

The different development trajectory of noncognitive abilities of urban and rural children: evidence from China family panel studies

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Abstract

Purpose – The purpose of this paper is to analyze the temporal development of noncognitive abilities of children and the development trajectory of rural and urban children's noncognitive abilities in China.

Design/methodology/approach – Lexis diagram is used as the research framework to depict the development trajectory of rural and urban children's noncognitive abilities in China. By employing the nationally representative longitudinal survey data, China Family Panel Studies (2010–2016), the difference of rural and urban children's noncognitive abilities is disentangled into temporal, age and cohort effects.

Findings – There is a significant temporal rural–urban difference in children's noncognitive abilities, but the rural–urban gap would expand, narrow or show more complex development trends under different measurements. The results of age and cohort comparison are similar to those of temporal comparison, that is, there are divergent trajectories of rural–urban gap due to the different measurements and different ages and/or cohorts. Specifically, urban children perform better in self-esteem, but rural children always have a higher social responsibility, such a contrast between urban children's weak social responsibility under the advantageous condition and rural children's strong social responsibility in the relatively disadvantageous environment.

Originality/value – Children's noncognitive ability is not innate but is a gradually acquired characteristic through training and cultivation. The rural–urban difference of children's noncognitive abilities implies educational issues concerning educational principles in the urban environment and the educational resources' allocation in the rural society in China. Besides, as the unidimensional measurement of children's noncognitive ability is insufficient, the systematic measurement composed of multidimensional indicators utilizing cohort data or longitudinal data would be needed.

Keywords China, Children, Development trajectory, Lexis diagram, Noncognitive ability, Rural–urban difference/gap

Paper type Research paper



Cognitive and noncognitive abilities are people's lifelong important abilities. After [Bowles and Gintis \(1976\)](#) brought up the importance of noncognitive abilities and a series of studies dominated by Perry Preschool Program, researchers started to focus on noncognitive abilities. Recently, with the burgeoning of related studies in China, related studies used

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noncognitive abilities as the outcome variable to either investigate the impact of noncognitive abilities on adult people's developmental outcomes, especially the outcomes in the labor market, or discuss the effect of familial factors such as parental participation, parenting styles, parent-child communications but relatively neglected the development process of children's noncognitive abilities.

At the meantime, the sociological studies on children's development in China paid more attention to some special or disadvantaged groups, which obviously put the rural-urban gap as the research background but paid little attention to the dynamic process of rural-urban difference. However, as an important feature of social structure in Chinese society and an important dimension of social development, rural-urban dual structure is not only the social context for children but also the social foundation for children's current and future development. Previous studies have shown that there was a significant difference in cognitive abilities between urban and rural children. Similarly, is there a significant difference in noncognitive abilities among them? What is the trajectory of such difference? Will the development of rural children's noncognitive abilities impede or promote the development of their cognitive abilities? So, related studies should analyze the difference of rural and urban children's development on the scope of child development from different dimensions and pathways.

Specifically, on the development of rural and urban children's noncognitive abilities, does the rural-urban difference vary in the funnel-shaped or funnel-shaped inverted? Or if all the dimensions of rural children's noncognitive abilities perform worse than those of urban children, *thus* the rural-urban difference grows in parallel. It is important and necessary to answer the questions above for following two reasons. On one hand, the development of urban children's noncognitive abilities, especially their social attitude, has an effect on the stability of urban society and tendency of Chinese society. On the other hand, the development of rural children's cognitive and noncognitive abilities is not only related to the development process of rural society but also to that of urban society due to the migration.

To answer these questions above, the article uses China Family Panel Studies to analyze the different development trajectory of rural and urban children's noncognitive abilities measured by multiple indexes to illustrate the rural-urban difference in child development and further discuss related education policies.

1. Literature review

As two dimensions of child development, cognitive and noncognitive abilities have a reciprocal relationship and affect developmental outcomes in childhood and adulthood mutually. The part of the literature review will be elaborated from three parts: the definition and measurement of noncognitive abilities, the factors that impact on noncognitive abilities and the outcomes of noncognitive abilities.

1.1 Definition and measurement

On contrast with cognitive ability, which is measured by reading, calculation and logical reasoning, etc. noncognitive ability/skill is a multidimensional concept, which refers to personal abilities that have an important impact on individual's income, social status and life behavior (Le and Hu, 2017). Noncognitive ability includes interpersonal skills, some personality and personality characteristics, motivation, emotional intelligence and soft skills not related to the cognitive ability (Xu, 2017). Sociologists have a rich understanding of noncognitive ability's connotation, such as psychological factors such as leadership, perseverance, self-esteem and internal and external locus of control, educational expectations and school-related attitudes and behaviors, which are all related to individual academic and future achievements (Hsin and Xie, 2017; McLeod and Kaiser, 2004).

In measurement, due to multidimensional nature of noncognitive ability, there is no unidimensional measurement of noncognitive ability. So far, the *big five-factor model of personality* is widely used as the measurement of noncognitive ability, which includes extroversion, openness, emotional stability (neuroticism), agreeableness and conscientiousness (Costa and McCrae, 1992; Cheng, 2013; Li *et al.*, 2017). The five dimensions and connotations of the big-five factor model of personality are (1) *openness*, which refers to creativity and curiosity, is opposite to being a conformist. The higher the score is, the more curious one tends to be, and more likely to seek and accept fresh new experiences and ideas; (2) *conscientiousness*, that is, things will be highly organized and efficient, which is in contrast with causal and negligent. The individual with more conscientiousness tends to be more motivated and persevered in goal-oriented behaviors; (3) *extraversion*, that is, outgoing, active, helpful, sociable and enthusiastic; (4) *agreeableness*, which is friendly, gentle and compassionate, is an interpersonal-oriented dimension; (5) *neuroticism*, which means sensitive and nervous, is in contrast with emotional stability. The higher the degree of neuroticism, the individuals are more likely to feel stress and depression. In addition, psychological indicators such as self-efficacy, self-esteem and locus of control are also commonly used to measure noncognitive ability (Zhou, 2015; Xu, 2017). *Self-efficacy* refers to people's confidence in whether they can successfully complete a certain work (Xu, 2017), and people with high self-efficacy will invest more resources, work longer and harder to improve their achievements. *Self-esteem* is people's overall emotional evaluation of their own value, strengths and importance. Higher self-esteem is conducive to the increase of income (Bowles *et al.*, 2001; Heckman and Rubinstein, 2001; Heckman *et al.*, 2006; Zhou, 2015; Wang *et al.*, 2017; Xu, 2017). *Locus of control* refers to an individual's view of the determinants of his life, that is, whether external factors or his own behavior can determine his life. People with internal locus of control believe that life is under their control, while those with external locus of control believe that fate and luck dominate his life (Zhou, 2015).

1.2 The determinants of children's noncognitive abilities

Recent researches paid more attention to the relationship of family background and children's noncognitive abilities and discussed the impact of family socioeconomic status and cultural capital on children's noncognitive abilities (Peter, 2016; Anger and Schnitzlein, 2017; Li and Zhao, 2017; Li *et al.*, 2017; Luo and Guan, 2017; Du *et al.*, 2018; Yao and Ye, 2018).

Most studies showed that family socioeconomic status (SES) and cultural capital had a significant impact on children's noncognitive abilities (Peter, 2016; Anger and Schnitzlein, 2017; Li and Zhao, 2017; Li *et al.*, 2017; Luo and Guan, 2017; Du *et al.*, 2018; Yao and Ye, 2018). To be specific, the enhancement of family SES and family cultural capital could improve children's noncognitive abilities (Li *et al.*, 2017; Luo and Guan, 2017; Du *et al.*, 2018; Yao and Ye, 2018). On the contrary, lower SES, such as mother's unemployment was not conducive to the improvement of children's noncognitive abilities (Peter, 2016). Further, Yao and Ye (2018) pointed that family culture played a more important role than economic capital in the relationship of family background and children's noncognitive abilities.

Based on the studies above, some researchers tried to explain factors besides family background that affected children's noncognitive abilities, these factors included preschool education (Durlak *et al.*, 2011; Wang *et al.*, 2017), parental participation (Li, 2018), teacher quality (Jennings and Diprete, 2010) and intergenerational transmission of noncognitive abilities (Grönqvist *et al.*, 2017; Lundborg *et al.*, 2018) etc. But these studies are relatively scattered with no mature theory constructed.

1.3 The effect of children's noncognitive abilities

For adult people, early studies focused more on the impact of noncognitive abilities/skills/traits on the labor market consequences (Bowles *et al.*, 2001; Heckman and Rubinstein, 2001;

Gelissen and Graaf, 2006; Heckman *et al.*, 2006; Lindqvist and Vestman, 2011; Cheng and Li, 2017; Huang and Xie, 2017; Xu, 2017). For children, previous studies have paid more attention to the influence of children's noncognitive abilities on their academic performance (Bowles *et al.*, 2001; Anger and Schnitzlein, 2017; Hsin and Xie, 2017; Li and Zhao, 2017; Li *et al.*, 2017; Smithers *et al.*, 2018) and educational attainment (Almlund *et al.*, 2011; Smithers *et al.*, 2018).

Most results of previous studies illustrated that the enhancement of children's noncognitive abilities was conducive to the increase of their academic performance (Bowles *et al.*, 2001; Almlund *et al.*, 2011; Anger and Schnitzlein, 2017; Hsin and Xie, 2017; Li and Zhao, 2017; Li *et al.*, 2017; Smithers *et al.*, 2018). But there were some results favoring the opposite conclusions that the impact of children's noncognitive abilities on their academic performance and school readiness might not exist or even be negative (Smithers *et al.*, 2018).

There is some supporting evidence on the relationship of children's noncognitive abilities and their academic performance. For example, Almlund *et al.* (2011) pointed out that there was a positive relationship of noncognitive ability and educational attainment, when noncognitive ability was measured by openness. Vedel (2014) summarized the empirical studies on the impact of *big five-factor model of personality* on grade point average (GPA) and draws conclusions as follows: the positive impact of conscientiousness and negative impact of neuroticism on GPA were prevalent; some studies showed that there were some weak positive impacts of agreeableness and openness on GPA; there was no significant relationship between extraversion and GPA. Chamorro-Premuzic and Furnham (2003) pointed out that conscientiousness, which was measured by ambition, responsibility and self-discipline, had a significant impact on the levels of education. Some researches further investigated the functional form and the mechanism of the relationship between personality traits and academic performance, implied that it was not a simple linear relation. For instance, the relationship of conscientiousness and academic performance was inverted-U, while the relationship between openness and academic performance was U-shaped (Cucina and Vasilopoulos, 2005).

1.4 Comments on researches

There are plenty of researches on the impact of noncognitive ability on labor market outcomes in the adulthood. By contrast, little attention is focused on children's noncognitive ability. Furthermore, the studies concerning children's noncognitive ability paid more attention on the determinants of children's noncognitive ability, these determinants including family SES, preschool education and formal education, etc. but failed to elaborate the precise definition and the contextual framework of children's noncognitive abilities and to discuss the developmental difference of different groups.

Therefore, relevant studies could be elevated from the following three aspects. First, using a unidimensional index as the measurement of children's noncognitive abilities is a lack of comprehensiveness and undermines the multidimensional nature of children's noncognitive abilities. Second, previous studies utilized cross-sectional data, which could hardly depict the temporal development of children's noncognitive ability (and their differences). Third, due to different regions, different survey time and different measurement indicators, these differences greatly weakened the comparability of the results of children's noncognitive ability researches. Therefore, in order to make researches more comparable, it is necessary to use the same measurement indicators for different types of children and keep track of the temporal development of these noncognitive ability indicators. This requires longitudinal data to describe the trajectory of children's noncognitive ability, and then compare the differences in level and development speed among different groups.

2. Data and methods

The article used four rounds of data from China Family Panel Studies (CFPS). As CFPS was a nationally representative and annual longitudinal survey, there were sufficient children samples of which noncognitive abilities were measured systematically and comprehensively and were suitable for this study.

2.1 Measurement

The relevant scales in four rounds were summarized in Table 1, referring to *CFPS User's Manual (3rd edition)*. In order to depict the developmental trajectory precisely, the ideal indicator would be those measured in four rounds of the survey. And the indicators measured in two or three rounds of the survey were relatively acceptable.

2.2 Variable definitions

The article set the adolescents aged 10–15 as research object according to the research goal of discussing the developmental trajectory of children's noncognitive abilities.

The article used five indexes to measure children's noncognitive abilities, including *Rosenberg's Self-Esteem Scale*, *Responsibility Scale*, *Positive Behavior Scale*, *Self-Control Scale* and *Nowiski-Strickland Locus of Control Scale for Children*. The five psychological scales were all positive scoring scales. The higher the score, the better the performance on the corresponding psychological test indicators.

Among the psychological scales, *Rosenberg's Self-Esteem Scale* was used to assess adolescents' overall feelings about self-esteem and self-acceptance; the *Responsibility Scale* measured the sense of responsibility of the interviewees, including seven questions; the *Positive Behavior Scale* measured the good behavior of the interviewees, including twelve questions; the *Self-Control Scale* and the *Nowiski-Strickland Locus of Control Scale for Children* measured children's sense of control from different aspects, among which the former measured the degree of self-control, while the latter measured the internal and external locus of control.

2.3 Variable selections

The core explanatory variable was urban or rural attributes. Urban or rural attributes were judged according to the urban and rural attributes of children's residency at the time of investigation and encoded as a binary variable, with 0 in the rural area and 1 in the urban area. Other control variables contained age, gender (girls as reference group, girls = 0) and grade.

2.4 Method

The main analytical method was Lexis diagram. As one of the basic tools of demographic analysis, Lexis diagram was a coordinate map where calendar time ("period") was depicted on the *x*-axis and age on the *y*-axis to analyze the dynamics in vital events such as births and deaths change over calendar time, age and/or cohort. Figure 1 was the Lexis diagram.

Indicator	2010	2012	2014	2016
Self-Esteem Scale	10	10, 12, 14	✓	✓ (reduced)
Responsibility Scale	✓	✓	✓	✓
Positive Behavioral Scale	11, 15	11, 15	✓	×
Self-Control Scale	×	✓	✓	×
Nowiski-Strickland Locus of Control Scale	13, 15	×	✓	×

Table 1. Psychological scales in CFPS2010-CFPS2016 (child questionnaire)

Note(s): The check mark denotes children aged 10–15 all answer the questions at the survey year; the cross mark denotes children do not answer the questions at the survey year; age denotes children at this age answer the questions at the survey year but not all the children aged 10–15

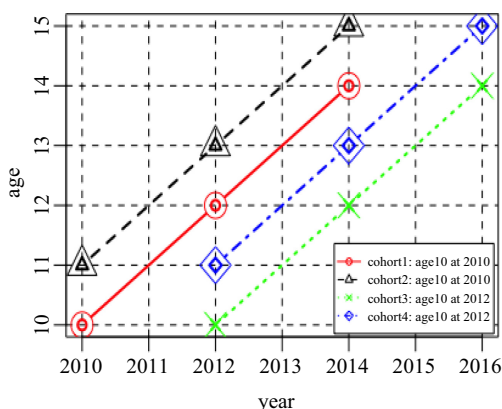


Figure 1.
The lexis diagram

The study discussed the impact of social change (temporal variation) on noncognitive abilities of children aged 10–15 through three steps.

The first step was to compare the overall noncognitive ability of children aged 10–15 in different years, that is, to compare the temporal difference of each index at the survey time.

The second step was to compare the noncognitive ability with the same age in different years, in order to control the age effect. Specifically, the study would compare the differences in noncognitive abilities of children aged 10/11 in 2010 and children aged 10/11 in 2014, as well as the differences of children aged 10/11 in 2012 and children aged 10/11 in 2016.

The third step was to use longitudinal data to discuss the development process of noncognitive ability of the same child cohort, which illustrated by Lexis diagram in Figure 1. So far, four children cohorts could be obtained from CFPS data, which were 10-year-old and 11-year-old children in 2010, and 10-year-old and 11-year-old children in 2012. Taking the 10-year-old children's cohort in 2010 as an example, the age of children in this cohort would become 12 in 2012, 14 in 2014, and so on.

3. Results

3.1 Temporal difference

According to Table 2, there was a significant temporal difference in noncognitive ability of children aged 10–15 for all indicators. Further analysis in Table 3 indicated that there was a significant urban–rural difference in self-esteem, responsibility and self-control; but there was no significant urban–rural difference in positive behavior; the urban–rural difference in locus of control was significant in 2010 but not significant in 2014.

Figure 2 showed that the urban–rural gap in self-esteem was lessening, while rural children's development was better than urban children's; the urban–rural gap in responsibility was increasing first and then decreasing, and rural children's responsibility was always higher than urban children's; the urban–rural difference in self-control was narrowing, although the difference was not significant; there was no significant urban–rural difference in locus of control, although the scores of urban and rural children were decreasing over time.

3.2 Age difference

Table 4 showed that at different time, the noncognitive ability of 10-year-old children was significantly different in self-esteem and responsibility; the noncognitive ability of 11-year-old children was significantly different in positive behavior scale; the responsibility of

Table 2.
Temporal difference of
children's noncognitive
ability

Index	2010	2012	2014	2016	Difference
Self-Esteem Scale	49.8231 (5.1678) <i>n</i> = 554	30.3750 (4.9032) <i>n</i> = 1,224	31.4096 (5.5103) <i>n</i> = 1,560		****
Responsibility Scale	24.2574 (4.1928) <i>n</i> = 3,325	25.0492 (4.3091) <i>n</i> = 2,805	25.1388 (4.5426) <i>n</i> = 2,658	25.7701 (4.5845) <i>n</i> = 2,713	****
Positive Behavior Scale	43.9869 (4.6232) <i>n</i> = 1,144	44.8002 (4.7405) <i>n</i> = 886	45.1600 (4.5913) <i>n</i> = 775		****
Self-Control Scale		42.6779 (6.2225) <i>n</i> = 2,490	43.1458 (6.4991) <i>n</i> = 2,450		-0.4679**
Nowiski-Strickland Locus of Control Scale	28.8765 (5.9659) <i>n</i> = 1,117		25.7152 (3.9432) <i>n</i> = 2,644		3.1613***

Note(s): 1) As *t*-test was to compare two groups of samples, for data gathered in three or more rounds of survey, the article used analysis of variance (ANOVA) to compare the difference of more than two groups and made Scheffé's multiple comparison. For positive behavior scale, there was a significant difference between 2010 and 2012, 2012 and 2014, but the difference between 2012 and 2014 was not significant; for self-esteem scale, there were significant differences between every two years; for responsibility scale, there were significant differences between 2010 and the other three years, but the remaining differences were not significant.
2) Standard deviation in the parenthesis, *n* denotes the sample size at the survey year. ****p* < 0.001, ***p* < 0.01, **p* < 0.05

Table 3.
Rural–urban difference
of children’s
noncognitive ability

Index	2010	2012	2014	2016
Self-Esteem Scale	−2.1051*** (0.4432)	2.0951*** (0.3151)	1.1757*** (0.2820)	
Responsibility Scale	0.5385*** (0.1494)	1.3849*** (0.1860)	1.2935*** (0.1769)	0.8467*** (0.1778)
Positive Behavior Scale	−0.1769 (0.2816)	−0.1650 (0.3664)	0.6923 (0.3569)	
Self-Control Scale		1.9636*** (0.2819)	1.7032*** (0.2532)	
Nowiski-Strickland Locus of Control Scale	0.3653 (0.3707)		0.3164** (0.2812)	

Note(s): Standard error in the parenthesis. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

11-year-old children in 2010 and 2014 was significantly different, but the responsibility of 11-year-old children in 2012 and 2016 was not significantly different.

Table 5 further depicted the urban–rural difference in 10-year-old and 11-year-old children’s noncognitive ability. There was a significant urban–rural difference in self-esteem for 10-year-old children; the urban–rural gap in responsibility for 10-year-old children has gone through a process from insignificant to significant, and the urban–rural gap turned to be larger over time in which rural children’s responsibility was always higher than urban’s. In contrast, the urban–rural difference of 10-year-old children in self-esteem was always significant, urban children’s self-esteem was higher in the base period, but rural children performed better.

For 11-year-old children, the urban–rural gap in responsibility gradually became significant from insignificant, and the urban–rural gap was increasing in which rural children’s responsibility was always higher than urban’s; though the urban–rural gap in positive behavior scale was expanding, the difference was not statistically significant.

Figure 3 showed that the urban–rural gap in responsibility was gradually expanding. Although children’s responsibility score was increasing over time, rural children’s responsibility was always higher than urban’s. The trajectory in self-esteem showed that the urban–rural gap was decreasing, though there was the same tendency of decrease-to-increase for rural and urban children, urban children’s extent of the decrease was larger than that of rural.

Figure 4 showed that like the results in Figure 3, the urban–rural gap in responsibility was gradually expanding, and rural children’s responsibility was higher than urban’s all the time. The trajectory of the urban–rural gap in positive behavior scale was decreasing first and then increasing, that is, rural children’s score was getting closer and exceeded that of urban children’s, though the urban–rural difference was not statistically significant at all.

3.3 Cohort difference

Table 6 showed that for the 10-year-old and 11-year-old cohort in 2010, there were significant differences in each measurement dimension; the responsibility of the 10-year-old cohort in 2012 was significant, however, there was no significant difference in responsibility for the 11-year-old cohort in 2012.

Table 7 further compared the urban–rural differences of four child cohorts. Among the results in the base period, only the 10-year-old cohort in 2010 had a significant urban–rural difference in self-esteem, while the rest of the cohort had no significant urban–rural differences in other noncognitive ability indicators. Such findings indicated that the urban–rural gap in the base period was not significant, and most of them were not statistically significant.

Figure 5 showed that there was an increase-to-decrease tendency of the urban–rural gap in responsibility. The difference was not statistically significant in the base period but became

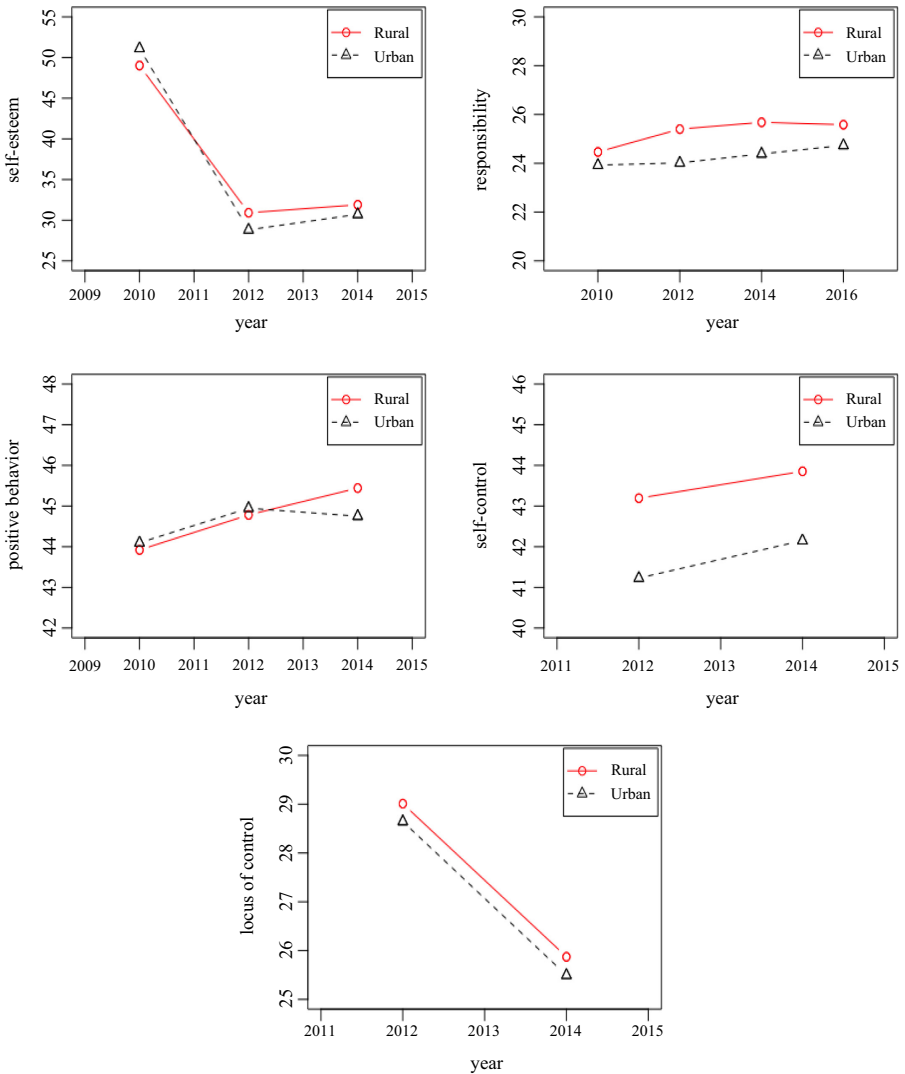


Figure 2.
The trajectory of
noncognitive ability for
rural and urban
children

significant in 2012 and 2014. Figure 5 also showed that although both rural and urban children's responsibility score increased over time, rural children's responsibility was always higher than urban children's. Besides, the urban-rural difference in self-esteem has been expanding. Rural children's self-esteem was significantly lower than urban children's in 2010 but higher than urban children's in 2012. In 2014, the rural children's self-esteem level was lower than urban children's (although not significant), and the urban-rural gap was larger than that of the base period.

Figure 6 illustrated that rural children's responsibility was always higher than urban's, and the rural-urban gap in responsibility was first expanding and then narrowing. What is more, the gap of responsibility in the base period was not statistically significant but became significant in 2012 and 2014. In terms of positive behavior scale, the urban-rural gap in 2010 was slightly increasing, but the gap was not statistically significant.

Index	2010	2012	2014	2016	Difference
<i>Children at age 10</i>					
Self-Esteem Scale	49.8231 (5.1678) <i>n</i> = 554		31.9700 (5.8728) <i>n</i> = 500		17.8531 ^{***}
Responsibility Scale (1)	23.8286 (4.3976) <i>n</i> = 566		24.8320 (4.7074) <i>n</i> = 506		-1.0034 ^{***}
Responsibility Scale (2)		24.2722 (4.6728) <i>n</i> = 485		24.9486 (4.5851) <i>n</i> = 467	-0.6764 [*]
<i>Children at age 11</i>					
Responsibility Scale (3)	24.1314 (4.1150) <i>n</i> = 563		25.2694 (4.4594) <i>n</i> = 412		-1.1380 ^{***}
Responsibility Scale (4)		25.1188 (4.0891) <i>n</i> = 446		25.2194 (4.7580) <i>n</i> = 515	-0.1006
Positive Behavior Scale	43.5522 (4.6691) <i>n</i> = 556		46.0000 (3.7519) <i>n</i> = 27		-2.4478 ^{**}

Note(s): Standard deviation in the parenthesis, *n* denotes the sample size at the survey year. ****p* < 0.001, ***p* < 0.01, **p* < 0.05

Table 4.
Age difference of
children's noncognitive
ability

Table 5.
Age difference of rural
and urban children's
noncognitive ability

Index	2010	2012	2014	2016
<i>Children at age 10</i>				
Self-Esteem Scale	-2.1051*** (0.4432)		1.7515*** (0.2626)	
Responsibility Scale (1)	0.4918 (0.3799)	0.7587 (0.5013)	1.4874*** (0.4199)	1.4199*** (0.4260)
<i>Children at age 11</i>				
Responsibility Scale (2)	0.1103 (0.3536)	0.8398 (0.4535)	0.8245 (0.4466)	1.4360*** (0.4167)
Positive Behavior Scale	-0.5507 (0.4031)		2.6703 (1.3736)	

Note(s): Standard error in the parenthesis. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

Figure 3.
The trajectory of
noncognitive ability for
10-year-old children

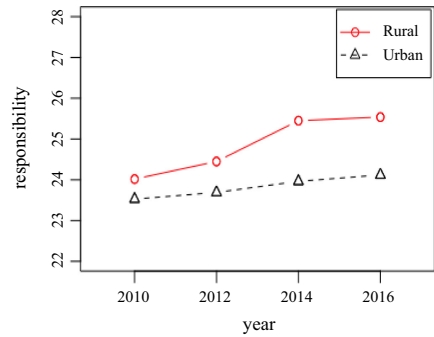
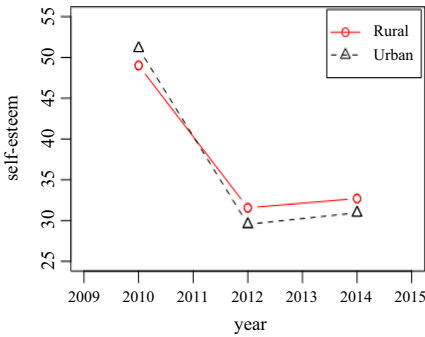


Figure 4.
The trajectory of
noncognitive ability for
11-year-old children

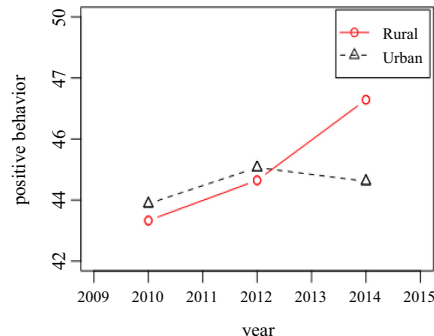
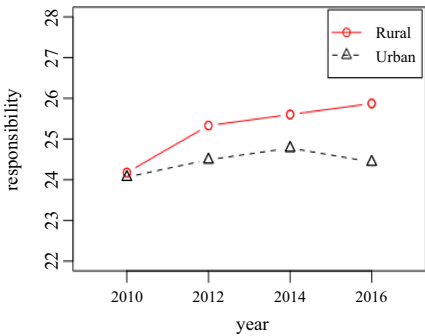


Figure 7 showed that the urban–rural gap in responsibility was first expanding and then narrowing. The gap in the base period was not statistically significant but became significant in 2012 and 2014. Figure 8 showed that the urban–rural gap in responsibility was decreasing all the time, and the difference was not statistically significant at all. Rural and urban children’s responsibility score was gradually increasing.

Cohort	Self-esteem scale	Responsibility scale	Positive behavior scale
Age 10 in 2010	18.1148***	-1.4163***	
Age 11 in 2010		-1.5986***	-2.9286**
Age 10 in 2012		-0.7346*	
Age 11 in 2012		-0.5134	

Note(s): *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

Table 6.
Cohort difference of
children's noncognitive
ability

Cohort	Self-esteem scale	Responsibility scale	Positive behavior scale
Age 10 in 2010	-2.1051***	0.4918	
Age 11 in 2010		0.1103	-0.5507
Age 10 in 2012		0.7587	
Age 11 in 2012		0.8398	

Note(s): Difference showed in the table is the rural minus the urban in the base period. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

Table 7.
Cohort difference of
rural and urban
children's noncognitive
ability

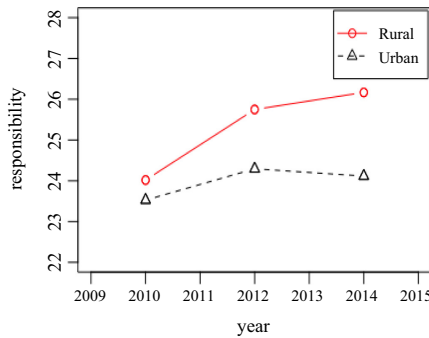
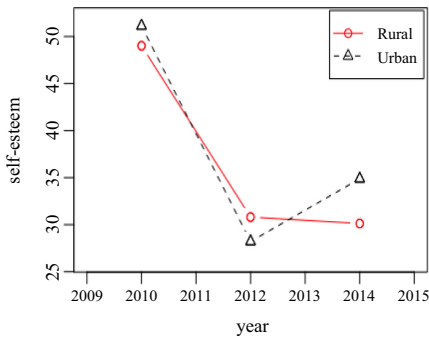


Figure 5.
The trajectory for 10-
year-old cohort in 2010

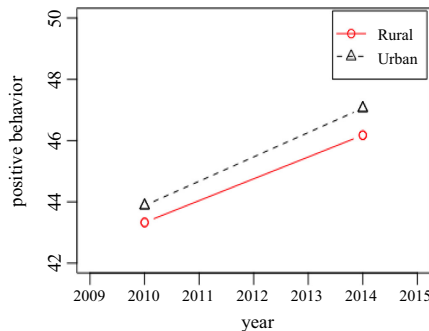
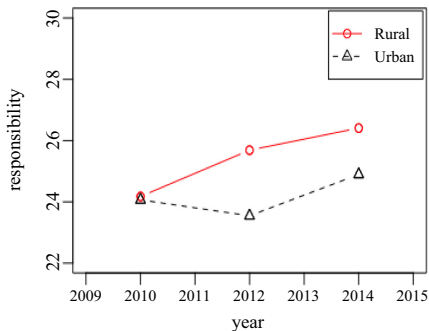
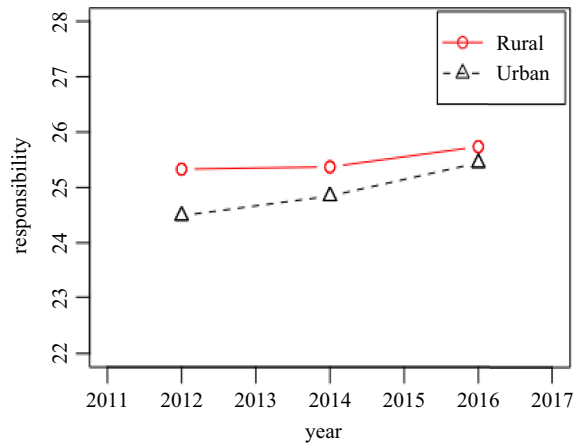


Figure 6.
The trajectory for 11-
year-old cohort in 2010

Figure 7.
The trajectory for 10-year-old cohort in 2012



Figure 8.
The trajectory for 11-year-old cohort in 2012



4. Conclusion

4.1 Conclusion

The article used four rounds survey data of CFPS, using Lexis diagram as the research tool to analyze the temporal development of noncognitive abilities of children aged 10–15, and the trajectory of urban–rural gap in children’s noncognitive abilities.

The main conclusions of the article are as follows:

- (1) There was a significant temporal difference of noncognitive abilities of children aged 10–15. In terms of urban-rural gap, there was a narrowing trend in *self-control* and *locus of control*; there is an increase-to-decrease trend in *self-esteem* and *responsibility*; there is a decrease-to-increase trend in *positive behavior scale*. In short, urban–rural differences in noncognitive ability of children aged 10–15 showed different development trends with different measurement indicators. If a unidimensional indicator was used to measure children’s noncognitive ability, it could hardly reveal the divergent development trends illustrated by different measurements of noncognitive abilities.

- (2) In the age analysis, the urban–rural gap in responsibility for 10-year-old and 11-year-old children showed a gradually expanding trend over time; the urban–rural gap in self-esteem of 10-year-old children was gradually narrowing, while the urban–rural gap in positive behavior scale of 11-year-old children was narrowing first and then expanding.
- (3) In cohort analysis, this paper concluded as follows: for the 10-year-old cohort in 2010, the urban–rural gap in self-esteem and responsibility gradually expanded over time; for the 11-year-old cohort in 2010, the urban–rural gap in positive behavior scale slightly expanded, but the gap in responsibility was first expanding and then narrowing. For the 10-year-old and 11-year-old children cohorts in 2012, there were different trends of urban–rural gap in responsibility, among which urban–rural gap of the 10-year-old children cohort was first expanding and then narrowing, but urban–rural gap of the 11-year-old children cohort was gradually decreasing.

4.2 Discussion

There are some remaining discussions concerning the article's findings which can be summarized into four aspects.

First, according to the findings of the article that children's noncognitive ability varies with age, the authors tend to conclude that many items of noncognitive abilities are not innate but gradually acquired via training and cultivation. It implies that further discussions are needed concerning the cultivation and effective intervention of children's noncognitive abilities due to the importance of noncognitive abilities on personal development.

Second, though there is a significant urban–rural difference of children's noncognitive abilities, fortunately, in most measured dimensions, there is a decreasing tendency or parallel tendency in urban–rural difference but not the funnel-shaped or expanding tendency. That is, though there is a significant disparity in the allocation of rural and urban educational resources, the urban–rural gap is not followed by the expanding inequality in the development process of children's noncognitive abilities. Therefore, future educational issues concerning educational ideas in the urban environment and educational resources in the rural society are of vital importance.

Third, urban children outperform rural children in most aspects of noncognitive ability, but rural children's responsibility is always considerably higher than urban children's. Under the unequal allocation of educational resource, there is a contrast between urban children's weak social responsibility under the advantageous condition and rural children's strong social responsibility in the relatively disadvantageous environment. To some extent, it implies that rural children are more responsible and focus on the social development, on the contrary, urban children tend to focus on personal development. Such findings indicate that educational issues in the urban environment should be reconsidered, as urban children concentrate more on their personal development and pursue self-interest but are less likely educated with social responsibility under the pressure and involution of urban educational system. As the consequence, studies and intervention should pay more attention to improve urban children's social responsibility.

Last but not least, the measurement of children's noncognitive abilities is such an important issue, especially combining the measurement with sociology and pedagogy theories to systematically understand the development process of noncognitive abilities. Based on different indicators, the differences in children's development results illustrate that a unidimensional measurement of children's noncognitive abilities is insufficient. Therefore, it is necessary to establish a systematic measurement via the use of multidimensional indicators and more comprehensive scales to cover many aspects of children's noncognitive

abilities and such requires the joint efforts of researchers from different disciplines such as psychology, sociology and education.

Besides, when discussing the impact of social change on children's noncognitive abilities, this article argues that we should not only compare the temporal and age difference but also analyze the cohort effect via Lexis diagram, the research can depict the development process of children's noncognitive abilities more comprehensively and systematically. This is also one of the contributions of this research framework, integrating temporal comparison, age comparison and cohort analysis into the same framework, though we did not use more advanced statistical methods to depict the separated effects of the three dimensions which need further research in the future.

Of course, the paper is not without any caveats. The first is about the samples. As some noncognitive indicators in the CFPS study design are only for the adolescents at the specific age, some indicators in temporal analysis cannot be inferred to overall 10–15 children; in addition, due to sample attrition of panel data, the sample size is too small in the cohort analysis, which attenuates the effectiveness of statistical test and related conclusion. Second, in the analytical framework, a series of statistical tests are used to approximately separate the influence of age and cohort from period effect, but no control variables are included. The age and cohort differences obtained are not the pure age effect and cohort effect, which are needed to be discussed by subsequent statistical control. Therefore, more researches utilizing cohort data or longitudinal data on children's noncognitive abilities are needed.

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