Trajectories of change in overall self-evaluation during childhood in relation to child-rearing factors and academic competence

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This paper examined how parent-reported child-rearing factors and children's own-reported academic competence are related to the trajectory patterns of change in overall self-evaluations during childhood and early adolescence (grades 3 to 6), which is considered to be a critical period for qualitative and quantitative changes in overall self-evaluations. Mixed trajectory modeling of overall self-rated scores at four time points (years) identified four distinct trajectories of change: declining, low, high, and rising. The results of multinomial logistic regression analysis with the high group as the reference category indicated that various factors at grade 3 related to child rearing (e.g., child rearing stress) explained the likelihood of belonging to the declining and low groups, and academic competence explained the likelihood of belonging to the low and high groups.

Keywords: *Global self-worth / self-esteem, academic competence, child-rearing factors*

Introduction

Overall self-evaluation, determined based on concepts such as self-esteem (Rosenberg, 1965) and global self-worth (Harter, 1985, 1988), is considered an aspect of self-definition. It drops the most sharply between the end of childhood and early adolescence. For example, Tsuzuki (2005) examined the self-esteem of Japanese children from fourth to ninth grade, using cross-sectional and longitudinal strategies, finding that it declines during this period. Oshio *et al.* (2014) conducted a meta-analysis of past Japanese studies using Rosenberg's (1965) self-esteem scale, in which they showed that the self-esteem of junior and high school students was lower than that of individuals at other developmental stages (university students, adults, and older adults).

Development of the ability to perceive overall self-evaluation as an aspect of self-definition is believed to be the result of cognitive development. A decline in self-evaluation also appears to emerge as a result of development. For example, acquiring the ability to think objectively leads to comparing the self with others and accepting evaluations based on a wide range of external criteria, such as feedback from teachers and peers and test scores. Therefore, overall self-evaluation tends to decline under these conditions, compared with when children evaluated themselves with an immature, ungrounded sense of self-worth and confidence. Kato *et al.* (2018) analyzed the influence that a critical thinking attitude has on the self-esteem trajectory of junior high school students and showed that the group that he defined as having high critical-thinking ability showed a steeper decline in self-esteem. The ability to think critically is acquired through cognitive development. By making the self the target of critical thinking, a

person reevaluates the self, including its negative aspects, with the result tending to be a decline in overall self-evaluation.

Academic achievement appears to be one factor that appears to strongly influence the self-understanding of schoolchildren and adolescents. However, academic achievement is known to have only a minor influence on overall self-evaluation (self-esteem) (A Meta-Analytic Review, Valentine *et al.*, 2004). This is because even if the same results are obtained, the impact varies according to the degree of value individuals, classrooms, and families attach to them (Rosenberg *et al.*, 1995; Crocker *et al.,* 2003).

Some researchers have insisted that overall self-evaluation is not necessarily the result of integrating various objectively evaluable self-images. For example, Coopersmith (1967) cited parenting behavior as an antecedent for self-esteem. Being loved by a parent (caregiver) allows a child to enjoy a positive and stable sense of self. Furthermore, by being appropriately disciplined while having his or her autonomy respected, a child develops the ability to make confident behavioral choices. These experiences contribute to the formation of an overall positive self-evaluation. Leary (2012) noted that self-esteem is an indicator of social acceptance and the output of a system that monitors acceptance and rejection. For school-age children and adolescents, “society” refers to interpersonal relationships in the family and classroom, and the importance of family interactions is suggested from explanations such as acquiring positive self-esteem through love and positive evaluations from others around them through appropriate social behaviors. However, although a meta-analysis of studies that investigated the relationship between self-esteem and parenting showed a significant effect size, the influence of

parenting was revealed to be small (Pinquart & Gerke, 2019).

Several studies have suggested two narratives concerning the formation of overall self-evaluation. The first is that it is formed as an accumulation of small influences exerted by various factors. The second is that several trajectories coexist during the formation of overall self-evaluation, and that a child develops along one of these trajectories. This study aimed to examine the latter and identify the factors that impact each trajectory.

A study that used cluster analysis to examine intra-individual changes in overall self-evaluation noted that changes in overall self-evaluation during adolescence can be divided into four different trajectories. Hirsch and DuBois (1991) identified the following four subgroups of self-esteem: Consistently High, Consistently Low, Moderately Rising, and Steadily Decreasing. Zimmerman *et al.* (1997) used the same analytical method and obtained similar results, examining three factors as the cause of varying trajectories of change among students in grades 6 to 10: peer pressure, academic performance, alcohol use. They found that the group with consistently low self-esteem was subject to relatively stronger pressure from their peers, whereas the group with consistently high self-esteem had relatively higher academic performance (Grade Point Average, or GPA).

This study investigated data on Japanese children and adolescents using group-based, or mixed, trajectory modeling, which is a method for analyzing developmental trajectories, to examine whether the results of these past studies can be replicated. Using group-based (mixed) trajectory modeling, we statistically identified whether latent groups (latent classes) within the same trajectory can be assumed in longitudinally measured data. If such groups can be assumed, the probability of belonging to each

trajectory and the variables that influence them can be estimated (Takahashi, 2022). In this study, we explored developmental trajectories in overall self-evaluation, measured at four time points between grades 3 and 6 in elementary school. If evidence for such trajectories is present, we will analyze how each trajectory is influenced by the academic self-evaluation and parenting factors in place at the initial time point of the trajectory.

We conducted our analysis using the same data as Nakayama (2023), who analyzed the influence of academic self-evaluation and parenting factors on overall self-evaluation for each grade. Nakayama (2023) presented the results of an investigation that adopted the first perspective described above (accumulation of influences; i.e., that influencing factors change over time). In contrast, our study takes the second perspective and investigates how factors at the initial stage (grade 3), when overall self-evaluation is recognized, determine subsequent trajectories.

Methods

Survey participants and ethical considerations

This study used part of the survey conducted in the Japan Children's Study (JCS)[1]. From the JCS participants, we analyzed data from 139 child–caregiver pairs (69 boys and 70 girls) who had provided consent for observations and surveys at the Mie-Chuo Medical Center and granted permission for their data to be used after study completion. The participants had taken part in the survey since their children were infants. However, this study targeted the results of four surveys conducted when the children

[1] The Japan Children's Study (JCS) is a birth cohort study that began in Japan in 2004. Yamagata et al. (2010) provide detailed information up to age 3.

were between grades 3 and 6.

Longitudinal studies that include the present study have undergone ethics review by the ethics committees of the Japan Science and Technology Agency and the National Hospital Organization's Mie-Chuo Medical Center for the plan up to age three and a half, and by the ethics committees of Mie-Chuo Medical Center, National Hospital Organization, and Mukogawa Women's University for the plan for ages five and beyond. The study participants (parents/caregivers) were informed about the study plan, protection of personal information, and the right to withdraw consent even after implementing observations and other activities and signed a consent form. Informed consent was obtained on behalf of the participants (children) from their parents or caregivers. We informed the participants that their responses to the questionnaire were voluntary and assumed their consent on return of the completed questionnaire.

Survey items

Overall self-evaluation: This was measured in the children at all four time points and the data obtained at each time point were used. The participants were asked to rate the following three items on a 5-point scale, ranging from 0 (not at all) to 4 points (always): "I had confidence in myself (I did very well)," "I felt like I could do almost anything," and "I was satisfied with myself (I like myself)" (total score range: 0–12).

Academic self-evaluation: Regarding self-evaluation for all subjects taught at school, including Moral education and Period for Integrated Studies, we adopted four items, specifically asking the children to self-evaluate those school subjects with the written tests that they likely prioritize (Japanese language, arithmetic,

science and social studies) (Eccles *et al.*, 1989) ("Are you good at subject xx?") We asked the children to respond on a 3-point scale ranging from "not good at all (1 point)" to "very good (3 points)" (total score range: 4–12). Although measurements were made based on responses from the children at all four time points, to investigate them as factors that influence overall self-evaluation trajectories, we used the data from the first time point (grade 3) for analysis.

Parenting factors: We asked the parents to respond at all four time points. However, to investigate parenting factors that influence the overall self-evaluation trajectories we used only the data from the first time point (grade 3) for the analysis.

1. Parenting attitudes: Based on Baumrind's (1967, 1971) classification of parenting attitudes and structural analysis of representative parenting behavior scales (Ito, Nakajima *et al.*, 2014), we selected three aspects: Control (3 items; example: "I try to tell them sternly that what is wrong is wrong"), Interest and Involvement (4 items; example: "I like to do things together with my child"), and (Excessive) Protection (4 items. example: "If I'm not around, I feel that my child will face difficulties in the future.") Ratings were made using a 4-point scale ranging from "disagree (1 point)" to "agree (4 points)" (total score range: 3–12 or 4–16).

2. Childrearing stress: To examine the influence of caregivers' negative perceptions and emotions toward parenting, we asked them to respond to six items, such as "I don't know how to deal with my child(ren)." Ratings were made using a 4-point scale ranging from "strongly disagree (1 point)" to "strongly agree (4 points)" (total score range: 6–24).

Analytical method

We used “gbmt” (Group-Based Modeling Trajectory; Magrini, 2022a), which is a package in the R statistical environment, to analyze and compare models related to the estimation of a trajectory, and SPSS version 25 to analyze the influence of the factors. “gbmt” is an implementation in R of group-based, or mixed, trajectory modeling proposed by Nagin (2005).

Moreover, when comparing the models, no general indicators have been established for choosing the optimal number of trajectories. Simulation studies have noted that the performance of goodness-of-fit indices is largely dependent on data characteristics, with no single indicator being superior (van der Nest *et al.*, 2020). Thus, examining several goodness-of-fit indices together is considered important. In this study, following Magrini (2022b), we integrated the ranking (in the package used, this is based on the smallness of the statistical volume) of various indices, such as the Akaike Information Criterion (AIC) and BIC Bayesian Information Criterion (BIC), and then evaluated the number of groups. After a plausible number of groups had emerged, we calculated the average probability of any individual belonging to each trajectory (average posterior probability) and assessed the model’s accuracy. An average posterior probability of 0.70 or higher is regarded as sufficient (Nagin, 2005). Maximum likelihood estimation is performed based on incomplete data; therefore, the expectation–maximization (EM) algorithm was used to estimate the parameters.

Results

Overall self-evaluation: trends in changes at the group level

Table 1 shows the mean global self-worth, standard

deviation, Cronbach's alpha coefficient, and correlation with the predictor variables at each grade level. Repeated-measures analysis of variance showed no trends in the data in this study that would suggest an overall decline in self-evaluation between grades 3 and 6 at the group level.

Table 1 Destriptive statistisc about global self-worth

	N	M (SD)	α	Correlation Coefficients (r)							
				T1	T2	T3	Love	Deciprine	(Over) involved	Parental stress	Academic competence
Grade 3 (T1)	117	7.25 (2.86)	.76				-.15	.05	-.02	-.05	.43 ***
Grade 4 (T2)	111	7.15 (2.99)	.83	.44 ***			-.12	-.03	-.02	.13	.21 *
Grade 5 (T3)	106	6.55 (2.87)	.83	.33 ***	.52 ***		-.06	.03	-.04	.08	.04
Grade 6 (T4)	108	7.00 (2.90)	.89	.38 ***	.44 ***	.57 ***	-.08	.12	.08	-.02	.23 *

***p <.001, *p <.05

Identification of the trajectory of changes, based on the results of group-based trajectory modeling

The nature of the overall self-evaluation trajectories was estimated using group-based trajectory modeling, assuming up to quadratic functions. We determined the optimal number of trajectories by sequentially increasing the assumed number of latent classes from 1 to 6 and then comparing the models. The model with four groups showed the best overall value (Table 2). We also calculated the average posterior probability of any individual belonging to each trajectory group and found that the values were between 0.80 and 0.89. All were assessed as sufficient. The

Table 2 Model estimation

N of group	AIC	BIC	CAIC	SABIC
1	2448.59	2457.02	2459.02	2450.68
2	2366.53	2400.25	2408.25	2374.85
3	2371.85	2426.64	2439.64	2385.38
4	2350.55	**2409.56**	**2423.56**	**2365.12**
5	**2350.30**	2438.81	2459.81	2372.14
6	2351.01	2439.52	2460.52	2372.86

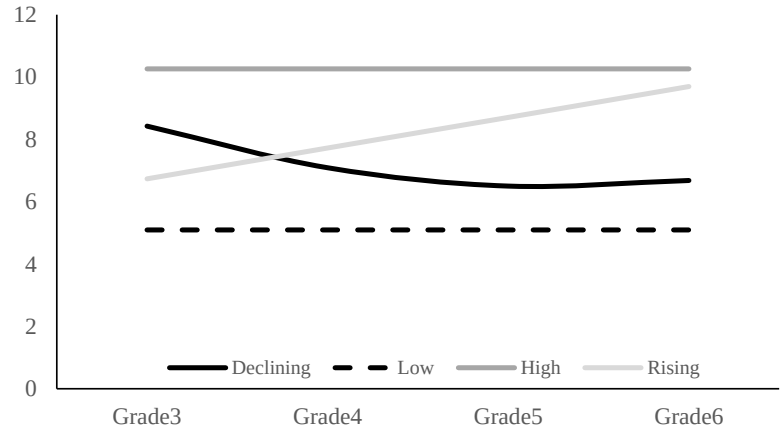
membership proportion for each group was between 12.8% and 41.6%, with no groups having an extremely small number of members. Therefore, we concluded that the number of classes was four.

Figure 1 shows the trajectories assumed from our analysis. Based on the characteristics of each group, we named the group that showed a gradual decline in the low-to-moderate score range as “Declining”; the group that was consistently in the low score range as “Low”; the group that was consistently in the high score range as “High”; and the group that showed an increase from the moderate-degree score range to the high-score range, as “Rising.”

Factors that predict the ease of membership in different change trajectories

We performed a multinomial logistic regression analysis, using the above as covariates and each group as the outcome variable, to examine the influence of academic self-evaluation and parenting factors on the ease of membership in various trajectory groups. We used the High Group as the reference group to explain

Figure 1
Characteristics of the estimated trajectories



the differences from the state of continuing to maintain positive self-evaluation. Table 3 presents the analysis results. Factors relating to childrearing, such as discipline, involvement, and childrearing stress, contributed significantly to distinguishing between the Declining and High Groups. Discipline and involvement predicted the likelihood of being assigned to the High Group, whereas childrearing stress predicted the likelihood of being assigned to the Declining Group. Childrearing stress and academic self-evaluations significantly contributed to distinguishing between the Low and High Groups, with both factors predicting the likelihood of being assigned to the Low Group. Moreover, academic self-evaluation served to distinguish between the Rising and High Groups by predicting the likelihood of being assigned to the Rising Group.

Table 3 Multinomial logistic regression analysis on trajectories

Independent variables	β	Odds ratio	Wald Test	p
[Group 1: declining (n=37, 29.6%)]				
Love	-.12	0.89	0.29	.59
Descipline	.48	1.61	4.08	<.05
(Over) involved	.38	1.00	3.86	<.05
Parental stress	-.29	0.58	5.06	<.05
Academic competence	-.06	0.94	0.06	.81
[Group 2: low(n=52, 41.6%]				
Love	-.22	0.81	1.07	.30
Descipline	.31	1.36	1.87	.17
(Over) involved	.14	1.15	0.62	.43
Parental stress	-.24	0.79	3.74	<.06
Academic competence	-.66	0.51	8.25	<.01
[Group 4: rising(n=16, 12.8%]				
Love	-.13	0.88	0.28	.60
Descipline	.19	1.21	0.51	.47
(Over) involved	.10	1.10	0.21	.65
Parental stress	-.13	0.88	0.82	.37
Academic competence	-.62	0.54	5.33	<.05

Reference group: Group 3 (high, n=20, 16%)

Discussion

Overall self-evaluation's trajectory pattern

This study examined the patterns of the change trajectories, investigating the changes in overall self-evaluation and influence of academic self-evaluation and parenting factors. Analysis using group-based (mixed) trajectory modeling resulted in the identification of four trajectory-based groups: the High Group, which showed consistently high overall self-evaluation scores throughout the survey period; the Rising Group, which showed a rise in scores from the moderate-degree score range; the Declining Group, which showed a decline in scores; and the Low Group, which had consistently low scores. Regarding characteristics, these groups were consistent with the results of previous studies using cluster analysis. However, the proportion of people classified into various groups differed from those in previous studies. Zimmerman *et al.* (1997) found the highest proportion in the High Group (48.3%), followed successively by the Declining (20%), Rising (18.4%), and Low (13.0%) Groups. Likewise, Hirsch and DuBois (1991) found that the proportion was highest in the High Group (35.2%) and lowest in the Low Group (12.5%) (Rising Group: 31.2%; Declining Group: 21.1%), whereas, in our study, the number of people assigned to the Low Group was the largest (41.6%), followed by the Declining (29.6%), High (16.0%), and Rising (12.8%) Groups.

Indicators of overall self-evaluation, such as self-esteem, differ by country and culture, with the scores of Japanese people tending to be low. For example, the White Paper on Children and Young People (Cabinet Office, 2019) examined the responses provided by young people in various countries to the statements, "I

am satisfied with myself" and "I feel that I have strong points," and found that young people in Japan had lower scores than those in South Korea, the US, the UK, Germany, France, and Sweden. Although no international comparisons were made in our study, the Low Group scores (changes in the mean: 5.2, 4.7, 4.51, and 4.79; estimated trajectory value: 5.10 [intercept]), which remained lower than the theoretical mean of 6 points, suggest a low level of overall self-evaluation and reflect the actual characteristics of Japanese schoolchildren.

Factors that distinguish the overall self-evaluation trajectories

A multinomial logistic regression analysis of the factors that explain the differences between the groups by trajectory showed that the significant predictors differed according to the groups being compared.

Factors related to parenting attitudes, such as discipline and involvement, determined whether overall self-evaluation declined or remained consistently high, with a high degree of discipline and involvement explaining the consistently high overall self-evaluation scores. Childrearing stress distinguished between consistently low, declining overall, and consistently high overall self-evaluation. High parenting stress and poor interpersonal environment within the family appeared to be factors that lowered the overall self-evaluation scores.

Academic self-evaluation differed between the Rising and High Groups. The Rising Group values academic performance, and the extent to which the members feel good about themselves appears to be increased by doing well in school. As the children advance through their grades, individual differences in how well

they can follow the lessons are expected to widen. Group members who were able to understand lessons easily in grade 3 are expected to be more likely to feel a sense of advantage because of this as they progress through the grades. However, the same factor predicted membership in the Low Group. Ease of understanding lessons appeared to indicate a high level of cognitive development. Children with a high level of cognitive development in grade 3 tend to view themselves more objectively and critically than children with a low level; thus, their overall self-evaluations are likely to be low.

Limitations of this study and future challenges

In this study, we identified the patterns of trajectories (individual differences) in overall self-evaluation and clarified parenting factors and academic self-evaluation as elements that distinguish these trajectories. Prior findings were reconfirmed using different analytical methods. Furthermore, we obtained new results such as the largest number of Japanese schoolchildren belonging to a group that shows consistently low overall self-evaluation. However, the analysis included only a limited number of participants (approximately 100). Thus, further verification using a larger sample of participants is required.

Moreover, in this study, we limited the factors that predict trajectories to those that were prevalent at the time of the initial survey (variables measured at grade 3). However, non-linear trajectories may also be predicted by some factors that are present at an intermediate stage. Therefore, this point should be examined using a different analytical method relating to trajectory factors.

Furthermore, this study targeted a period when children are believed to begin recognizing overall self-evaluation as part of

their self-definition and seeing it change dramatically. Overall self-evaluation is thought to stabilize toward adulthood. To answer the question of which factors stabilize these evaluations, the developmental stage after junior high school also needs to be investigated.

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