Assessments	*t*	*p*
Working Memory - Digit Forward	1.772	.040
Working Memory - Digit Backward	2.514	.007
Inhibitory Control - HKTS	3.245	< .001
Cognitive Flexibility – DCCS	1.576	.060

Summary of Maternal & Paternal Parenting Styles

	Types of Parenting	*t*	*p*
Maternal Parenting	Over-protective	-1.022	.156
	Authoritative	.256	.399
	Authoritarian	-1.165	.124
	Permissive	-.924	.180
Paternal Parenting	Over-protective	-1.895	.032
	Authoritative	.817	.209
	Authoritarian	-3.050	.002
	Permissive	-1.013	.158

Results (Qualitative)

- 65% of parents had significant improvement in their supportive and scaffolding parenting,
- 68% of parents indicated improvement in their parent-child communication, and
- 64% of parents perceived improvement in their parent-child relationship.

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Discussion

- Significant improvement in working memory and inhibitory control of young children after the intervention.
- Significant decrease in father's over-protective and authoritarian parenting styles.
- Furthermore, the intervention improved parents' supportive and scaffolding parenting, parent-child communication, and parent-child relationship.
- The dramatic changes in research design to single group pre-post design, small sample size, COVID-19, short duration of the study significantly affected the internal and external validity of this study.

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