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The impact of housework participation on prosocial behavior development among junior high school students in China

Jin Zhao✉ & Huirong Tuo

This study examines the effect of housework participation on the development of prosocial behaviors among students in China. Using data from the China Education Panel Survey, a nationally representative survey of 8678 students at 221 classes in 28 counties, we employed two identification strategies (i.e., the OLS model and IV model) to overcome the endogeneity of housework participation. Our analysis reveals a significantly positive effect between housework participation and prosocial behavior development. The mechanism analysis indicated that compared to nonparticipator, students who participate in housework tend to develop a higher level of positive emotions, more parental supervision, and a closer parent-child relationship. We also find that most of these effects are more prominent for disadvantaged groups (males and left-behind). Our study underscores the need for policies and interventions aimed at promoting housework participation habits and actions to enhance students' behavior development in educational settings.

Keywords Housework participation, Prosocial behavior, Junior high school students, In China

As an important part of individual socialization, prosocial behaviors appears at an early age in human life influences their life trajectory, and is closely related to societal development[1–4]. On the one hand, some research indicates that students behavioral development influences both short-term academic achievement[5,6] and long-term educational success[7,8]. Others found that prosocial behaviors are positively associated with psychosocial adjustment among students, can reduce mental health problems such as anxiety and depression[9], and increase personal well-being[10]. On the other hand, engaging in prosocial behaviors can contribute to positive social change through, for instance, reducing discrimination, improving the situation and well-being of those in need, or fostering more sustainable personal lifestyles[11–14].

As key socialization environments for students[15], individuals acquire social skills and build relationships within their primary social unit, the family[16]. Mostly, housework participation is an integral activity part of student's life in many parts of the world[17–19]. Regarding the impact of housework participation, Goodnow and Delaney (1989) found that in addition to cultivating student's sense of responsibility, participation in housework played a significant role in student's socialization[20], for many parents, such demands as labor force involvement mean that student's housework is critical to household maintenance and family well-being[21]. Vaillant (2012), in his 20-year Grant Study in America, argued that people who had labor education experience in childhood, even simple housework experience, tended to experience more happiness in later life than those without labor education experience[22]. Several Chinese studies explored the positive impact of housework participation on cognition and non-cognition development, academic performance, and mental development of junior high school students[23–25].

However, chinese schools and parents pay too much attention to student academic achievements, while neglecting the importance of student housework participation and all-round development[26], this phenomenon is closely intertwined with the competitive nature of education systems, particularly evident among Chinese students[26]. The research conducted revealed that approximately 12% of junior high school students abstained from engaging in housework[23], while a substantial proportion ranging from 48.0 to 68.2% participated in housework less than an hour[23,27]. Furthermore, 22.6% and 17.3% of students reported an average daily housework participation time of 1–2 h and 2 h or more, respectively[23,25,27]. Notably, the percentage of male

School of Marxism, Xi'an University of Finance and Economics, No. 360 Chang'ning Street, Chang'an District, Xi'an, Shaanxi Province, China. ✉email: zhaojinceee@163.com

students refraining from housework exceeded that of their female counterparts[25], and the trend was similarly evident among urban students[23].

The Chinese government has fully recognized the significance of the all-round development of students and, in response, has enacted a comprehensive series of policies and regulations. The State Council and Ministry of Education successively issued the opinions on comprehensively strengthening labor education in the new era and labor education in universities and middle and primary schools guidelines (for trial implementation)[28]. Labor education includes family labor education and school labor education, students engage in activities such as assisting parents with houseworks and cooking, as well as participating in campus cleanup and waste management initiatives, which are all called labor education, the policies on labor education explicitly emphasize the necessity for students to engage in such educational experiences within the home.

Although there has been a wealth of research investigating the effect of housework participation on students' development, empirical studies from China exploring the relationship between housework participation and students' prosocial behavior development are limited, especially in terms of comparing those who engage in housework with those who do. Three primary shortcomings in the existing literature underscore the need for our study. Firstly, a significant portion of the literature lacks national representativeness, thus limiting the generalizability of findings. Secondly, the causal relationship between students' participation in housework and their prosocial behaviors requires a more nuanced discussion. Finally, it is imperative to explore potential mechanisms to gain a deeper understanding of how engagement in housework influences students' prosocial behaviors.

Hence, this study aims to achieve four objectives. Firstly, we aim to describe the conditions of housework participation, and prosocial behaviors. Secondly, we seek to assess the effect of housework participation on students' prosocial behavior. Thirdly, we explore the heterogeneous effect of housework participation on students' prosocial behaviors. Lastly, we endeavor to explore potential pathways through which housework participation affects students' prosocial behaviors.

Materials and methods

Study design and participants

The data used in this study were drawn from the latest publicly released wave of the China Education Panel Survey (CEPS) in the academic year 2013–2014. The CEPS, administered by the National Survey Research Center at Renmin University in China, is a nationally representative longitudinal survey for junior high school students to explore the socioeconomic determinants of students' development. It adopts a multistage stratified probability proportional to size (PPS) sampling method. First, 28 counties or districts were selected as primary sampling units. Second, four schools were randomly chosen within each selected county. Finally, 438 classes from the 7th and 9th grades were randomly selected in these schools, and 19,487 students were surveyed. Rich information was collected by interviews, including students, family, class, and school modules.

This study focuses on the second semester during the 2013–2014 school year and the first follow-up survey in the CEPS, because these two rounds of survey provide available samples with detailed housework participation and prosocial behaviors information. These survey topics are beneficial for our study to investigate the effect of housework participation on prosocial behaviors among students. The baseline survey was conducted in the second semester during the 2013–2014 school year. Students included in this study were 7th graders (10,279 students) who completed their first follow-up survey in the second semester during the 2014–2015 school year (9449 students) with a 92% follow-up rate. According to the purpose of the research, due to missing information on key variables (i.e., housework participation and prosocial behaviors), the size of the final analytical sample includes 8678 students across 221 classrooms in 112 schools. More details on the sampling, questionnaires, and other issues are available at http://ceps.ruc.edu.cn/English/Home.htm.

Measures

The independent variables and mechanism variables were measured in the baseline survey of the CEPS project, which asked students about their relevant situations in grade 7, the dependent variables were measured in the first follow-up survey, which asked the eighth graders about their prosocial behaviors in the past year. The measures of housework participation and prosocial behavior in this study have been validated in previous studies for their application in CEPS survey research[23,24,29,30].

Housework participation

Housework participation was measured using two students-reported questions about their involvement in housework per day within their family, based on literatures[23–25]. Students were asked to answer the following two questions: the first question asked, "What was the average duration, in minutes, of housework or assistance to parents that you undertook from Monday to Friday last week?" Similarly, the second question asked, "What was the average duration, in minutes, of housework or assistance to parents that you carried out over the weekend?" The data from the two questions were combined to generate a continuous variable representing the daily amount of time, in hours, students spent on housework or assistance to their parents. The total hours of housework participation are aggregated on a scale ranging from 0 to 8, with higher scores indicative of prolonged involvement in household tasks.

Our analysis focused mainly on the housework participation, measured by whether students participated in housework per day. We, therefore, defined the housework participation as a binary variable that took the value of one if students participated, and zero otherwise. Thus, our estimation of the housework participation effect applies to the average effects of engaging in housework in China.

Prosocial behavior score

The questionnaire included three self-reported items to collect data on prosocial behavior scores: "How often did you do the following things in the past year: (1) helping elders; (2) following orders and lining up; and (3) being nice and honest." There were five response options: "0 = never, 1 = seldom, 2 = sometimes, 3 = often, 4 = always." Three items in total are summed from 0 to 12, and higher scores represent higher frequencies of prosocial behavior. The Cronbach's α was 0.671. Cronbach's α is sensitive to the number of items in the scale; when it is above 0.6, it is an acceptable level of reliability[30,31].

Socio-demographic characteristics

Building upon theory and empirical studies[2,11,12,14,32–35], in all of our analyses we included a rich seft of students, parent, and family characteristics that prior research shows matter to student's prosocial behavior development. These covariates may also be confounders for our key treatment variable (housework participation). We control variables in our empirical models to avoid bias from omitted variables. Control variables included demographic and family characteristics of students in the present study, students were asked their age (years), gender (1 = male, 0 = female), whether they were boarding at school or not (1 = Yes, 0 = No), whether they were only children (1 = Yes, 0 = No), and left-behind students (1 = Yes, 0 = No). Parental information included whether or not they had senior high or higher degrees (1 = Yes, 0 = No), family economic status was at the lowest level (1 = Yes, 0 = No), and student's Hukou (1 = Rural Hukou, 0 = Urban Hukou).

Statistics analysis

This paper seeks to examine the effects of housework participation on students' prosocial behaviors in China. Firstly, we initially presented descriptive statistics concerning students and family background characteristics. Furthermore, this paper employs ordinary least squares (OLS) regressions along with a set of covariates as indicated above as a preliminary method to elucidate the relationship between housework participation and student's prosocial behaviors. This step was intended to provide a baseline understanding, serving as a reference point for subsequent analyses using more sophisticated methodologies. As a result, we first estimate the following linear equation.

$$Y_i = \beta_0 + \beta_1 Housework_i + \beta_2 X_i + \gamma_i + \epsilon_i \quad (1)$$

Where Y_i is the measure of prosocial behavior scores for students *i*; $Housework_i$ is a dummy variable indicating whether student *i* is participated in housework, then $Housework_i$ equals 1; otherwise, $Housework_i$ is 0; The vector X_i is a set of covariates at the individuals and parents levels which we introduced above. γ_i is county fixed effect and ϵ_i is a random error term. If Eq. (1) is correctly specified, the estimated coefficient on housework participation, β_1, can capture its effect on one's prosocial behavior outcomes. Here, *i* represents each of the observations.

Our empirical objective is to disentangle the specific influence of housework participation on students' prosocial behavior, we acknowledge the potential for endogeneity that could compromise the integrity of our estimates. We recognize that a straightforward OLS estimation of β_1 in Eq. (1) might be susceptible to bias due to the presence of endogenous factors. Firstly, omitted variables correlated with housework participation and students' prosocial behavior may cause problems. Seondly, we consider the possibility of reverse causality, where prosocial behavior could influence housework participation, students who exhibit prosocial behavior might be more likely to engage in housework. Our DWH (Durbin–Wu–Hausman) test showed that P value was less than 0.05 in the full sample, indicating that housework participation was indeed endogenous. To infer causation between housework participation and adolescents' problem behaviors, this paper employs the instrumental variable (IV) method to address the potential endogeneity problem. The methodology is designed to robustly estimate the impacts of housework participation, controlling for underlying biases.

It is important to discuss how we choose the IVs. Our selected instrument—the average housework participation time of students at the county level—is expected to be correlated with the independent variable (housework participation) but not with the dependent variable (prosocial behaviors), thereby serving as valid instruments for this analysis. The rationale behind this choice is straightforward: disparities in the implementation of relevant labor education policies across distinct regions lead to varied average levels of labor education acceptance within counties. This variation serves as an indicator of the varying degrees of emphasis placed on labor education at the county level, which in turn, has a direct effect on students participated in housework. Consequently, those students residing in counties with longer housework participation time are inclined to participate more actively in housework. Additionally, we assume that this instrument variable do not directly affect students' prosocial behavior devolopment. We validate our IVs by confirming a significant association with the endogenous variable and ensuring that the instruments are not weak, thus enhancing the robustness and validity of our analysis. This approach deepens our understanding of the relationship between housework participation and prosocial behavior devolopment.

We adjust standard errors for clustering at the school level in all regression models. All analyses are performed using Stata 17.0 (Stata Corp., Texas, USA).

Results

Student's housework participation and prosocial behaviors

Table 1 presents the sample descriptive statistics, including the overall sample characteristics as well as by whether students had ever participated in housework. Our sample comprised 4499 boys (51.8%) and 4179 girls (48.2%). The age range was 11 to 17years, with an average of 12.91 ± 0.85 years. In the sample, 30.9% are boarding at school, slightly less than half (44.4%) are only child, 23.2% are left-behind students, a small proportion of parents

Variables, mean (SD)	(1) Full sample	(2) Housework participation = 1	(3) Housework participation = 0	(4) T-test Difference (2)-(3) *P*-value
Dependent variables				
Prosocial behavior total scores	8.399	8.493	7.791	0.703***
	[2.283]	[2.222]	[2.562]	
Helping elders	2.142	2.195	1.798	0.396***
	[1.073]	[1.058]	[1.108]	
Following orders and lining up	3.061	3.084	2.909	0.175***
	[0.970]	[0.956]	[1.114]	
Being nice and honest	3.197	3.214	3.083	0.131***
	[0.868]	[0.845]	[1.006]	
Students characteristics				
Age (Years)	12.913	12.898	13.012	−0.114***
	[0.846]	[0.838]	[0.890]	
Male 1 = yes 0 = no	0.518	0.507	0.590	−0.083***
	[0.499]	[0.500]	[0.492]	
Boarding at school 1 = yes 0 = no	0.309	0.303	0.348	−0.045***
	[0.462]	[0.460]	[0.476]	
Only child 1 = yes 0 = no	0.448	0.443	0.486	−0.044***
	[0.497]	[0.497]	[0.500]	
Left-behind students 1 = yes 0 = no	0.232	0.229	0.247	−0.018
	[0.422]	[0.421]	[0.432]	
Family characteristics				
Father has high school education or above 1 = yes 0 = no	0.368	0.366	0.386	−0.020
	[0.482]	[0.482]	[0.487]	
Mother has high school education or above 1 = yes 0 = no	0.303	0.302	0.311	−0.009
	[0.459]	[0.459]	[0.463]	
Family economic status was at the lowest level 1 = yes 0 = no	0.209	0.216	0.171	0.045***
	[0.407]	[0.411]	[0.377]	
Rural students 1 = yes 0 = no	0.527	0.535	0.478	0.057***
	[0.499]	[0.499]	[0.500]	
Observations	8678	7522	1156	

Table 1. Summary statistics of background characteristics. The value displayed for *t*-tests are the differences in the means across the groups. ***, **, and * indicate significance at the 1, 5, and 10% critical level.

had education beyond senior high school (36.8% of mothers and 30.3% of fathers), 20.9% are family economics status is bottom, and slightly more than half (52.7%) are rural students. Notably, a significant majority (86.7%, 7522/8678) of students participated in housework, with over half (58.5%, 4401/7522) participating less than an hour, and a considerable portion (32.2%, 2421/7522) investing less than half an hour in housework (Fig. 1).

The results from the *t*-tests indicate statistically significant differences ($P < 0.001$) between the two groups for most of the variables (except for left-behind students and parental education). These differences were particularly pronounced among younger students, females, non-boarding students, more siblings, rural students and those from economically disadvantaged families (Table 1, Column 4). These substantial differences between participant and non-participant in China highlight the necessity of controlling for baseline differences when estimating the effects of housework participation on students' prosocial behaviors.

Specifically, students who participated in housework exhibited a higher of prosocial behavior total scores (Mean ± SD: 8.49 ± 2.22) compared to non-participant (Mean ± SD: 7.79 ± 2.56). Moreover, conditional on helping the elderly (Mean ± SD: 2.19 ± 1.06 vs. 1.79 ± 1.11), following orders and lining up (Mean ± SD: 3.08 ± 0.96 vs. 2.91 ± 1.11), and being nice and honest (Mean ± SD: 3.21 ± 0.84 vs. 3.08 ± 1.01), individuals who participated in housework are more likely to exhibit a higher frequency of prosocial behaviors than their counterparts without participated in housework.

Effects of the housework participation on student's prosocial behaviors

Table 2 offers a comprehensive overview of the effect of housework participation on students' prosocial behaviors. In column 1, we estimate the impact of housework participation on the overall prosocial behavior scores of students, controlling for individual and family variables. Columns 2–4 further refine our analysis by presenting the adjusted regressions to estimate the effects of housework participation on three distinct aspects of prosocial behaviors. Estimations from the all model additionally control for the full set of county fixed effects. The most important parameters are the coefficients for the variable of housework participation.

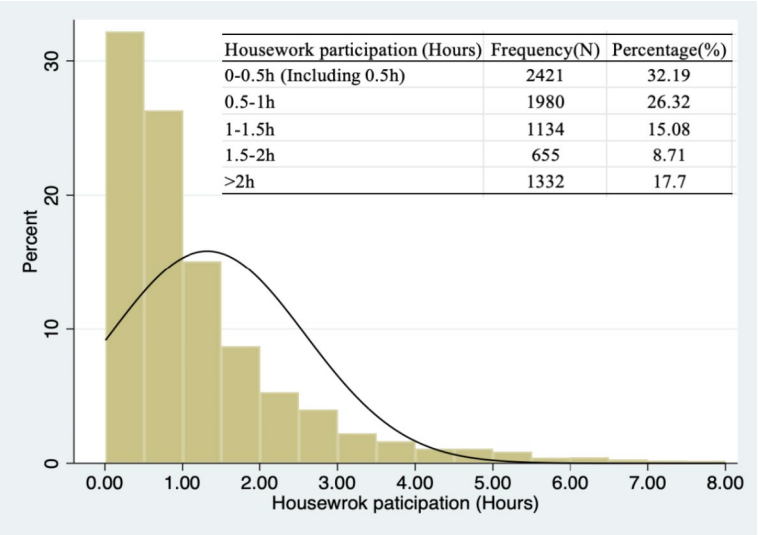

Fig. 1. Housework participation of students. $N = 7522$.

Variables	(1) Prosocial behavior total scores	(2) Helping elders	(3) Following orders and lining up	(4) Being nice and honest
Housework participation 1 = yes 0 = no	0.618***	0.352***	0.157***	0.109***
	(0.087)	(0.039)	(0.038)	(0.030)
Students characteristics				
Age (Years)	−0.095**	−0.019	−0.056***	−0.021
	(0.040)	(0.020)	(0.018)	(0.013)
Male 1 = yes 0 = no	−0.409***	−0.045	−0.159***	−0.205***
	(0.056)	(0.027)	(0.024)	(0.019)
Boarding at school 1 = yes 0 = no	0.141	0.125***	0.004	0.011
	(0.095)	(0.037)	(0.048)	(0.028)
Only child 1 = yes 0 = no	0.072	0.000	0.052*	0.019
	(0.071)	(0.028)	(0.028)	(0.028)
Leftbehid students 1 = yes 0 = no	−0.200***	−0.026	−0.077***	−0.097***
	(0.070)	(0.033)	(0.028)	(0.028)
Family characteristics				
Father has high school education or above 1 = yes 0 = no	0.234***	0.038	0.127***	0.069***
	(0.056)	(0.026)	(0.026)	(0.021)
Mother has high school education or above 1 = yes 0 = no	0.136**	0.079**	0.021	0.036
	(0.064)	(0.031)	(0.028)	(0.027)
And family economic status was at the lowest level 1 = yes 0 = no	−0.064	−0.034	−0.012	−0.017
	(0.066)	(0.028)	(0.031)	(0.025)
Rural students 1 = yes 0 = no	−0.109*	−0.034	−0.021	−0.054**
	(0.059)	(0.027)	(0.025)	(0.022)
County fixed effects	YES	YES	YES	YES
Constant	10.149***	2.316***	4.068***	3.766***
	(0.557)	(0.288)	(0.261)	(0.179)
R-squared	0.068	0.054	0.067	0.048
Observations	8678	8678	8678	8678

Table 2. The effect of housework participation on student's prosocial behavior development. Each coefficient represents a separate regression, and all regressions include student and family Characteristics. Standard errors in parentheses, clustered at the school level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

When we examine the effects of housework participation on one's prosocial behaviors, three notable findings emerge. First, the results in Column 1 of Table 2 indicate that, after accounting for sociodemographic factors, the regression result demonstrate a statistically significant and positive effect of housework participation on one's prosocial behavior ($\beta = 0.618$, $P < 0.001$). Specifically, compared with their peers didn't participate in housework, those participated in housework is 62% points more likely to be prosocial behavior. This means students who participated in housework exhibit higher frequency of prosocial behavior.

Additionally, our analysis identified several other crucial factors that shape prosocial behavior. Specifically, the estimated coefficients of the control variables are also informative. For example, younger students, females, non-left-behind individuals, those with parents possessing higher education levels, individuals from families with better economic status, and urban dwellers are more likely to inclined to demonstrate prosocial behavior ($P < 0.1$), as evident in Table 2, column 1. These results indicated that children from families with relatively advantaged backgrounds were more likely to attend preschools in China.

Third, crucially, given that our dependent variable is combined with three distinct dimensions, we conducted a further analysis by substituting the overall prosocial behavior score with its three sub-aspects, the results presented in Columns 2–4, These results were consistent with the finding shown in column l. Specifically, compared with their peers did not participate in housework, those participated in housework are 35% points more likely to be helping elders ($\beta = 0.352$, $P < 0.001$), 16% points more likely to be following orders and lining up ($\beta = 0.157$, $P < 0.001$), and 10% points more likely to be nice and honest ($\beta = 0.109$, $P < 0.001$). Notably, we observed a larger significant influence of housework participation on the aspect related to assisting the elderly.

IV-Estimates

To address potential issues of endogenous factors between housework participation and prosocial behavior, we further analyzed the impact of housework participation by using the IV approach for the average housework participation time of students at the county level to address the potential endogeneity of housework participation. Table 3 presents the IV results for prosocial behavior.

Before proceeding with the instrumental variable analysis to assess the impact of housework participation, it is crucial to evaluate the strength of our instrumental variable. The first-stage equations for housework participation are depicted in column 1 of Table 3. Overall, the estimated coefficients were statistically significant at the 1% level. Additionally, the F-test values for the first-stage regression was 19.18, significantly surpassing the commonly accepted threshold of 10. This provides substantial evidence supporting the "relevance" of our instrumental variable. Consequently, a weak instrumental variable does not pose a threat to this study.

Mostly, regression results from the IV models also suggest that the impacts of housework participation on student's prosocial behavior total scores is insignificant at the 10% level (Table 3, column 2). Notably, the coefficient estimations are larger compared to the results in Table 2. Specifically, compared with their peers did not participate in housework, those participated in housework are more likely to be helping elders ($\beta = 3.775$, $P < 0.001$), as evident in Table 3, column 3. These findings suggest that the positive correlation between housework participation and students' prosocial behavior is robust and valid.

Robustness check

We conduct several robustness checks to check if the results from our basic model are robust. The results of these robustness checks are shown in Table 4.

First, in Column 1, we replaced the independent variable with the housework participation during winter and summer holidays to check the robustness of our OLS construction (Table 4, row 1, columns 1). The reason

Variables	(1) Housework participation	(2) Prosocial behavior total scores	(3) Helping elders	(4) Following orders and lining up	(5) Being nice and honest
The average housework participation time of students at the county level	3.089***				
	(0.705)				
Housework participation		3.193*	3.775***	−1.318	0.736
		(1.839)	(0.980)	(0.950)	(0.554)
Students characteristics	Yes	YES	YES	YES	YES
Family characteristics	Yes	YES	YES	YES	YES
First-stage F test	19.183				
Constant	1.007***	5.687***	-1.739	4.880***	2.546***
	(0.404)	(2.064)	(1.135)	(1.062)	(0.638)
Observations	8678	8678	8678	8678	8678

Table 3. Instrumental variable estimates. Each coefficient represents a separate regression, and all regressions include student and family Characteristics. Standard errors in parentheses, clustered at the school level. Since this paper uses the average housework participation time of students at the county level as an instrumental variable, students in the same county will share the same instrumental variable, and controlling for county fixed effects will not yield estimable results. Therefore, this paper's instrumental variable estimation does not control for county fixed effects. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Variables	Full sample		Subgroup	
	(1) Housework participation during winter and summer holidays	(2) School fixed effects	(3) Random classes	(4) Boarding at school = 0
Prosocial behavior total scores	0.557***	0.600***	0.546***	0.622***
	(0.048)	(0.088)	(0.110)	(0.110)
Helping elders	0.289***	0.342***	0.336***	0.375***
	(0.024)	(0.039)	(0.050)	(0.052)
Following orders and lining up	0.143***	0.150***	0.119**	0.141***
	(0.021)	(0.038)	(0.046)	(0.045)
Being nice and honest	0.125***	0.108***	0.091**	0.106***
		(0.031)	(0.038)	(0.037)
Observations	8678	8678	5940	5996

Table 4. Robustness check of the effect of housework participation on student's prosocial behavior development. Each coefficient represents a separate regression, and all regressions include student and family Characteristics. Standard errors in parentheses, clustered at the school level, fixed at county level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Variables	(1) Prosocial behavior total scores	(2) Helping elders	(3) Following orders and lining up	(4) Being nice and honest
Housework participation*ages	0.060	0.003	0.026	0.030
	(0.090)	(0.039)	(0.044)	(0.035)
Housework participation*males	0.370***	0.074	0.100	0.197***
	(0.131)	(0.065)	(0.065)	(0.050)
Housework participation*boarding at school	0.069	−0.029	0.076	0.022
	(0.179)	(0.075)	(0.077)	(0.063)
Housework participation*only child	0.050	0.067	0.014	-0.031
	(0.172)	(0.067)	(0.069)	(0.070)
Housework participation*left-behind students	0.642***	0.129	0.271***	0.241***
	(0.184)	(0.096)	(0.075)	(0.068)
Housework participation*father has high school education or above	0.004	0.052	−0.017	-0.031
	(0.155)	(0.076)	(0.064)	(0.057)
Housework participation*mother has high school education or above	−0.059	0.022	−0.037	-0.045
	(0.161)	(0.074)	(0.069)	(0.064)
Housework participation*family economic status was at the lowest level	0.016	−0.048	−0.027	0.091
	(0.212)	(0.078)	(0.094)	(0.080)
Housework participation*rural students	0.092	−0.000	−0.003	0.095*
	(0.152)	(0.069)	(0.068)	(0.055)
Observations	8678	8678	8678	8678

Table 5. Heterogeneity analysis of the effect of housework participation housework participation on student's prosocial behavior development. Each coefficient represents a separate regression, and all regressions include student and family Characteristics. Standard errors in parentheses, clustered at the school level, fixed at county level. *, **, and *** indicate statistical significance at the 10%,5%,and 1% levels, respectively.

for using this independent variable was similar to our previous discussion on the whether students participated in housework per day, and the estimated coefficients of housework participation during winter and summer holidays remains virtually unchanged compared with the base model ($\beta = 0.557$, $P < 0.001$). Second, we added school dummies to control for the school unobserved shocks (Table 4, row 1, columns 2). Notably, the coefficient estimation is consistent with the results we discussed ($\beta = 0.600$, $P < 0.001$). Third, if students are not randomly assigned to classes, this may lead to bias in our results. We, therefore, used the randomly sorted sample in the regressions in columns 3, row 1. This led to a small coefficient on prosocial behavior ($\beta = 0.546$, $P < 0.001$). Last, students boarding at school in the sample were eliminated for further verification of the robustness of the results (Table 4, row 1, columns 4). The result suggests that housework participation also had a large effect on students' prosocial behavior ($\beta = 0.622$, $P < 0.001$).

Heterogeneous analysis

To examine the differential impact of housework participation on students'prosocial behaviors, we conducted a heterogeneity analysis from nine distinct perspectives, as presented in Table 5. These include age, gender,

Variables	(1) Positive emotions	(2) Parental supervision	(3) Parent–child relationship
Housework participation (1 = yes; 0 = no)	0.162***	0.369***	0.119***
	(0.034)	(0.044)	(0.014)
Students characteristics	Yes	Yes	Yes
Family characteristics	Yes	Yes	Yes
County fixed effects	Yes	Yes	Yes
Constant	0.857***	7.573	1.794***
	(0.101)	(0.293)	(0.101)
Observations	8366	8451	8631

Table 6. Mechanism of the impact of housework participation on student's prosocial behavior. Each coefficient represents a separate regression, and all regressions include student and family Characteristics. Standard errors in parentheses, clustered at the school level. These mechanism variables have some missing values. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

boarding status, only-child status, left-behind status, father's educational level (high school or above), mother's educational level (high school or above), family economic status (poorest) and Hukou status. Table 5 repeat the analyses reported in Table 2, but this time adding the interaction term of housework participation with student demographic and family characteristics, respectively.

A number of informative patterns emerge from heterogeneity analyses. As shown in Table 5, first, we found no significant evidence of heterogeneous effects across most student demographic and family characteristics, including student ages, boarding at school, only child, parental education level, family economics status, and student Hukou types, (Table 5, row1, rows 3–4, rows 6–8). Second, there appear to be certain gender differences in the effect of housework participation on students' prosocial behaviors, more specifically, compared with females, males tend to benefit more from participated in housework on their prosocial behavior outcomes (Table 5, row 2, column 1), which show that male participated in housework are 37% points higher than females in their probabilities to engage in prosocial behaviors ($\beta = 0.370$, $P < 0.001$). Moreover, estimates of gender heterogeneity in housework participation on the two other prosocial behavior indicators are insignificant (namely, helping elders and following orders and lining up), with the only one exception showing that males tend to benefit more from housework participation on their probabilities of being nice and honest ($\beta = 0.197$, $P < 0.001$) (Table 5, row 2, column 2–4).

Third, results from Table 5 further suggest significant heterogeneity in the benefits of housework participation on prosocial behavior by left-behind students. More specifically, compared with non-left-behind students, those left-behind students benefit more from housework participation (Table 5, row 5, column 1), which show that left-behind students participated in housework are 64% points higher than non-left-behind students in their probabilities to engage in prosocial behavior ($\beta = 0.642$, $P < 0.001$). Moreover, estimates of left-behind students' heterogeneity in housework participation on the two other prosocial behavior indicators are statistically significant and positive (namely, "following orders and lining up ($\beta = 0.271$, $P < 0.001$)." and "being nice and honest ($\beta = 0.241$, $P < 0.001$)."") (Table 5, row 5, columns 3–4). While this heterogeneity was not observed when we focus on the helping elders' indicators (Table 5, row 5, columns 2).

Moreover, nearly all estimates of students Hukou types heterogeneity in housework participation on the three other prosocial behavior indicators are insignificant, with the only one aspect showing that rural tend to benefit more from housework participation on their probabilities of being nice and honest ($\beta = 0.095$, $P < 0.001$) (Table 5, row 9, column 4), which show that rural students participated in housework are 10% points higher than urban students in their probabilities to engage in prosocial behaviors.

Mechanism

In this subsection, we analyze possible mechanisms to better understand how housework participation may affect students' prosocial behaviors. Columns (1)-(3) of Table 6 report mechanisms by which housework participation on students' prosocial behaviors.

On the one hand, positive emotion plays a crucial role in shaping student's prosocial behaviors. The presence of positive emotions is associated with prosocial behaviors, as previous studies indicate that students with greater positive emotions reported greater prosocial behaviors compared to their peers[36,37]. Considering this literature, we first investigated the impact of housework participation on positive emotions. Our findings show that students who participate in housework appropriately tend to foster their positive emotions development ($\beta = 0.162$, $p < 0.001$), which may explain why students who participate in housework can help their prosocial behavior development. (Columns 1 in Table 6).

On the other hand, the role of parental supervision and the dynamics of parent-child relationships is important in molding students' behaviors. Extensive research underscores the correlation between parental supervision and a positive parent-child relationship with the development of students' prosocial behaviors[32]. As a result, we estimate the influence of students' participation in housework on both parental supervision and parent-child relations (Columns 2 in Table 6). Our insights indicate that students who participate in housework tend to enhance parental supervision ($\beta = 0.369$, $p < 0.001$). Furthermore, our study reveals that housework participation fosters closer relationships between parents and children ($\beta = 0.119$, $p < 0.001$), ultimately fostering the development of prosocial behaviors among students (Columns 3 in Table 6).'

Discussion

Housework participation of Chinese students has become a focus of study in recent years. Nowadays, some studies have indicated that participation in housework could promote intelligence development, non-cognitive skill enhancement, and physical and mental health from a theoretical perspective, but fewer studies have analyzed housework participation on prosocial behavior development from an empirical perspective. To address this research gap, this study sought to investigate the effect of housework participation on students' prosocial behavior development based on representative data from the publicly released wave of the China Education Panel Survey (CEPS) in the academic year 2014–2015, specifically, this paper empirically assesses the impact of housework participation on students' positive emotion, parental supervision and parent-child relationship using IV methods. Based on a nationally representative dataset, our empirical analysis not only provides evidence on this topic but also contributes to a more comprehensive understanding of the effects of housework participation on students' prosocial behaviors.

Our findings revealed that a significant majority (86.7%) of students participated in housework, the results were consistent with the conducted research in (60–88%)[38–40]. However, there is a considerable portion 58% participating less than an hour, and nearly (32%) investing less than half an hour in housework. There exists a notable gap in the national regulation mandating a minimum of three hours of family-oriented labor activities for junior high school student[41]. American ninth-grade boys participated in housework for 5.92 h per week, while girls spend 7.56 h weekly[35,42]. This study indicates that there is still a certain gap in the level of participation in housework among junior high school students in our country compared to the United States.

The results from the t-tests indicate younger students, females, non-boarding students, more siblings, rural students and those from economically disadvantaged families are more likely participated in housework. The results were consistent with the conducted research and highlights the prevalent phenomenon of neglect of housework participation[43,44].

These results showed that housework participation has significantly positive effects on the prosocial behaviors of students. Students who participate in housework tend to develop a higher level of positive emotions, more parental supervision and better parent-child relationship, which in turn promotes better prosocial behaviors. Our instrumental variable estimation results generally validate the robustness of the above results. Thus, our findings underscore the critical role of housework participation in fostering prosocial behaviors in China.

Most importantly, we explored whether the links between students' housework participation and prosocial behaviors differed among different individual characteristics. Our heterogeneity analysis offers profound insights into the impact arising from the diverse individual characteristics. On the one hand, gender is one of the important factors affecting prosocial behavior[40,45–48], and girls were reported to be more prosocial[49]. Building on the findings above, we observe that boys tend to participate less in housework. Given boys' early behavioral self-regulation deficits compared with girls, it is possible that programs that target behavior may have greater effects on boys' outcomes than girls. That is, if they are able better equipped to engage boys and improve their behavioral skills, they may also enable boys to learn more than girls[33]. This study divides the research sample into a female and male group to verify this view. Notably, for male students, participation was associated with a higher likelihood of exhibiting prosocial behavior. This means that the boys would benefits more from engaging in housework, thereby contributing to the reduction of inequality in prosocial behavior.

On the other hand, there exists a notable association between the migration status of parents and the development of prosocial behavior in students. A study conducted by Fan et al. (2010) revealed that rural students who are left behind tend to exhibit lower levels of prosocial behavior compared to their peers who have not been left behind[50]. Considering the reduced parental supervision among left-behind students, educational programs focused on enhancing behavioral skills may yield more significant outcomes for this specific group. Most importantly, the findings reveal that the effect of housework participation is particularly pronounced among left-behind students. This suggests that participation in housework has a more profound impact on the prosocial behavior of left-behind students. This provides a new perspective for the current research on promoting the development of prosocial behavior among male students and left-behind students.

The current study holds several limitations that merit acknowledgment. Firstly, owing to data constraints, our analysis was unable to insight into the specific content of housework participation, more rigorous explorations are needed to improve our understanding of the research findings. Future studies with more detailed data can shed more light on these issues. Secondly, there exists a potential for self-reporting bias to have influenced our findings, as housework participation was measured through self-reported responses. Third, the data utilized in this study was collected in 2014, which may limit its applicability to contemporary contexts. Future research employing updated datasets with enhanced granularity and comprehensiveness may yield more refined and robust estimates. Lastly, although we have employed the OLS and IV models to address the endogeneity in the housework participation, respectively, still, we are unable to purge out all the potential unobserved confounders. The relationships of housework participation and students' prosocial behavior outcomes are still worth further explorations with a more robust identification strategy.

Notwithstanding these limitations, our study makes some significant contributions by offering a comprehensive analysis of the relationship between housework participation and prosocial behavior among students. Importantly, by emphasizing the linear relationship between housework participation and prosocial behavior, we underscore the advantageous effects of housework participation on prosocial behavior, particularly in developing countries where educational pressures are often pronounced. The concept of labor education and student involvement in labor activities, particularly participating in housework should be consistently emphasized and advocated.

From a policy perspective, this paper suggests that prioritizing student's housework participation and behavior development is essential for fostering their overall well-being, it is necessary to give more attention to the housework participation of students. Integrate the education of labor concepts and labor spirit throughout

the entire process of talent cultivation, and across all aspects of family, school, and society. At the family level, first, parents should avoid passing down the traditional gender role concept of "men working outside and women managing the home" to their children. They should actively promote gender equality within the family and set examples of gender roles for their children's participation in housework. Second, parents need to recognize that a reasonable distribution of housewrok has a positive impact on boys, thus ensuring a balance in the time spent on housewrok between boys and girls.

At the school level, we propose the following enhancements: firstly, the introduction of comprehensive policies to encourage students in two key areas: (1) to engage in daily housework such as cleaning, cooking, and home beautification, which are essential for cultivating self-care skills and habits, and for fostering a sense of family responsibility; (2) to participate regularly in the cleaning and beautification of designated school areas, as well as in service-oriented activities like assisting the disabled and respecting the elderly, thereby instilling a sense of responsibility towards the school and community, and an awareness of social ethics. Secondly, the incorporation of housework participation as a component of homework, complete with an assessment and incentive system, to nurture good living habits among students. Thirdly, a focus on providing adequate support to girls and students from underprivileged backgrounds or those with many siblings, assisting them in managing housework effectively. Lastly, strengthening communication between school and home, and offering guidance to families to instill a sense of gender equality and to provide direction on family labor education for their children.

Data availability

Detailed information about the CEPS survey can be retrieved from the CEPS website (Available at http://ceps.ruc.edu.cn/English/Home.htm).

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Author contributions

J.Z. contributed to the study design, data analysis, manuscript draft, and H.T. contributed to the data cleaning, supplementary analysis, and critical revisions. All authors have read and approved the manuscript.

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Declarations

Competing interests

The authors declare no competing interests.

Additional information

Correspondence and requests for materials should be addressed to J.Z.