

Investigating the Impact of After-School Programs on Children's Inquiry Skills in Japan

Fuyuko Kanefuji*

Abstract: This study examines the relationship between Japanese children's inquiry skills and their participation in various after-school programs. Inquiry skills—encompassing the ability to explore, analyze, and synthesize information—are essential competencies in 21st-century education. However, limited research has explored how different types of after-school programs contribute to their development.

Using data from a large-scale survey conducted by the National Institution for Youth Education (NIYE) in 2021, this study analyzes the associations between four types of after-school programs and children's inquiry skills, while also considering the influence of socioeconomic status (SES). The findings indicate that participation in nature activities, arts and cultural activities, and private tuition outside of cram schools is positively associated with children's inquiry skills, with nature activities showing the strongest correlation.

These results provide valuable insights for policymakers and practitioners designing after-school programs. The study highlights the potential role of after-school activities in fostering children's inquiry skills and addressing disparities related to SES, thereby complementing formal education.

Keywords: After-school programs, program characteristics, children's inquiry skills, program types.

Introduction

After-school programs are widely recognized as an essential component of children's educational experiences. These programs are defined in this study as those that operate outside the formal school curriculum and provide opportunities for children and youth to develop various cognitive and non-cognitive skills. Afterschool programs can take place in both school-based and out-of-school settings, and are provided by both the public and private sectors. The timing of these programs varies, taking place before or after school, on weekends or during long holidays.

While numerous studies have examined the impact of after-school programs on children's development, two significant gaps remain in the existing literature. First, previous research

* Fuyuko Kanefuji
Department of Human Sciences, Bunkyo University, Japan
Corresponding author: kanefuji@bunkyo.ac.jp

has primarily focused on the frequency and duration of participation, overlooking the relationship between program content, instructional methods, and children's abilities. Second, although some studies have investigated the effects of after-school programs on children from low socio-economic backgrounds, the relationship between different program types and non-cognitive abilities remains underexplored. Few have explicitly examined its relationship with non-cognitive skills such as inquiry skills—a key competency emphasized in 21st-century education reforms.

Inquiry skills represent an important non-cognitive ability that has gained increasing attention in the context of 21st-century education reforms. These skills involve the ability to explore, analyze, and synthesize information to solve problems and are considered essential for lifelong learning and adaptation to complex, rapidly changing environments (Griffin, McGaw, & Care, 2012). Inquiry-based learning, which emphasizes active student engagement in questioning, investigation, and problem-solving, is widely recognized as a key pedagogical approach in 21st-century competency-based education (OECD, 2018; MEXT, 2021). In Japan, educational reforms have increasingly incorporated inquiry-based learning as a means of fostering students' critical thinking, problem-solving abilities, and interdisciplinary learning (MEXT, 2021).

Despite the recognized importance of inquiry skills in contemporary education, there has been limited empirical research on how after-school programs contribute to fostering these skills. Furthermore, although international frameworks for 21st-century skills development highlight the significance of inquiry-based learning (Griffin, McGaw, & Care, 2012), there has been no standardized measurement scale for assessing children's inquiry skills in Japan.

To address this gap, the National Institution for Youth Education (NIYE) in Japan developed a new scale for measuring children's inquiry skills as part of a national survey in 2021 (NIYE, 2021). This study employs this newly developed scale to examine the relationship between participation in different types of after-school programs and children's inquiry skills. The NIYE scale was designed in response to curriculum reforms emphasizing inquiry-based learning in Japanese school education and defines inquiry skills as “the qualities and abilities to better discover and solve problems while considering one's way of being and living through interdisciplinary and comprehensive learning” (MEXT, 2021). In other words, inquiry skills encompass not only individual-level knowledge acquisition but also the ability to collaborate with others and apply acquired knowledge and skills to solve local and global challenges (NIYE, 2021).

Beyond assessing children's non-cognitive skills, this study considers the potential of this scale as a tool for evaluating the quality of after-school programs. By investigating how different types of after-school programs contribute to the development of inquiry skills, this study aims to contribute to the ongoing discussion on effective educational strategies and provides evidence-based recommendations for designing more inclusive after-school programs.

Literature Review:

After-school programs and Children's Development

Numerous studies have investigated the relationship between participation in after-school programs and children's academic achievement and social-emotional development. Research has consistently shown that participation in these programs is associated with improved academic performance, social skills, emotional stability, and self-esteem (Posner & Vandell, 1994, 1999; Mahoney, Lord, & Carryl, 2005).

Meta-analyses have also examined the relationship between participation in after-school programs and children's development. Simpkins et al.'s (2004) meta-analysis of 83 studies found that high participation rates in after-school programs were associated with improved academic performance, reduced problem behavior, and improved social skills. Baker and Witt's (1996) study found that participation in multiple activities was associated with higher grades and academic achievement test scores.

Socio-Economic Status and Access to After-school programs

Research has also investigated the relationship between socio-economic status (SES) and participation in after-school programs. Studies have suggested that children from low-SES tend to derive particular benefits from participation in after-school programs, including improvements in academic performance and social-emotional development (Durlak, Weissberg, & Pachan, 2010; Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011). A meta-analysis by Lauer et al. (2006) systematically reviewed randomized controlled trials (RCTs) and quasi-experimental studies conducted in the United States since 1985, focusing on after-school and summer educational support programs for children with low academic achievement. The findings indicated that participation in these programs was related to small but statistically significant differences in reading and mathematics achievement among adolescents.

Despite the potential advantages of after-school programs, access remains unequal. Studies have consistently shown that participation rates are higher among children from higher-SES, while those from lower-SES backgrounds have fewer opportunities to engage in high-quality after-school programs (Duncan & Murnane, 2011; Reardon, 2013). This participation gap has raised concerns about educational inequality and disparities in academic and social development (Putnam, 2015).

After-school programs and Research in Japan

In Japan, research on after-school programs has primarily focused on after-school activities and their relationship to children's development. The National Institution for Youth Education (NIYE) has conducted large-scale surveys examining after-school activities and their associations with children's independence, self-esteem, and health indicators (NIYE, 2001, 2006, 2008, 2011, 2014, 2016, 2019, 2021, 2024; Ikeda, 2021; Kato, 2021; Kanefuji, 2021, 2024).

However, compared to Western countries, research on the potential roles of after-school programs in fostering non-cognitive abilities such as inquiry skills remains limited.

Internationally, the importance of 21st-century competencies, including problem-solving, critical thinking, and collaborative learning, has been increasingly recognized in education policy and research (OECD, 2018; Trilling & Fadel, 2009). Inquiry-based learning has gained prominence as an approach that encourages students to actively engage with knowledge through exploration and interdisciplinary learning (Hmelo-Silver, Duncan, & Chinn, 2007). In Japan, curriculum reforms have also placed emphasis on inquiry-based learning, aiming to enhance students' ability to think critically, integrate knowledge across disciplines, and apply learning to real-world contexts (MEXT, 2021). However, there is still limited empirical research on how participation in after-school programs relates to the development of inquiry-related skills.

Gaps in the Existing Literature

While existing research has contributed to understanding the role of after-school programs in children's development, several gaps remain. Prior studies have predominantly focused on the frequency, timing, and duration of participation, with limited attention to the relationship between program content, instructional methods, and children's developmental characteristics. Moreover, research has largely overlooked the link between after-school programs and various non-cognitive skills, particularly inquiry skills.

Understanding the potential role of after-school programs in fostering inquiry skills is important for designing effective educational policies and practices. By integrating interdisciplinary and inquiry-based approaches, these programs may help complement formal education and provide opportunities for exploration and critical thinking. However, empirical studies examining these associations remain scarce.

Research Purpose

This study investigates the relationship between participation in various types of after-school programs and the development of children's inquiry skills in Japan. Specifically, it categorizes after-school programs into four types: nature activities, arts and cultural activities, private lessons other than cram school, and cram school—based on their content and instructional methods. The analysis explores how participation in these programs is associated with the development of inquiry skills. This study contributes to the growing body of research on the role of extended education in fostering 21st-century competencies and offers evidence-based insights for designing effective inquiry-based learning programs.

Research Questions

1. To what extent is participation in each of the following types of after-school programs—nature activities, arts and cultural activities, private lessons other than cram school, and cram school—associated with children's inquiry skills, after controlling for their gender and socioeconomic status (SES)?

Methods

Data

Survey Methodology and Sampling

This study utilizes national-level data collected through a survey conducted by the National Institution for Youth Education (NIYE) in 2020, following approval from the relevant authorities for secondary data analysis. The survey was conducted in collaboration with the Ministry of Education, Culture, Sports, Science and Technology (MEXT), prefectural and municipal education offices, and related municipal union education offices.

A two-stage stratified village sampling method was employed. First, public schools across Japan were stratified based on school size and city size. Second, a sample of 600 elementary schools (100 schools per grade), 150 junior high schools (second grade only), and 150 senior high schools (second grade only) was selected. This study focuses on data from elementary school students in grades 4–6 who participated in the NIYE survey. By matching children's survey responses with parental survey data, a total of 4,652 children and their parents were included in the analysis¹.

Scale of Children's Inquiry Skills and Its Validity

The National Institution for Youth Education (NIYE) conducted an exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) to assess the validity of the inquiry skills scale (see the Supplementary Table in the Appendix). These analyses identified a three-factor structure comprising collaborative attitudes, proactive attitudes, and acquisition of knowledge and skills. The NIYE (2021) findings indicated that the model demonstrated a good fit to the data, supporting the validity of the scale in measuring a latent construct interpreted as inquiry skills. The scale exhibited high internal consistency, with a Cronbach's α of .86, and was found to be applicable across different school-age groups.

The scale consisted of 16 items, and data were collected directly from children through self-administered questionnaires. In this study, the analysis was conducted using these child-reported responses to assess their inquiry skills.

Categorization of After-school programs

The NIYE survey examined children's participation in out-of-school activities over the past year, including those conducted after school, on weekends, and during long-term holidays. Based on the survey data regarding program content and instructional methods, this study categorized after-school programs into four distinct types: nature activities, arts and cultural activities, private lessons other than cram school, and cram school. Data on the frequency of children's participation in these activities were obtained from parental reports. Parents were asked to report their children's experiences during the year prior to the survey.

1 The author requested and received permission from NIYE to analyze the survey data in this study (permission date: March 1, 2024)

Nature Activities

Data on nature activities were collected on a total of 13 items (Table 1). Parents were asked to indicate the frequency of participation using a three-point scale: many times (score of 3), a little (score of 2), and never (score of 1). The total score for nature activities was computed as the sum of the scores across all 13 items, yielding a possible range from 13 to 39.

Table 1: List of items included in the nature activity scale

No.	Description
1	Mountaineering, hiking, orienteering, and walking rallies
2	Swimming in the sea and rivers or riding a boat, canoe, and yacht
3	Interacting with animals, such as horseback riding and cow milking
4	Cooking outdoors or staying in tents
5	Snow activities, such as skiing and playing in the snow
6	Catching insects and water creatures
7	Observing and studying plants and rocks
8	Observing stars and clouds
9	Gathering wild vegetables, mushrooms, and nuts
10	Catching fish and collecting shellfish
11	Making crafts from natural materials
12	Planting trees, thinning trees, and clearing brush
13	Planting and growing rice and vegetables

Arts and Cultural Activities

Data on the frequency of children's participation in arts and cultural activities were collected after providing a description of the activities types included in this category. Examples given to parents included movies, music (e.g., opera, pop music, orchestras, concerts), visual arts (e.g., painting, sculpture, photography), historical buildings and sites, theater and dance performances, performing arts (e.g., Kabuki, Rakugo², Manzai³), museum exhibitions.

Parents were then asked to report the frequency of their children's engagement in the following three types of activities during the year preceding the survey, using the same three-point scale: 1. watching or listening to arts and cultural activities via television, DVDs, or the Internet, 2. attending cinemas, art galleries, museums, or theaters to directly experience arts and cultural activities, 3. creating or performing works related to arts and cultural activities

Private Lessons and Cram School

The third and fourth categories, private lessons other than cram school and cram school, were assessed based on parents' reports of children's weekly attendance in these activities. The frequency data for these two categories were dichotomized based on the median participation level. Children whose participation frequency was above the median were classified as the high-participation group, whereas those with participation below the median were categorized as the low-participation group.

² Rakugo is the Japanese traditional art of storytelling.

³ Manzai is a kind of the comedy performed by a duo.

Basic Statistics of Survey Items

Table 2 presents the basic demographic characteristics of the children in the sample. The male–female ratio was approximately 50%, and the distribution of students across grades was relatively even, with slightly over 30% in each grade. These distributions indicate no significant gender or grade bias in the sample.

In this study, “socioeconomically disadvantaged children” refers to those from families with low parental socioeconomic status (SES). Data on household annual income was collected as a proxy variable for SES. Household annual income data were obtained from the parental survey and categorized into seven income brackets, which were further clustered into three income groups⁴: low: Less than 4 million yen, medium: Between 4 million and less than 8 million yen, high: 8 million yen or higher. Table 3 provides summary statistics for all survey items used in this study.

Table 2: Participants’ Demographics

Variables	n	%
Sex		
Male	2,191	47.1%
Female	2,396	51.5%
NA	65	1.4%
Grade		
Fourth grade	1,605	34.5%
Fifth grade	1,543	33.2%
Sixth grade	1,475	31.7%
NA	29	0.9%
Annual SES of parents		
1. Less than 2 million yen	212	4.6%
2. More than 2 to less than 4 million yen	636	13.7%
3. More than 4 to less than 6 million yen	1,192	25.6%
4. More than 6 to less than 8 million yen	1,209	26.0%
5. More than 8 to less than 10 million yen	707	15.2%
6. More than 10 to less than 12 million yen	369	7.9%
7. More than 12 million yen	327	7.0%
Total	4,652	100.0%

4 The median SES in Japan is approximately 4.4 million yen (USD 30,000) according to 2022 statistics (Ministry of Health, Labour and Welfare, 2022).

Table 3: Descriptive statistics for variables analyzed in this study ($N = 4,013$)

Variable	M	SD	Scale range / Description
Gender (1 = boy, 2 = girl)	1.52	0.50	Binary scale (child report)
Socioeconomic status (SES)	3.85	1.52	1 to 7 (parent report)
Participation in nature activities	19.20	4.56	Total score (13–39), based on 13 items (parent report)
Participation in arts and cultural activities	5.30	1.75	Total score (3–9), based on 3 items (parent report)
Private lessons (excluding cram schools)	0.73	0.45	Recoded into a binary variable (1 = high, 2 = low) based on the median (parent report)
Cram school attendance	0.44	0.50	Recoded into a binary variable (1 = high, 2 = low) based on the median (parent report)
Inquiry skills	31.57	7.74	Total score (0–48), based on 16 items (parent report)

Note. Participation in after-school programs (nature activities, arts and cultural activities, private lessons, and cram school attendance) and socioeconomic status (SES) were reported by parents. Gender and inquiry skills were based on children's self-reported responses. Inquiry skills were measured using 16 items rated on a 4-point Likert scale.

Data Analysis

In order to address the research question, two statistical methods were employed: two-way ANOVA and hierarchical multiple regression analysis. First, a two-way ANOVA was conducted as a preliminary analysis to examine potential interactions among the independent variables. Based on the results of this preliminary analysis, a hierarchical multiple regression analysis was subsequently performed. In this analysis, inquiry skills served as the dependent variable, while the four types of after-school program participation were designated as the independent variables. Gender and socioeconomic status (SES) were included as control variables. The decision to include these control variables was based on previous research (NIYE, 2021), which found that gender and SES influence children's inquiry skills. Furthermore, the preliminary analysis indicated that there were no significant interactions among the variables. All statistical analyses were conducted using IBM SPSS Statistics, version 28.0.

Results of preliminary analysis

To examine the effects of socioeconomic status (SES) and participation in after-school activities on children's inquiry skills, a series of two-way analyses of variance (ANOVAs) were conducted. Table 4 summarizes the results for each activity type. For nature activities, arts and cultural activities, and private lessons (excluding cram schools), significant main effects were observed for both SES and activity participation. However, none of the interaction effects between SES and activity participation reached statistical significance. In contrast, in the

model involving cram school attendance, only SES had a significant main effect; neither cram school attendance itself nor its interaction with SES was statistically significant.

These results informed the decision to exclude interaction terms from the subsequent hierarchical multiple regression analysis. The absence of significant interactions suggested that the effects of SES and activity participation were additive rather than multiplicative. This analytical strategy enabled the assessment of the unique contributions of each factor to inquiry skills while statistically controlling for key demographic variables such as gender and SES. These preliminary findings underscored the importance of a more focused multivariate approach to address the research questions.

Table 4: Two-Way ANOVA Results Examining the Effects of SES and After-School Activity Participation on Inquiry Skills

Activity Type	Source	df	F	p	Partial η^2
Nature Activities	SES	6, 4083	7.65	< .001***	.01
	Participation	1, 4083	45.39	< .001***	.01
	SES × Participation	6, 4083	1.02	.413	.00
Arts and Cultural Activities	SES	6, 4248	7.51	< .001***	.01
	Participation	1, 4248	37.44	< .001***	.01
	SES × Participation	6, 4248	0.99	.429	.00
Private Lessons (Non-Cram)	SES	6, 4272	6.35	< .001***	.01
	Participation	1, 4272	12.99	< .001***	.00
	SES × Participation	6, 4272	1.54	.161	.00
Cram School Attendance	SES	6, 4266	7.06	< .001***	.01
	Participation	1, 4266	2.12	.146	.00
	SES × Participation	6, 4266	0.88	.508	.00

Note. The dependent variable was the total score for inquiry skills. SES and participation in after-school activities were used as independent variables. Participation in the four activity types was dichotomized into high and low groups based on the median. *** $p < .001$.

Results: Results of Hierarchical Multiple Regression Analysis

To further examine the contributions of out-of-school program participation to inquiry skills, a hierarchical multiple regression analysis was conducted (Table 5). Participation in four types of after-school programs was entered as the main predictor, with SES and gender included as control variables. The analysis aimed to assess the incremental explanatory power gained by adding each type of program participation and to identify which programs were most strongly associated with children's inquiry skills.

In Model 1, gender and SES were entered as control variables due to their previously established associations with inquiry skills. Subsequently, participation in nature activities was added in Model 2, contributing significantly to the model. Arts and cultural activities were introduced in Model 3, followed by private lessons (excluding cram schools) in Model 4. All three types of participation showed significant positive associations with inquiry skills at the 1% level. Cram school participation did not contribute significantly and was therefore excluded from the final model.

Table 5: Hierarchical multiple regression analysis predicting inquiry skills ($N = 4,013$)

Predictor Variables	Model 1 β	Model 2 β	Model 3 β	Model 4 β
Gender	.110***	.140***	.129***	.128***
SES	.118***	.096***	.088***	.082***
Participation in nature activities		.256***	.250***	.248***
Participation in arts & cultural activities			.063***	.060***
Private lessons (not cram schools)				.035*
R^2	.025	.089	.092	.094
ΔR^2	—	.064***	.004***	.001*
Adjusted R^2	.024	.088	.092	.093
F for ΔR^2	57.574***	323.145***	18.713***	5.931*
Standard error of estimate	7.37	7.12	7.11	7.10
Durbin-Watson	—	—	—	1.876

Note. $p < .05$ (*), $p < .01$ (**), $p < .001$ (***). Standardized beta coefficients (β) are reported. Dependent variable: total score for inquiry skills.

While the R^2 values remained modest, each step of the model showed statistically significant improvement in explanatory power. Multicollinearity diagnostics indicated no concerns. These results reinforce the findings from the preliminary analyses, highlighting that children's engagement in nature-related, cultural, and individualized educational activities outside school is positively related to the development of inquiry skills. The implications for the design and targeting of after-school programs are discussed in the following section.

Discussion

This study examined the relationship between children's participation in after-school programs and their inquiry skills. Participation in nature activities, arts and cultural activities, and private lessons (excluding cram schools) was positively associated with children's inquiry

skills, according to the hierarchical multiple regression results. The key findings can be summarized as follows.

First, the preliminary analyses revealed a strong association between children's participation in after-school programs and parental SES in Japan. Participation rates in all four types of programs—nature activities, arts and cultural activities, private lessons other than cram school, and cram school—increased with SES. These findings align with previous studies (NIYE, 2021; Tokyo Metropolitan Government, 2017; Tokyo Metropolitan University, 2023). One possible explanation is that after-school programs often involve substantial costs. Additionally, Japanese parents tend to prioritize financial investment in their children's after-school education, a trend that has been increasing (Benesse Educational Research and Development Institute, 2017). This study reaffirmed the link between children's participation and parental SES, highlighting that children from lower-SES are less likely to engage in diverse after-school programs and benefit from after-school experiences.

Second, the findings indicate that children participating in nature activities, arts and cultural activities, and private lessons other than cram school demonstrated higher levels of inquiry skills. Notably, participation in nature activities showed the strongest association. Inquiry skills, a key non-cognitive ability, are linked to prosocial behaviors such as empathy and contributions to society (NIYE, 2021). These results are consistent with previous research indicating that after-school participation fosters children's social skills, including their ability to collaborate and understand others (Pettit, Laird, Bates, & Dodge, 1997). Moreover, these findings align with studies on the benefits of nature-based experiences. Research has demonstrated that forest kindergartens positively impact preschool children (Knight, 2009; O'Brien & Murray, 2007). Exposure to green spaces has also been linked to enhanced cognitive functioning (Wells, 2000), reduced stress in rural children (Wells & Evans, 2003), and improved attention in children with attention deficit hyperactivity disorder (Kuo & Taylor, 2004).

These findings suggest that inquiry skills develop through activities that promote open-ended exploration, collaborative problem-solving, and interdisciplinary thinking, rather than through structured, rote-based instruction. Nature-based activities, in particular, expose children to unpredictable and diverse environments, requiring them to observe, hypothesize, and adapt—not only individually but also in interaction with others. Such experiences foster both independent cognitive growth and the ability to collaborate in addressing complex problems, which aligns with the definition of inquiry skills as comprising the qualities and abilities needed to discover and solve problems through interdisciplinary and comprehensive learning (MEXT, 2021).

This interpretation is further substantiated by Piaget's constructivist theory, which emphasizes active knowledge construction through interaction with one's environment (Piaget, 1950, 1972). According to Piaget, learning is most effective when children engage directly with their surroundings, testing hypotheses and refining their understanding through experience. Nature-based activities provide an optimal setting for such experiential, problem-solving-oriented learning, fostering not only intellectual curiosity but also the ability to work collaboratively and apply learning to real-world contexts.

In contrast, cram school lessons typically emphasize structured, predetermined content and standardized test preparation, which may not provide sufficient opportunities for interdisciplinary learning or collaborative problem-solving. While cram schools may enhance individual knowledge acquisition, they often do not encourage students to integrate different

fields of knowledge, consider diverse perspectives, or apply their learning to broader societal issues. As a result, cram school learning may not sufficiently support the development of inquiry skills, which extend beyond individual learning to include interdisciplinary problem-solving and collaborative engagement (MEXT, 2021; NIYE, 2021).

Taken together, these theoretical perspectives help explain the observed relationships and underscore the importance of incorporating collaborative, interdisciplinary, and exploratory activities into after-school programs.

Implications for After-school Programs

The findings of this study offer several implications for the development of after-school programs for children in Japan. First, nature-based activities should be incorporated into after-school programs for all children, regardless of SES. In this study, children's engagement with nature was assessed through 13 items (see Table 1), which included both extraordinary experiences such as hiking in the mountains, swimming in the sea, and camping, and more familiar, everyday experiences such as interacting with animals, collecting insects or plants, and growing vegetables. This range of activities highlights that nature-based experiences do not necessarily require special environments or costly resources; they can be embedded into children's daily lives in accessible ways. The observed association between nature activities and inquiry skills suggests that even these everyday experiences can meaningfully support children's development. Therefore, after-school programs can benefit from intentionally incorporating diverse forms of nature engagement, adapted to local contexts and available resources.

Second, after-school programs should be tailored to children's individual needs and interests. The finding that private lessons other than cram schools were associated with higher inquiry skills suggests that personalized and flexible learning opportunities may be effective in fostering these skills. This has particular implications for children from low-income backgrounds, who may face structural barriers to accessing such opportunities. Providing accessible, interest-based options within community programs could help mitigate disparities.

Third, caution is warranted when designing after-school programs that emphasize academic skill development in a highly structured manner, similar to cram schools. The results indicated that participation in cram schools was not associated with children's inquiry skills, possibly due to the standardized and predetermined nature of their curricula. After-school programs aiming to promote inquiry and exploration should therefore prioritize activities that encourage open-ended learning, collaboration, and interdisciplinary thinking.

Limitations and Future Research Directions

This study has several limitations that warrant further investigation.

First, as the study relied on cross-sectional data, causal relationships cannot be inferred. Longitudinal studies tracking changes over time, as well as experimental studies based on

time-series research and randomized controlled trials (RCTs), are necessary to validate these findings.

Second, the analysis was limited to elementary school students. Future research should include older students, such as those in junior high and high school, to examine whether the observed patterns persist across different educational stages.

Conclusion

This study explored the relationship between children's participation in after-school programs and their inquiry skills in Japan. The findings highlight the importance of nature-based activities, arts and cultural experiences, and personalized private lessons in fostering inquiry skills. Moreover, the results underscore the need to develop after-school programs that are responsive to children's diverse interests and accessible to those from all socioeconomic backgrounds.

By contributing to a deeper understanding of effective after-school learning environments, this study supports efforts to promote inquiry skills and holistic development. It also offers practical insights for policymakers and practitioners aiming to design after-school programs that meaningfully support children's cognitive and social growth.

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Appendix

Factor loadings from maximum likelihood factor analysis with Promax rotation for the 16 items of the Inquiry Skills Scale (NIYE, 2021; N = 13,813).

Item	Factor 1	Factor 2	Factor 3	Communality (h ²)
Collaborative attitude				
1. Act according to the rules	.78	-.22	.04	.46
2. Listen to others properly	.78	-.11	-.02	.49
3. Think considering the other person's point of view	.60	.03	.07	.44
4. Act in a way that does not cause trouble for others	.55	.07	-.08	.32
5. Help someone if one is in trouble	.47	.19	.05	.41
6. Do what one can do by oneself	.40	.31	-.09	.37
Proactive attitude				
7. Able to tackle difficult problems in a positive manner	-.02	.74	-.03	.51
8. Able to speak up and say what is on their mind	-.21	.62	-.02	.24
9. Willing to do things on their own without being told to do so	.18	.57	.00	.50
10. Make plans and act on their own	.11	.50	.08	.40
11. Cooperate with others in group activities	.24	.40	-.02	.35
12. Do not leave things one does not understand as they are, but rather look them up	.14	.37	.16	.34
Acquisition of knowledge and skills				
13. Interested in the life and culture of a country or region outside of Japan	-.06	.03	.70	.47
14. Interested in the politics and elections of that country or region	.04	-.05	.65	.41
15. Interested in discovering new things through experimentation and observation	-.09	.09	.61	.38
16. Read or watch the news of the day in newspapers, on the TV, or on the Internet	.11	-.07	.55	.32

Inter-factor correlations

	Factor 1	Factor 2	Factor 3
Factor 1	1.00	.71	.57
Factor 2	.71	1.00	.49
Factor 3	.57	.49	1.00

Note. Loadings < .30 are not suppressed. Factor extraction was performed using maximum likelihood estimation with Promax rotation. The scale consisted of 16 items. The reliability coefficient for the overall scale was $\alpha = .86$.