Dormitory management and boarding students in China's rural primary schools

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Abstract

Purpose – The purpose of this paper is to explore whether an in-service life teacher training program can improve boarding students' health, behavior, and academic performance.

Design/methodology/approach – The authors conducted a cluster-randomized controlled trial to measure the effect of life teacher training on student health, behavior, and academic performance among 839 boarding students in ten central primary boarding schools in Shaanxi. And the authors also tried to identify why or why not life teacher training works. Both descriptive and multivariate analysis are used in this paper.

Findings – The authors find significant improvements in health and behavior. Specifically, compared to boarding students in control schools, 15 percent fewer students in treatment schools reported feeling cold while sleeping at night. The results also showed that student tardiness and misbehaviors after class declined significantly by 18 and 78 percent, respectively. However, the in-service life teacher training program had no measurable impact on boarding students' BMI-for-age *Z*-score, number of misbehaviors in class, and academic performance. The analysis suggests that improved communication between life teachers and students might be one mechanism behind these results.

Originality/value – This is the first empirical work which explored how to improve the welfare of boarding students via their life teachers. Because of the sudden increase in boarding students in rural China, it is almost certain that school personnel lack experience in managing boarding students. As such, one promising approach to improving student outcomes might be in-service training for life teachers.

Keywords Primary school, Rural China, Boarding, Life teacher training programme

Paper type Research paper

Introduction

Because of the expansive geography and low population densities in many Western provinces of China, there have always been children that have had to board while going to public schools, including elementary schools (Wang, 2011). Recent research has shown that boarding students tend to have poorer health and more behavior problems than their non-boarding peers (Pang and Han, 2005; Xiong, 2007; Ye and Pan, 2008; Luo *et al.*, 2009). Moreover, boarding students in poor, rural areas of China experience reduced academic performance relative to their non-boarding peers (Mo *et al.*, 2013). Such findings on boarding students in China are not surprising, as studies of the

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impacts of boarding on poor children outside of China also yield similar results (Malcolm, 1970; Adams, 2007; Moswela, 2006).

Several reasons may underlie this problem. First, we know that boarding students tend to be from relatively poor families living in remote villages (Luo *et al.*, 2009). Because of this, boarding students may be undernourished and performing less well than their non-boarding counterparts even prior to arriving at school. However, once in school, they are not getting much help. Dormitory and student canteen facilities in boarding schools remain under-equipped and services are far below that needed for student development (Pang and Han, 2005; Lu, 2009; Wang and Li, 2009). Because school canteens offer food that is lacking in certain essential nutrients (such as iron), boarding students in Western China suffer from higher rates of anemia than their non-boarding peers. Anemia, in turn, reduces academic performance (Luo *et al.*, 2009).

Aside from poor facilities and nutrition, one other possible reason for poor performance among boarding students is that school personnel are poorly trained in boarding school management and lack sufficient time to provide care and support to boarding students – especially for ones as young as those in elementary school. In fact, it is not supposed to be like this. In China, the primary staff members that oversee the lives of boarding students are called *shenghuo laoshi* or life teachers. In theory, the responsibilities of the life teacher include dormitory management, boarding students' safety, logistics, psychological health, and physical health (Ministry of Education (MoE), 2006). In other words, the life teachers are supposed to be taking care of boarding students outside of the classroom. According to policy, life teachers are supposed to be trained on how to discipline and communicate effectively with students (MoE, 2006). They should be able to inculcate good sleeping and health habits among students and recognize common student illnesses (MoE, 2006).

Unfortunately, at present, life teachers – especially in poor rural areas – barely receive any training and are often overwhelmed with other duties. Zai and Xuan (2011) describe how life teachers are hardly ever trained. During our in-the-field interviews over the period of time that preceded this study, we did not find a single teacher that had received formal training in the skills needed to competently carry out their life teacher activities. Exacerbating the problem, life teachers are frequently overwhelmed with other responsibilities. A canvas survey conducted by the Rural Education Action Project found that only 5 percent of the boarding schools have full-time life teachers in Shaanxi province (Luo *et al.*, 2009). In fact, nearly all life teachers work part-time, taking on additional responsibilities as homeroom teachers, classroom teachers and even workers in the school canteens (Su, 2007; Ye and Pan, 2008).

While this has always been a problem in rural China, the problem is being magnified greatly by the fact that, in recent years, more and more students are beginning to live in elementary schools as boarding students – especially in poor, rural areas of China. In the late 1990s, China's State Council launched the Rural Primary School Merger Program. The overall goal of the program was to utilize scarce educational resources to more efficiently improve the quality of primary school education for poor, rural students (State Council, 2001). A key aspect of the program was to close down remote village schools and merge them into centralized and larger schools, often selected towns and in the county seat (Liu *et al.*, 2010). As a result of the merger program, more than 20,000 rural primary schools were closed down each year between 2001 and 2005 (National Bureau of Statistics of China, 2001, 2010). Because the program merged remote village schools into centralized town or county schools, many additional students had to begin boarding at their new schools to avoid long commutes

(Liu *et al.*, 2010). By 2006, 30 million primary school and junior high school students were boarding across China. Boarding students accounted for more than 10 percent of all primary students in Western China, including all of those students in Western China's cities and better off rural areas (Zhang, 2008). In many poor rural areas, up to 50 percent or more of primary students are boarding (Zhang, 2005).

Given the discussion above about boarding students (namely, they are currently are less healthy, frequently are misbehaving, and often demonstrate reduced academic performance), compounded by the fact that the recent merger program has sharply increased the number of boarding students, a critical policy question arises: what are ways to improve the outcomes of boarding students? Indeed, a number of studies have evaluated the impact of various measures that can improve the health, behavior and academic performance of boarding students. For example, Luo *et al.* (2012) evaluate a nutritional supplement program that increased hemoglobin levels by 2.21 g/L and improved student scores on standardized exams by 0.2 standard deviations. Xu *et al.* (2000) illustrate that health education increases the likelihood that students practice recommended health behaviors (such as brushing teeth) from 29.6 to 43.8 percent. Lai *et al.* (2013) show that a computer assisted learning program in rural boarding schools improves academic performance by at least 0.12 standard deviations.

Surprisingly, despite the overwhelming importance of life teachers in ensuring student health, good behavior, and academic performance (especially in the case of elementary school-aged students), to our knowledge, no study has explored measures, activities, or investments that are able to improve the welfare of boarding students via their life teachers. Because of the sudden increase in boarding students as a result of the merger program, it is almost certain that school personnel lack experience in managing boarding students. As such, one promising approach to improving student outcomes might be in-service training for life teachers, especially given the complexity of tasks that they are expected to perform and the absence of training prior to being assigned to the job.

The overall goal of this paper is to evaluate the impact of a life teacher training program on the health, behavior, and academic performance of boarding students in poor, rural areas of China. Based on data from a cluster-randomized controlled field experiment in ten rural Chinese primary boarding schools in Shaanxi province, we present three analytic exercises that seek to help us achieve our overall research aim. First, we analyze to what extent life teachers are currently equipped or trained to manage students in boarding schools. Second, we compare the health, behavior, and academic performance of boarding students in schools with life teacher training programs with boarding students in schools without such programs, examining both the directions and magnitudes of the impacts on a number of outcomes. Third, we examine one mechanism (better communication between students and life teachers) that may have led to these outcomes, explore whether poor students selectively benefitted, and conduct a series of robustness checks.

As with any empirical study, we face several limitations. The most important limitation is that our data set is restricted to ten primary schools. The statistical power of analysis is necessarily low and the results (especially those in which we do not find statistical significance) must be interpreted with caution.

Second, although we look at a number of different outcomes, we realize that boarding at school is a holistic experience that may affect the values, safety, self-esteem, and countless other outcomes of students. In this study we are only able to focus on three: health, behavior, and academic performance. Moreover, among these

three areas of outcomes, the exact measures are limited, too. Despite these limitations, especially as the merger program continues to accelerate and more students begin to board at school, we believe that this study does present useful empirical evidence that suggests new approaches and policy directions to improve education in rural China. We also hope it stimulates more research in this area.

The rest of the paper is organized as follows: Section 2 describes the sampling and experimental procedures that we implemented. Section 3 describes the methods used in this study by introducing the intervention arms, data collection procedures, and analytical approach used to analyze the data. Section 4 presents results on the effectiveness of training life teachers on student health, behavior, and academic performance. Section 5 concludes with a discussion of the results and possibilities for future research.

Methods

We conducted a cluster-randomized controlled trial to measure the effect of life teacher training on student health, behavior, and academic performance among 768 boarding students in ten central primary boarding schools in Shaanxi. Shaanxi Province was chosen for three reasons. First, on a practical level, Shaanxi has experienced a high rate of primary school mergers (Ministry of Education, 2008), such that a large number of students are boarding students. Second, Shaanxi has a large number of poor counties that we can sample. In 2007, the rural per capita net income in Shaanxi was 2,645 yuan (420 dollars), well under the 20th percentile when compared to other provinces. The rural per capita net income was also far below the national level of 4,140 yuan (National Bureau of Statistics of China, 2008). In fact, 8 percent of nationally designated poverty counties are located in Shaanxi. Third, the ten prefectures of Shaanxi can be broadly categorized to three geographic regions: Southern Shaanxi is located in a mountainous, subtropical area. Northern Shaanxi is centered on the Loess Plateau and borders the Ordos Desert. Central Shaanxi is best off in terms of income per capita when compared to Southern and Northern Shaanxi. Each region is different and represents a different area of Western China, thus increasing the external validity of our sample.

In choosing our sample we obtained a list of all nationally designated poor counties in each of the three regions. There were a total of 50 poor counties. Geographically, 20 counties were located in North Shaanxi, 11 counties were located in Central Shaanxi, and 19 counties were located in Southern Shaanxi. We then randomly selected ten counties from this list: a total of four counties in Southern Shaanxi, four counties in Northern Shaanxi and two counties in Central Shaanxi.

Within each sample county, the survey team obtained a list of all townships. The townships were then ranked by per capita gross value of industrial output (GVIO), a variable that allows researchers to more accurately divide the sample into wealth terciles (Rozelle, 1996). After the townships were ranked, the enumeration team randomly selected three townships from each county: one from the richest one-third of the townships; one from the poorest one-third of the townships; and one from the middle-income townships. In these 30 sample townships, we then used official records to assemble a list of all primary schools: a total of 144 primary schools.

Because our randomized controlled trial seeks to understand the effect of life teacher training on boarding students, we proceeded to draw on a combination of official records and a canvas survey to identify all schools with boarding students. Moreover, because we were interested in central schools (i.e. those receiving new

boarding students), we excluded any schools reporting that they would be merged into other schools in the next year. We identified a total of 25 central boarding schools among the original 144 schools.

Among these 25 central primary boarding schools, only ten were randomly chosen to be included in the RCT and receive a baseline survey because of resource constraints. The distribution of the sample schools are marked on the map (Figure 1). Table I represents the basic characteristics of the ten sample schools and life teachers.

Within the ten schools in our sample, all students in grades 1 through 5 (2294 students in total) who attended the school during the 2007-2008 school year received a baseline survey. However, because our focus was on boarding students only, we ultimately enrolled 768 students who were confirmed to be boarding students at the start of the academic year (September 2008). There was no attrition, as all 768 students were surveyed at the end of the academic year (June 2009).

Despite our small sample size, our use of stratified random sampling at the regional, county, and township level ensure that our sample is representative of boarding schools in poor counties of Shaanxi. Indeed, there are no systematic differences among observable characteristics between the ten sample schools, the remaining 15 schools that were not part of the study, and 52 schools from a separate study of schools in Shaanxi (Table AI).

Following the baseline survey, our research team randomly assigned five schools to receive life teacher training (treatment group) and five schools to a control group. Within each treatment school, the principal told us who the life teacher in the school was and all life teachers were asked (and agreed) to participate in a life teacher training course. Figure 2 summarizes the flow of participants through each stage of the study, as well as the project timeline.

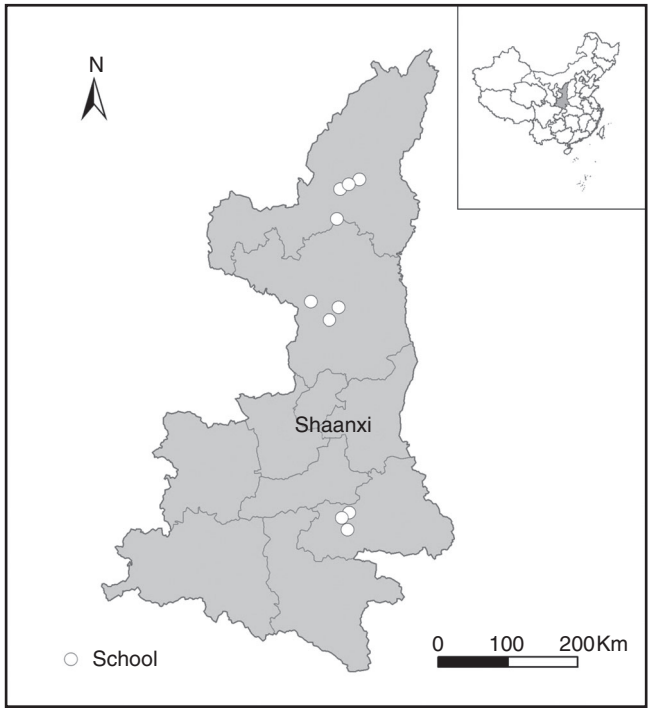

Figure 1.
Distribution of sample schools

Variable	Mean	SD	Min	Max
School characteristics				
(1) Number of boarding students	147	102	48	404
(2) Areas of dorms, m^2	377	296	80	1000
(3) Whether warming facilities are available in dorms, 1 = yes	0.90	0.32	0	1
(4) Number of life teachers (including full-time and part-time life teachers)	4.10	3.31	0	9
(5) Of which, ratio of part-time life teachers	0.74	0.42	0	1
Life teacher characteristics				
(6) Male, 1 = yes	0.65	0.49	0	1
(7) Age, year	36.19	10.08	23	56
(8) Has a diploma of college or above, 1 = yes	0.69	0.47	0	1
(9) Years of being a life teacher, year	4.23	3.35	0.4	12
(10) Ever participated in physiological health training, 1 = yes	0.08	0.27	0	1
(11) Has a professional qualification of physiological health, 1 = yes	0.00	0.00	0	0
(12) Ever participated in psychological health training, 1 = yes	0.19	0.40	0	1
(13) Has a professional qualification of psychological health, 1 = yes	0.09	0.29	0	1

Source: Authors' survey

Table I.
Characteristics of sample schools and life teachers at baseline survey

To confirm that our randomization was successful, we checked to see if students were balanced on observable characteristics. Table II shows that, while treatment and control students were identical in many observable characteristics, they differed in terms of the incidence of diarrhea, area of dorms (significant at the 1 percent level), as well as home value, grades in math class, mother's education, and the number of siblings (significant at the 10 percent level).

To remedy the potential issues reflected by the imbalance of factors, we first make sure to control in our regressions any of the observable variables that are imbalanced (like because of our small sample size). Furthermore, because there may be unobservable variables that we are unable to control, we employ the differenced form of dependent variables (i.e. looking at changes between endline and baseline measures for the same students). By doing so, we are able to better account for imbalances in our sample.

Finally, to avoid possible biases or the Hawthorne Effect, during the baseline survey all study participants and enumerators were blind to which schools belonged to which arms of the study. Control students, teachers and principals did not know that they were being used as controls. Finally, if at any time during the study our research team visited a treatment school, we also visited a control school for the same amount of time.

The intervention: life teacher training for the treatment group

Our experiment split schools into treatment and control groups. The treatment schools received life teacher training in the form of an intensive two-week training program that lasted from July 20, 2008 to July 30, 2008. The overall goal of the program was to increase the knowledge and skills of life teachers on/about the management of boarding students. The control schools did not receive the life teacher training.

In-service teacher training is sometimes included as an important component in social development programs to improve teacher quality and student educational performance in developing countries. In developing countries, pre-service teacher preparation (i.e. graduating from college with a teaching credential) is not always

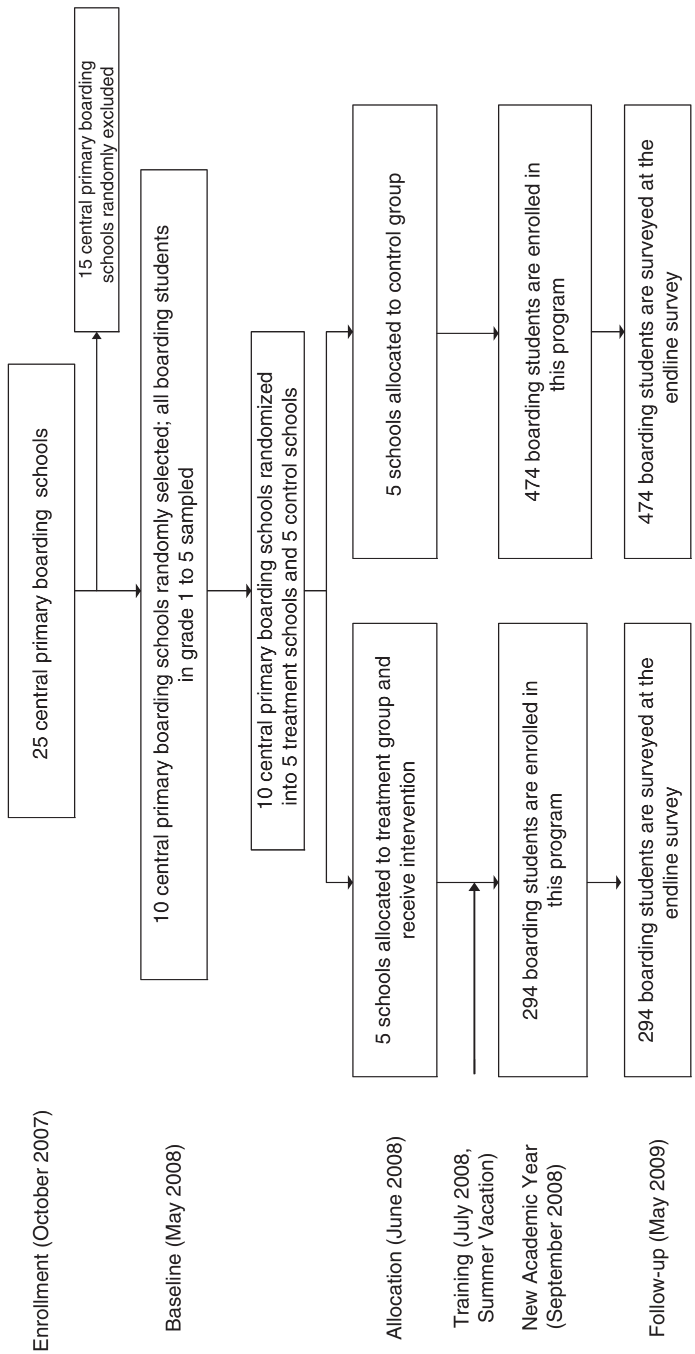

Figure 2.
Trial profile

Variables	Treatment	Control	Difference	*p*-value
Number of observations	474	294		
Health				
Ever feel cold while sleeping at night, 1 = yes	0.74	0.67	0.07	0.41
Incidence of diarrhea, 1 = yes	0.03	0.01	0.02***	0.00
Z-score of BMI	−0.61	−0.56	0.05	0.66
Behaviors				
Number of being later or leave early for class	0.15	0.03	0.13	0.15
Number of misbehaviors at class[a]	5.23	3.72	1.52	0.69
Number of misbehaviors after class[b]	1.05	0.69	0.36	0.48
Academic performance				
Z-score of math test[c]	0.24	−0.47	0.71*	0.07
Student characteristics				
Age, year	11.72	12.13	−0.41	0.27
Male, 1 = yes	0.54	0.52	0.02	0.56
Family characteristics				
Mom's education, 1 = illiteracy	0.21	0.35	−0.14*	0.06
His/her mom ever migrated out for work for more than one year, 1 = yes	0.05	0.03	0.01	0.47
Number of siblings, person	1.81	2.40	−0.59*	0.09
His/her family's house value is less than 5000 yuan, 1 = yes	0.27	0.41	−0.14**	0.01
Distances from home to school, km	6.77	8.90	−2.13	0.20
School characteristics				
Number of boarding students	110.16	262.70	−152.53*	0.06
Areas of dorms, m^2	211.46	648.94	−437.47***	0.01
Number of life teachers (including full-time and part-time life teachers)	5.64	4.70	0.93	0.71
Ratio of part-time life teachers among all life teachers	0.88	0.73	0.14	0.50

Table II.
Comparison of boarding students' characteristics between treatment group and control group in baseline survey

Notes: [a]The misbehaviors at class include excessive fidgeting, excessive talking in class or not paying attention; [b]the misbehaviors after class include bickering, fighting, and bulling; [c]the *Z*-score is the *Z*-score of average score of boarding student math test scores in the last two semesters. *,**,***Significant at 10, 5, 1 percent level, respectively
Source: Authors' survey

required. As a consequence, in-service training is often the only preparation teachers receive (Zhang *et al.*, 2013). Although, to our knowledge, in-service training for life teachers has not been implemented in other countries, in-service training has a long track record as a way for governments to improve the performance of teachers and students (Parsad *et al.*, 2001; Angrist and Lavy, 2001).

The training materials for the life teacher training were created in cooperation with a number of different professors in education, psychology, and health from Northwest (Xibei) University of Xi'an and Xi'an Jiaotong University's School of Medicine. The professors (henceforth called the teaching team) worked intensively with the research team to design a curriculum (textbooks, exercise brochures, and teaching plans) appropriate to the needs of the life teachers in rural primary boarding schools. The teaching team also consulted life teachers in primary boarding schools (in parts of China outside of the research area) for feedback and comments before finalizing the curriculum.

The training focussed on dorm management, psychological education and health education. All of the specific units were carefully and systematically designed

according to the needs of the life teachers. Specifically, the training course consisted of ten modules, reflecting the needs of boarding students: boarding registration, morning hygiene, dining, morning management, nap time, afternoon management, afterschool play/activities, after dinner/before bed activities, sleeping, and health care.

Shortly after the baseline survey, life teachers in the treatment schools received an invitation letter to join the training program. They were asked to gather at a hotel conference room for a ten-day training in dorm management, psychological education and health education. All (100 percent) of life teachers that received the invitation attended the training program.

The teacher training sessions ran from 8:30 a.m. to 6 p.m. (with two hours of lunch break at noon) in July 2008. A professor in psychology, who also led the development of the curriculum, was responsible for overseeing the implementation of the curriculum. Four psychology graduate students who were also involved in the development of the curriculum also assisted her. Specifically, the main responsibility of the professor was to deliver knowledge of dorm management, student psychology, and student health to life teachers. The graduate students also led life teachers in exercises to understand how to translate what they learned in theory to practice. A volunteer was also responsible to collect daily feedback on the training from trainees (life teachers) and report to the teaching team and the research team.

Monetary incentives were also used to increase compliance during the training. All expenditures in room and board, transportation, and course materials for the training were covered by the research team. Conditional on full attendance in all training sessions, each trainee would be offered a two-day free sightseeing tour in Xi'an City after the end of the training program. One of graduate students recorded attendance at each session, including whether a trainee arrived late or left the session early. The time sheet showed that no one missed any course. Note that, because the training was held during the summer vacation, no additional stipend was given to the trainees.

In March 2009 (at the beginning of the second semester), the life teachers were invited again to attend to a one-week refresher course. The training team was identical to the first round of training. The training material was also the same (although the delivery of the material was abbreviated to fit into the shorter training period). In addition to covering all expenditures in room and board, transportation, and course materials, this time each trainee received 300 yuan as compensation for his/her time at the end of the training program (since they were attending during the school year). This amount is equivalent to one-third of the typical monthly wage of a full time life teacher. The assistant-trainers deducted 60 yuan each time a trainee missed a session and deducted 30 yuan each time a trainee arrived late or left the session early.

Data collection

Our enumeration team visited each of the 10 central primary boarding schools in Shaanxi and undertook a two-part survey effort: a baseline survey, conducted before the announcement of the program; and an endline/evaluation survey, which was conducted one year after the first part of the intervention. During both surveys, survey instruments were administered to students, homeroom teachers, life teachers, and principals of the schools. The objective of the surveys was to collect information on health, behavior and academic performance outcomes as well as a set of control variables (to increase the precision of the analysis).

Student survey. At the student level, the survey instrument was composed of three blocks. The first block was used to collect information on boarding. Specifically, we

asked students whether he/she was boarding at school during the semester, and if so, whether they ever felt cold at night when they were sleeping. These variables are used to identify the boarding status and health of each student. In the second block, students were asked to answer a series of questions to measure the quality of communication between students and life teachers, including "What do you think about the relationship between you and your life teacher?" "Does the life teacher know who your friends are?" "Will you look for help from your life teacher when you feel unhappy?" We use this information ultimately to explore the mechanism behind how the life teacher training program worked. In the third block, enumerators asked students to provide basic information about themselves and their families, including age and gender, their parents' migration status, their parents' education level, the number of their siblings, the distance from home to school, and the value of their families' house. These variables served as control variables in the analysis to increase the precision of estimation.

Homeroom teacher's dairy. Another source of information about students came from dairies that were kept by the teachers of each student. In particular, we asked homeroom teachers (*banzhuren*) to keep weekly diaries on all students on a student-by-student basis. The dairies documented things such as bad behavior (misbehavior during class including talking excessively in class and not paying attention; misbehavior after class including fighting and bullying in the school yard), absences from school (being late for school, leaving early from class; missing class altogether) and health problems (whether the student had diarrhea or not). Because this was such an intense exercise, we only asked the homeroom teachers to keep the dairies for four weeks during the baseline survey (prior to the time that the first session of the life teacher training was given). Exactly a year later (after the two life teacher training sessions) we asked the homeroom teachers to keep the diaries one more time (again, for four weeks). These data are used to measure the behavior and health of each boarding student. We took many measures to control the quality of data collection during these times, such as calling homeroom teachers every week to remind them to record student behaviors.

Nursing team's measurement. With the assistance of nursing teams from Xi'an Jiaotong University's School of Medicine, we measured students' height and weights. A team of four nurses visited each of the sample schools. To collect the anthropometric data, the nursing teams used high quality sets of equipment approved by the Chinese Center for Disease Control for measuring the physical development of sample students. Age information was taken from the birth records that are part of each student's school matriculation folder. These data are primarily used to create the body mass index (BMI)-for-age *Z*-score as one of the measures of health outcomes in our analysis[1].

Life teacher survey. We also collected information about life teachers in the school. Specifically, we surveyed all life teachers in sample schools. In addition to collecting demographics of each life teacher, we were interested in understanding their working experience, training, and qualifications as life teachers. These data were used to help us understand the nature of life teachers in rural boarding schools.

Principal survey. At the school level, we conducted a two-hour sit-down survey with the principal of each sample school. The main focus of the survey was targeted at collecting information about each school's boarding facilities and services. These were mainly used to help us understand the nature of boarding schools. We also supplemented the information contained in the principal questionnaire with records from the school. The main purpose of this data collection effort was to collect the

academic records of each student in the past two semesters. With these data, we measure the academic performance of boarding students with math test scores. We chose to use math test scores as a reflection of students' academic performance because this practice is well accepted in the literature (Rivkin *et al.*, 2005; Banerjee *et al.*, 2007; Yi *et al.*, 2012). Moreover, although scores on other subjects would be useful to gather, schools only followed the same record-keeping conventions for math test scores.

Analytical approach

We used both unadjusted and adjusted ordinary least squares (OLS) regression analysis to estimate how the academic and non-academic outcomes were changed by the life teacher training program. Our unadjusted analysis regressed changes in the student outcome variables on a dummy variable of the treatment status. This method (also called difference-in-difference method) can eliminate the time-constant unobserved effect of unobservable or observable confounding variables by differencing over time. Furthermore, we used adjusted analysis as well to control for some accidental differences after randomization between the treatment group and control group and improve precision. In all regressions, we account for the clustered nature of our sample by reporting adjusted standard errors clustered at the school level.

The models are presented in order of increasing comprehensiveness.

First, the unadjusted model is:

$$\Delta Y_{is} = \beta_0 + \beta_1 T_i + \varepsilon_{is} \quad (1)$$

where ΔY_{is} is the change in the outcome variables that we are interested in evaluating. Specifically, the variable ΔY_{is} represents the health, behavior, or academic performance for student i in school s. The dummy variable, T_i, is variable for the students attending a school assigned to the treatment group (equals one for the treatment group and zero for the control group), and ε_{is} is a random disturbance term (clustered at school level). By this construction, β_1 is equal to the unconditional difference in the change in the outcome between the treatment and control groups over the program period. In other words, β_1 measures how the treatment group changed in the outcome levels during the program period relative to the control group.

Each $\Delta Y_{is,}$ or the change in outcome variable (health, behavior, or academic performance) is actually represented by several different variables. For outcomes relating to health, we have three measurements: whether a boarding students reported feeling cold at night sleeping; the incidence of diarrhea recorded by homeroom teachers; and BMI-for-age *Z*-score collected by the nursing teams. For the behavioral outcomes, we have three variables: the number of times a student was tardy or left early from class; the number of times that a student misbehaved in class (defined as excessive fidgeting, excessive talking in class or not paying attention); and the number of times that a student misbehaved after class (defined as bickering, fighting, or bullying). The academic outcome was measured by *Z*-score of the average score of each student's math test score over the two semesters of the RCT.

We also used three variables to measure the quality of communication between life teachers and students as a way to understand one of the mechanisms of how the life teacher training program worked. The three variables are reported by boarding students: whether the student felt he/she had a good relationship with the life teacher; whether the life teacher knew most of the students' friends; and whether the student would look for help from life teachers if unhappy.

To improve the efficiency of the estimation, we built on the unadjusted model in Equation (1) by including a set of control variables (X_{isBase}):

$$\Delta Y_{is} = \beta_0 + \beta_1 T_i + \delta' X_{isBase} + \varepsilon_{is} \quad (2)$$

where all the variables and parameters are the same as those in Equation (1), except for the addition of X_{isBase}. When the variables in the X matrix are included, we control for the student's and his/her family's characteristics in the baseline survey to increase the precision of analysis, including each student's age, gender, number of siblings, migration status of parents, distance from school, and assets of students. A series of school characteristics are also included in the X matrix to control for differences in school facilities and resources. These are, specifically, total number of boarding students, area of dorms in square meters, number of life teachers at the school, and ratio of part-time to full-time life teachers

Results

We present both the descriptive and multivariate results in the following three parts. First, we report on the current levels of training and preparation among life teachers. Second, we show the impact of the life teacher training intervention on student outcomes of health, behavior, and academic outcomes. Third, we try to understand the possible mechanisms by which the life teacher training program is affecting students, examine whether poor students are benefitting, and conduct robustness checks.

The boarding facilities of the schools and training of life teachers

As detailed in the existing literature, the facilities are poor in boarding schools. On average, the dorm area used by each student is 2.56 m^2 (= 377/147, Table I, rows 1 and 2). Given that the average use area of a dorm room by each student does not meet the standard of 3 m^2 required by Ministry of Education (2011), this is both dangerous and unhealthy for students. More troubling, in an area where nightly temperatures fall below freezing for over half the year, one of the ten centralized primary schools reported not having any heating facilities (Table I, row 3).

Although facilities are poor, well-trained and experienced life teachers can work around such limitations. On average, the participating teachers were 36 year old. In total 65 percent of them were male (Table I, column 1, rows 6 and 7). The hope is that they might be well equipped and trained to manage boarding students.

Unfortunately, in almost every dimension they come up short. Each school had 4.1 life teachers, that is to say, each life teacher would have to take care of 36 boarding students (= 147/4.1, Table I, column 1, rows 1 and 4). Even worse, 74 per cent of life teachers work part-time (Table I, row 5). Only 69 per cent of them had a college diploma (Table I, row 8). The average experience of being a life teacher was only 4.23 years (Table I, row 9). Only 8 percent of them reported that they ever participated in trainings on health (Table I, row 10) and only 19 per cent of them ever participated in training on student psychology (Table I, row 12). Furthermore, not one had a professional qualification (required among life teachers in rich urban areas) in physiological health (Table I, row 11) and only 9 percent of them had a professional qualification in psychological health (Table I, row 13).

In sum, centralized boarding schools in poor areas of China are not equipped and their staff not qualified to ensure the proper development of students in terms of

behavior, health, and academic performance. We now turn to consider whether a life teacher training program can rectify some of these problems.

The impact of a life teacher training program

As mentioned, we are interested in the impact of a teacher training program on three kinds of student outcome variables: health, behavior, and academic performance. We begin by exploring results from the unadjusted model (without including control variables) before turning to the multivariate model.

Unadjusted model. The life teacher training program appears to have moderate benefits for the health of students. Specifically, it improves the sleep quality of students and reduces the incidence of diarrhea at school (Table III, columns 1 and 3), but it has no effect on the BMI-for-age *Z*-score of students (Table III, column 5). When comparing boarding students in schools with the life teacher training program with boarding students in control schools, treatment students are on average 15 percentage points less likely to report feeling cold while sleeping at night (significant at the 1 percent level) and 2 percentage points less likely to experience diarrhea at school (significant at the 5 percent level). Although, on average, boarding students in schools with life teacher training demonstrated slight increases (0.05) in their BMI-for-age *Z*-score, this finding is not significant. One possible explanation for these results is that sleeping quality and the incidence of diarrhea are closely related to dorm management and can be improved by life teacher's efforts in the short run. However, the BMI-for-age *Z*-score is heavily dependent on the provision of other factors such as nutrition, which is usually out of the control of life teachers (or changing this measure takes longer than the period of our study).

Student behavior also improves as a result of the life teacher training program. Student behavior is measured by three indices: the incidences of student tardiness (arriving late or leaving early from class), the number of student disruptions in class (defined as fidgeting, talking in class, not paying attention) and the number of disciplinary problems out of class (defined as bickering, fighting, and bullying in class). On average, the program improved student punctuality in arriving and leaving on time to class, reducing incidences of student tardiness by 0.18 (Table IV, column 1). This result is significant at the 10 percent level. The program also improved student behavior outside of the classroom, reducing the number of disciplinary problems by 0.87, a result significant at the 5 percent level (Table IV, column 5). However, the program seems to have no effect on behavior in class (Table IV, column 3). Of course, given that the program was designed to train life teachers on how to manage the daily life and behavior of boarding students, the fact that in-class behavior was not altered in the short run perhaps is not surprising.

A third outcome of interest was student academic performance. In addition to improving health and behavioral outcomes of students, the life teacher training program might have improved boarding students' ability to learn. However, the results indicate that the life teacher training program had no measurable effect on boarding students' academic performance (Table V, column 1). Compared to students in control schools, boarding students in schools receiving the life teacher training program demonstrated a gain of 0.09 points more on their math scores over the period between the baseline and endline surveys. However, this result is not significant. Of course, the short duration between the program implementation and evaluation survey may have provided insufficient time for students to improve their scores. Moreover, even though life teachers may have also served as part-time homeroom teachers, our training did

Variables	Dependent variables: $\Delta Y_{is} = Y_{is2009} - Y_{is2008}$ Changes in ever feel cold while sleeping at night (1)	(2)	Changes in incidence of diarrhea (3)	(4)	Changes in BMI-for-age Z-score (5)	(6)
Treatment variable						
(1) Training Intervention group, 1 = yes	−0.15***	−0.14***	−0.02**	−0.03**	0.05	−0.16
	(0.03)	(0.04)	(0.01)	(0.01)	(0.13)	(0.11)
Student characteristics						
(2) Age in 2008, year		0.01		−0.01		0.09**
		(0.02)		(0.01)		(0.03)
(3) Male, 1 = yes		0.08		0.01		−0.09
		(0.05)		(0.01)		(0.06)
Family characteristics						
(4) Mom's education, 1 = illiteracy		0.06		0.02		−0.06
		(0.04)		(0.01)		(0.04)
(5) Mom ever migrated out for work For more than one year by 2008, 1 = yes		−0.26**		−0.03		−0.23*
		(0.10)		(0.04)		(0.11)
(6) Number of siblings, person		0.02		0.01		−0.02
		(0.02)		(0.01)		(0.02)
(7) The value of family house is less than 5000 RMB, 1 = yes		0.01		0.01		0.03
		(0.05)		(0.02)		(0.05)
(8) Distance from home to school, km		0.00		0.00		0.01*
		(0.00)		(0.00)		(0.00)
School characteristics						
(9) Total number of boarding students, person		0.00		−0.00		−0.00*
		(0.00)		(0.00)		(0.00)
(10) Areas of dorms, m2		−0.00**		−0.00		−0.00
		(0.00)		(0.00)		(0.00)
(11) Number of life teachers		−0.00		−0.00		0.01
		(0.01)		(0.00)		(0.02)
(12) Ratio of part-time life teacher		−0.02		−0.03*		−0.26*
		(0.02)		(0.02)		(0.12)
Grade dummies	YES	YES	YES	YES	YES	YES
Constant	0.46***	0.32	0.04	0.12*	−0.08	−0.18
	(0.10)	(0.18)	(0.05)	(0.07)	(0.09)	(0.23)
Obs	768	768	679	679	644	644
R^2	0.054	0.076	0.007	0.025	0.027	0.130

Table III.
OLS estimators of impact of life teacher training program on the boarding student's health

Notes: Robust standard errors (clustering at school level) are reported in parentheses. *,**,***Significant at 10, 5, 1 percent level, respectively

	Dependent variables: $\Delta Y_{is} = Y_{is2009} - Y_{is2008}$					
	Change in number of being later or leave early for class		Changes in number of misbehaviors at class[a]		Changes in number of misbehaviors after class[b]	
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment variable						
(1) Training Intervention group, 1 = yes	−0.18*	−0.48***	0.76	0.30	−0.87**	−0.78**
	(0.09)	(0.06)	(3.27)	(2.91)	(0.28)	(0.23)
Student characteristics						
(2) Age in 2008, year		−0.05		−0.72		−0.00
		(0.03)		(0.59)		(0.05)
(3) Male, 1 = yes		−0.03		−0.42		−0.23
		(0.05)		(0.62)		(0.14)
Family characteristics						
(4) Mom's education, 1 = illiteracy		0.05**		1.59		0.53**
		(0.02)		(1.22)		(0.18)
(5) Mom ever migrated out for work for more than one year by 2008, 1 = yes		0.13**		1.00		−0.34
		(0.04)		(1.07)		(0.29)
(6) Number of siblings, person		−0.00		−0.11		0.05
		(0.01)		(0.28)		(0.08)
(7) The value of family house is less than 5000 RMB, 1 = yes		0.04		2.25		−0.15
		(0.04)		(1.54)		(0.14)
(8) Distance from home to school, km		−0.00		−0.20**		−0.04**
		(0.00)		(0.07)		(0.01)
School characteristics						
(9) Total number of boarding students, person		−0.00***				−0.00
		(0.00)				(0.00)
(10) Areas of dorms, m^2		0.00				0.00**
		(0.00)				(0.00)
(11) Number of life teachers		0.06***				0.01
		(0.01)				(0.04)
(12) Ratio of part-time life teacher		0.15***				0.79*
		(0.04)				(0.39)
Grade dummies	YES	YES	YES	YES	YES	YES
(13) Constant	0.00	0.40	−4.26	1.94	−0.55	−1.38
	(0.05)	(0.29)	(5.16)	(5.18)	(0.66)	(0.91)
Obs	679	679	679	679	679	679
R^2	0.042	0.103	0.018	0.064	0.047	0.123

Notes: [a]The misbehaviors at class include excessive fidgeting, excessive talking in class or not paying attention; [b]the misbehaviors after class include bickering, fighting, and bulling. The Variance Impact Factor of school characteristics variables are more than 10 which suggests collinearity (Chen *et al.*, 2003). Thus, they are not controlled in model (4). Robust standard errors (clustering at school level) are reported in parentheses. *, **, ***Significant at 10, 5, 1 percent level, respectively

Table IV.
OLS estimators of impact of life teacher training program on the boarding student's behaviors

Variables	Dependent variable (Changes in math test score [a]): $\Delta Y_{is} = Y_{is2009} - Y_{is2008}$ (1)	(2)
Treatment variable		
(1) Training Intervention group, 1 = yes	0.09	0.03
	(0.20)	(0.16)
Student characteristics		
(2) Age in 2008, year		−0.06
		(0.04)
(3) Male, 1 = yes		0.10
		(0.09)
Family characteristics		
(4) Mom's education, 1 = illiteracy		−0.05
		(0.15)
(5) Mom ever migrated out for work for more than one year by 2008, 1 = yes		0.11
		(0.19)
(6) Number of siblings, person		−0.04**
		(0.02)
(7) The value of family house is less than 5000 RMB, 1 = yes		−0.00
		(0.06)
(8) Distance from home to school, km		0.01***
		(0.00)
School characteristics		
(9) Total number of boarding students, person		0.00**
		(0.00)
(10) Areas of dorms, m^2		−0.00**
		(0.00)
(11) Number of life teachers		0.01
		(0.02)
(12) Ratio of part-time life teacher		0.10
		(0.16)
Grade dummies	YES	YES
Constant	−0.03	0.41
	(0.29)	(0.45)
Obs	673	673
R^2	0.023	0.089

Table V.
OLS estimators of impact of life teacher training program on the boarding student's academic performance

Notes: The math score is the average score of boarding student math test scores in the last two semesters[a]. Robust standard errors (clustering at school level) are reported in parentheses. *,**,***Significant at 10, 5, 1 percent level, respectively

not include any content on in-class classroom management. For these two reasons, it is not surprising that the life teacher training had no effect on academic performance.

Taken together, the results demonstrate that the life teacher training program yielded significant improvements for student health and behavior – just after one year of implementation. Of course, given the concerns about power, the results of the unadjusted model may be supplemented (and made more precise) by controlling for other variables (that is, using the adjusted model).

Multivariate model (adjusted model). To further explore the impact of the life teacher training program, we add a set of control variables to the unadjusted model. When analyzing the effect of the life teacher training program using a multivariate approach,

we find that the results are largely consistent with the unadjusted model in terms of the overall impacts of the program (Tables III-V). Indeed, after controlling for the student characteristics (e.g. age, gender), family characteristics (e.g. mom's education, mom's migration status, number of siblings, value of family house, and distance from school), and school characteristics, we find that the program improves the health and behavior of students, but has no measurable impact on student academic performance (similar in sign and magnitude to those results in the unadjusted model).

Specifically, in terms of health outcomes, the multivariate analysis also shows that the life teacher training program improved student sleep quality. In fact, the coefficient on the adjusted model (−0.14 – Table III, column 2, row 1) is almost identical to that on the unadjusted model (−0.15 – Table III, column 1, row 1). The result is significant at the 5 percent level. In sum, providing life teacher training reduces the average student's rate of reporting feeling cold at night by roughly 14 percentage points.

When controlling for other variables, the coefficient for changes in the incidence of diarrhea remains statistically significant (Table III). More specifically, like the unadjusted model, the adjusted model shows that the teacher training program reduced the incidence of diarrhea by 3 percentage points. Finally, the multivariate results parallel the unadjusted model in suggesting that the program indeed had no measurable impact on students' BMI-for-age *Z*-scores. Life teacher training therefore seems to reduce the incidence of diarrhea even after controlling for a series of variables, but it has no effect on students' BMI-for-age *Z*-scores.

Taking these results together, our interpretation is that, in the year following the life teacher training program, teachers were able to provide better living standards for students. However, they were unable to change the physical environment – poor facilities, nutrition, and hygiene – that led to diarrhea and low BMI-for-age *Z*-score. The final interpretations, of course, must be tempered because of the low power of the statistical evaluation. It is possible that had the number of intervention and control schools been increased, the ability to detect statistical significant differences would be greater.

In terms of behavior, the multivariate results also mirror the unadjusted results. Specifically, the effect size estimated in the multivariate models for student tardiness is bigger (−0.48 – Table IV, column 2, row 1) and more significant (at the 1 percent level) than the estimates in our unadjusted model (−0.18 and the 10 percent level). The coefficient of the number of misbehaviors after class (−0.78 – column 6) is almost identical in the adjusted model to those in the unadjusted model (−0.87 and −0.78, respectively). Moreover, when adding controls, the coefficient representing changes in number of misbehaviors during class changes from 0.76 to 0.30 (columns 3 and 4), although this finding is still not significant. This result is consistent with our original interpretation, that the training content for life teachers (which focusses on how to improve behavior of students outside the classroom) had no additional and direct impact on students vs untrained life teachers within the classroom. As such, we conclude that the life teacher training program improved student behavior, at least outside of the classroom.

Finally, the unadjusted and adjusted models both suggest that the teacher training program had no impact on student academic performance. When looking at changes in math test scores and adding control variables, we note that boarding students in schools with the life teacher training program experienced a 0.03 point gain (Table V, column 2) over students in control schools. However, like the results from the unadjusted model, this is not significant. Again, this result might be explained by two facts: life teachers are not responsible for managing the academics of students and the benefits of improved behavior and health on student performance might not be measurable in one year.

In summary, and perhaps most policy relevant, we find that a mere 17 days worth of training for life teachers not only measurably improves student health, it helps ensure better behavior among boarding students. While the program did not improve academic performance, these results do show that training life teachers truly can improve the outcomes of poor, rural boarding students.

Mechanisms of impact, heterogeneous analyses, and robustness checks

Mechanisms of impact: improved student-teacher communication. Thus far in the paper, our results show that life teacher training programs benefit students in terms of improved health and behavior. As an additional empirical exercise, in this section we attempt to explore one of the potential mechanisms for why this might be the case: improved communication with life teachers.

In our interviews with students (in the control schools), we frequently heard rural boarding students complain that their life teachers left them confused about expectations, did not care about them, or punished them too severely/inappropriately. In turn, the students said they were unwilling to listen to life teachers when they were told to behave and did not want to seek help from teachers. This fact is not surprising, as life teachers are responsible for managing so many aspects of students' day-to-day lives, yet have very little time or training to accomplish this goal.

Hence, one possible mechanism that might aid life teachers in helping students improve their lives (in the case of this study – health, behavior, and academic performance) is better communication. Because of this possibility, in this section we examine if the life teacher training program helped teachers communicate more effectively with students. If so, it might be that students would report having better relations with the teacher, which in turn, would lead to better outcomes.

We draw on three variables collected during our surveys to proxy improved communication with students. First, does the student report having a good relationship with the life teacher? Second, does the student believe the life teacher knows his or her friends? Third, would the student seek help from the life teacher if he or she felt unhappy?

In all three measures, the life teacher training program appears to have a positive impact. The unadjusted models showed that, boarding students in schools with life teacher training programs demonstrated a 19 percentage point gain over students in control schools in reporting good relations with life teachers. The gain was significant at the 5 percent level (Table VI, column 1, row 1). The coefficient is positive in the adjusted models although it is not significant any more (Table VI, columns 2, row 1).

These same results hold for the other two measures. With the implementation of the life teacher training program, the number of boarding students who reported that their life teachers knew their friends in treatment schools was more than their peers in control schools by over 12 percentage points (the results were nearly identical in the adjusted and unadjusted models and in both models were significant, respectively at the 1 percent level and 5 percent level – Table VI, columns 3 and 4). Moreover, the life teacher training program increased the number of boarding students reporting they would seek help from life teachers when they felt unhappy by 15 percentage points (Table VI, column 5, row 1). Although the coefficient is not significant in the adjusted model, it is positive (Table VI, column 6, row 1).

Taken together, the results suggest that the life teacher training program indeed helped teachers communicate more effectively with their students. That is, students are reporting having better relationships with life teachers, seeing them as understanding

Variable	Dependent variables: $\Delta Y_{is} = Y_{is2009} - Y_{is2008}$ Changes in whether the boarding student had good relation with life teachers (1)	(2)	Changes in whether life teacher know most of the boarding student's friends (3)	(4)	Changes in whether the boarding student would look for help from life teacher if he/she felt unhappy (5)	(6)
Treatment variable						
(1) Training Intervention group, 1 = yes	0.19**	0.09	0.12***	0.10**	0.15**	0.08
	(0.08)	(0.11)	(0.02)	(0.03)	(0.06)	(0.08)
Student characteristics						
(2) Age in 2008, year		−0.05*		−0.00		−0.01
		(0.02)		(0.01)		(0.03)
(3) Male, 1 = yes		−0.11		−0.06**		−0.04
		(0.07)		(0.02)		(0.06)
Family characteristics						
(4) Mom's education, 1 = illiteracy		0.04		0.03		0.09
		(0.05)		(0.02)		(0.06)
(5) Mom ever migrated out for work for more than one year by 2008, 1 = yes		−0.14		0.01		−0.10
		(0.08)		(0.04)		(0.12)
(6) Number of siblings, person		−0.00		−0.00		0.01
		(0.02)		(0.01)		(0.02)
(7) The value of family house is less than 5000 RMB, 1 = yes		0.03		−0.01		−0.02
		(0.05)		(0.03)		(0.03)
(8) Distance from home to School, km		0.00		0.00		−0.00
		(0.00)		(0.00)		(0.00)
School characteristics						
(9) Total number of boarding Students, person		−0.00		0.00		0.00
		(0.00)		(0.00)		(0.00)
(10) Areas of dorms, m^2		−0.00		−0.00		−0.00***
		(0.00)		(0.00)		(0.00)
(11) Number of life teachers		0.03		0.00		−0.00
		(0.02)		(0.00)		(0.01)
(12) Ratio of part-time life teacher		−0.13		−0.03		−0.10
		(0.15)		(0.06)		(0.07)
Grade dummies	YES	YES	YES	YES	YES	YES
Constant	−0.44***	0.09	−0.25***	−0.15	−0.17	0.12
	(0.06)	(0.28)	(0.06)	(0.13)	(0.10)	(0.28)
Obs	674	674	674	674	674	674
R^2	0.032	0.065	0.040	0.057	0.020	0.035

Notes: Robust standard errors (clustering at school level) are reported in parentheses. *,**,***Significant at 10, 5, 1 percent level, respectively

Table VI.
OLS estimators of impact of life teacher training program on communication between life teacher and boarding students

their social lives, and more willing to reach out for help when unhappy. One way to think about these results is that the life teacher training helped life teachers more consciously care for their students. Although our intervention was unable to change any structural constraints – facilities, the number of life teachers working part-time versus full-time or even salaries – the life teacher training clearly improved their interactions with students. Given that students are far more willing to obey the demands of teachers they perceive as caring and understanding (Wang, 2011), in turn, life teachers were able to more effectively manage the day to day needs and behavior of students, in spite of the limited time and facilities.

Heterogeneous analysis. In order to better understand what kinds of students are benefitting from the program, we run heterogeneous analyses. We are especially interested in whether the poorest students get equitable benefits from the life teacher training program. To conduct these analyses, we interacted our variable for poverty (whether a student's house value was under 5,000 yuan) with his or her treatment status. Our results are reported in Table AII.

We find that the poorest students do in fact benefit more than other students in two areas: BMI-for-age *Z*-score and number of misbehaviors after class. When controlling for other variables, the BMI-for-age *Z*-score among the poorest students increased more than other students by 0.23. This finding is significant at the 5 percent level (Table AII, column3, row 3). Moreover, the number of misbehaviors after class among the poorest students were reduced more than other students by 0.54 (Table AII, column 3, row 6), a finding significant at the 10 percent level.

Why is it that poor students experienced measurable improvements in BMI-for-age *Z*-score but not the average student? One reason may be that the poorest students were seriously malnourished (as a result of living in poverty). The additional training might have helped life teachers provide correct nutrition and targeted care, such that the students experienced increases in their BMI-for-age *Z*-score. However, students from richer families might have been healthier to begin, such that the extra care would not change their BMI-for-age *Z*-score quickly.

Robustness checks: multiple imputation and seemingly unrelated regression. We also conduct two checks to verify whether our OLS results reported above are robust. First, we use multiple imputation to examine whether missing data is driving our results (Table AIII). Although we took many measures (e.g. we called homeroom teachers every week to remind them to record their teacher diaries) to control the quality of data collection, some data were still missing. One concern might be our current interpretations are driven by existing observations, but, upon including data from the missing students, our interpretations would no longer be valid. To address this problem, we conduct a robustness check using multiple imputation to determine how sensitive our existing analysis is to missing data (Table AIII).

Second, we estimate the impact of treatment on multiple outcomes using Seemingly Unrelated Regression (SUR) for each of three kinds of outcomes (health, behavior, and academic performance) (Table AIV). Since multiple outcome variables on health, behavior, and communication with life teachers are used for each student in our sample, the error terms of outcome variables might be correlated. In this case, SUR approach might be more efficient estimator for the treatment effect than OLS.

While we do present the tables containing results from our robustness analysis in Table AIII and Table AIV, we omit a thorough discussion of the results from these two additional analyses for brevity. The results are substantively similar to and support the main results above: compared to boarding students in control schools,

fewer students in treatment schools reported feeling cold while sleeping at night (by 15 percentage points) and fewer students in treatment schools reported having diarrhea (by 3 percentage points). The results also showed that incidences of student tardiness and misbehaviors after class declined significantly by 0.16 and 0.79, respectively. However, the in-service life teacher training program had no measurable impact on boarding students' BMI-for-age *Z*-score, number of misbehaviors in class, and math scores.

Discussion and conclusion

With the implementation of the school merger program in rural China, more and more poor, rural elementary students are now boarding in centralized schools. Unfortunately, studies show that boarding students suffer reduced health, tend to misbehave, and perform less well academically than their non-boarding peers. One key finding of this paper is that life teachers, who are supposed to provide the majority of care for boarding students, receive insufficient training are not providing the care that they should (if they received better training). Reporting on the results of a cluster-randomized controlled trial across 768 students in ten schools randomly chosen across Shaanxi Province, this paper arrived at this conclusion by estimating the impact of a life teacher training program on a number of health, behavioral, and academic outcomes of boarding students.

According to the findings, we have shown that boarding schools in poor, rural areas are indeed inadequately equipped to support the healthy development of boarding students. In addition to having poor facilities, boarding schools were staffed with undertrained life teachers. Around three-quarters (74 percent) of the life teachers were working part-time and almost none of them had professional certifications or had ever participated in trainings before entering the job.

We have also shown that when life teachers participated in a short (2 part, 17 day) training program, their students experienced improved health and behavior outcomes. However, there was no measured significant effect on student academic performance.

So what caused this? In the paper we have shown that one likely mechanism by which the life teacher training improved student outcomes is by helping life teachers communicate more effectively with students. Significantly more students in schools receiving life teacher training reported having good relations with life teachers, reported that the teacher knew of their peer group, and said they would seek help from life teachers.

While we are aware of the limitations of this study, at the very least this work suggests that the life teacher training program has potential for future policy action. We only examined three possible outcomes, and more importantly, our sample size included only ten schools. In light of the fact that such a small sample size limited our statistical power and external validity, our findings are particularly noteworthy. Even with a sample size of just ten schools, we found robust results significant at the 1 percent level. While we are cautious in extending our results, our careful randomization means that such positive results are statistically valid for poor rural elementary schools in Shaanxi Province. As such, we believe this kind of study should be repeated in more areas of China, and at the very least considered as a potential policy approach to reduce gaps in health and behavior among boarding and non-boarding students.

Will this happen? Currently, most influential voices in the Ministry of Education (MOE) suggest that investment into rural education should take the form of better

books, classrooms, or facilities. However, our results at least suggest new options to support poor, rural students, who will be more and more likely to be boarding at schools as the Merger Program continues. Top policymakers should consider how ensuring well-trained staff members can actually lead to better health and behavioral outcomes. In addition, while we were unable to show a link between better-trained staff and academic performance, we believe that such a causal connection is likely if the study were repeated with a larger sample size over a longer period of time. As such, it is our hope that this work broadens the possibilities available to China's top policymakers as they seek to invest in rural education.

Note

1. Although there are other measures of student health (weight-for-height or weight-for-age), we chose BMI-for-age because the World Health Organization (WHO) uses BMI-for-age, which we draw on to serve as a reference for our study. They do not measure weight-for-age and weight-for-height for school-aged children. Furthermore, according to our review of the literature, height-for-age cannot measure short-term changes in malnutrition (O'Donnell *et al.*, 2007). As such, we only tried the indicator of Z-score of BMI-for-age. For additional information on the calculation of BMI-for-age Z-score, please refer to WHO Multicenter Growth Reference Study Group (2006).

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Variables	Sample[a] (1)	Others[b] (2)	Difference (3) = (1)-(2)	*p*-value (4)	External sample[c] (5)	Difference (6) = (1)-(5)	*p*-value (7)
Number of observations	10	15			52		
School size							
Number of classes	8.80	7.53	1.26	0.1644	9.58	−0.78	0.6361
Number of students	357	312	45	0.4227	450	−93	0.1314
Number of teachers	28	22	6	0.1203	22	6	0.2888
Infrastructure							
Area (m^2)	6138	6769	−631	0.7091	n.a.	n.a.	n.a.
Number of classrooms	16.10	12.60	3.50	0.4275	n.a.	n.a.	n.a.
Whether warming facilities are available in classroom	1.00	0.93	0.07	0.4259	n.a.	n.a.	n.a.
Whether there is student canteen	1.00	0.93	0.07	0.4259	0.94	0.06	0.4354
Whether there is tables for dinner	0.70	0.38	0.34	0.1062	n.a.	n.a.	n.a.
Whether the canteen provide lunch to students	1.00	0.93	0.07	0.4101	0.92	0.08	0.0777*
Boarding							
Number of boarding students	147	155	−9	0.8323	138	9	0.8083
Areas of dorms	377	371	5	0.9792	n.a.	n.a.	n.a.
Whether warming facilities are available in dorms (Yes = 1)	0.90	0.53	0.37	0.0573*	n.a.	n.a.	n.a.
Number of life teachers (including full-time and part-time life teachers)	4.10	5.27	−1.17	0.4322	n.a.	n.a.	n.a.
Of which, ratio of part-time life teachers	0.74	0.86	−0.12	0.4579	n.a.	n.a.	n.a.

Notes: [a]With canvas survey, 25 central primary boarding schools are identified from 144 primary schools in rural Shaanxi. Of which, 10 schools (including both 5 treatment schools and 5 control schools) are randomly chosen to be included in RCT; [b]of 25 central primary boarding schools, 15 schools are excluded from RCT due to resources constraint; [c]external sample are from another rural primary schools survey across from northwest China (More details on this survey see Miller *et al.*, 2012). Here we only keep the observations of *wanquanxiaoxue* in which there are six grades like central primary schools

Source: Authors' survey

Table AI.
Comparison of mean characteristics of sample schools and other schools in canvas survey

Dependent variable	Coef.	SE
Health		
(1) Changes in ever feel cold while sleeping at night	−0.00	0.10
(2) Changes in incidence of diarrhea	−0.02	0.05
(3) Changes in BMI-for-age *Z*-score	0.23**	0.10
Behavior		
(4) Change in number of being later or leave early for class	0.07	0.10
(5) Changes in number of misbehaviors at class	1.95	2.02
(6) Changes in number of misbehaviors after class	−0.54*	0.25
Academic performance		
(7) Changes in math test score	0.15	0.12
Communication		
(8) Changes in whether the boarding student had good relation with life teachers	−0.09	0.13
(9) Changes in whether life teacher know most of the boarding student's friends	−0.02	0.04
(10) Changes in whether the boarding student would look for help from life teacher if he/she felt unhappy	−0.00	0.07

Table AII.
Heterogeneous effect of life teacher training program by family house value

Notes: The covariates controlled in these regression are same to those in Tables III-VI. This table reported the coefficients and standard errors of the interaction between treatment variable and family household value (< 5000 rmb = 1). *,**,***Significant at 10, 5, 1 percent level, respectively

Dependent variable	Without covariates Coef.	SE	With covariates Coef.	SE
Health				
(1) Changes in ever feel cold while sleeping at night	−0.15***	0.03	−0.15**	0.05
(2) Changes in incidence of diarrhea	−0.03**	0.01	−0.02**	0.01
(3) Changes in BMI-for-age *Z*-score	0.05	0.12	−0.13	0.11
Behavior				
(4) Change in number of being later or leave early for class	−0.16*	0.08	−0.46***	0.08
(5) Changes in number of misbehaviors at class[a]	0.81	3.23	−2.42	4.62
(6) Changes in number of misbehaviors after class[b]	−0.79**	0.33	−0.56*	0.29
Academic performance				
(7) Changes in math test score	0.11	0.21	−0.03	0.18
Communication				
(8) Changes in whether the boarding student had good relation with life teachers	0.19**	0.08	0.06	0.11
(9) Changes in whether life teacher know most of the boarding student's friends	0.12***	0.03	0.08*	0.04
(10) Changes in whether the boarding student would look for help from life teacher if he/she felt unhappy	0.13**	0.06	0.07	0.07

Table AIII.
Impact of life teacher training program: results from imputation analysis

Notes: Imputation times = 8. This table reported the coefficients and standard errors of treatment variable. The covariates controlled in these regression are same to those in Table III-VI. *,**,***Significant at 10, 5, 1 percent level, respectively

Dependent variable	Without covariates Coef.	SE	With covariates Coef.	SE
Health				
(1) Changes in ever feel cold while sleeping at night	−0.16***	0.05	−0.12	0.09
(2) Changes in incidence of diarrhea	−0.02**	0.13	−0.03	0.02
(3) Changes in BMI-for-age *Z*-score	0.05	0.05	−0.17*	0.17
Behavior				
(4) Change in number of being later or leave early for class	−0.18***	0.04	−0.46***	0.08
(5) Changes in number of misbehaviors at class[a]	0.76	0.93	0.30	0.98
(6) Changes in number of misbehaviors after class[b]	−0.87***	0.17	−0.63**	0.30
Academic performance				
(7) Changes in math test score	n.a.	n.a.	n.a.	n.a.
Communication				
(8) Changes in whether the boarding student had good relation with life teachers	0.20***	0.05	0.09	0.09
(9) Changes in whether life teacher know most of the boarding student's friends	0.12***	0.03	0.09*	0.06
(10) Changes in whether the boarding student would look for help from life teacher if he/she felt unhappy	0.16***	0.00	0.08	0.09

Notes: This table reported the coefficients and standard errors of treatment variable. The covariates controlled in these regression are same to those in Tables III-VI

Table AIV.
Impact of life teacher training program: results from SURE

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