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Assessing the Quality of Upper-Secondary Vocational Education and Training: Evidence from China

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An increasing number of policy makers in developing countries have made the mass expansion of upper-secondary vocational education and training (VET) a top priority. The goal of this study is to examine whether VET fulfills these objectives of building skills and abilities along multiple dimensions and further identify which school-level factors help vocational students build these skills and abilities. To fulfill this goal, we analyzed representative, longitudinal data that we collected on more than 12,000 students from 118 schools in one province of central China. First, descriptive analysis shows that approximately 90 percent of VET students do not make any gains in vocational or general skills. In addition, negative behaviors (misbehavior in the classroom, antisocial behavior, and other risky behaviors) are highly prevalent among VET students. A nontrivial proportion of student internships also fail to meet minimum government requirements for student safety and well-being. Perhaps as a result of these outcomes, more than 60 percent of students express dissatisfaction with their VET programs, as evidenced by either self-reports or dropping out. Finally, using a multilevel model, we find that school inputs (such as school size, teacher qualifications, and per pupil expenditures) are not correlated with vocational and general skill at the end of the school year, or student dropout in the academic year.

In an attempt to provide future generations of students with useful skills and abilities, an increasing number of policy makers in developing countries have made the mass expansion of upper-secondary vocational education and training (VET) a high priority. International organizations, such as the Organi-

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zation for Economic Cooperation and Development (OECD), the United Nations Educational, Scientific, and Cultural Organization (UNESCO), and the Asian Development Bank (ADB), have also promoted the large-scale expansion of VET in developing countries with the understanding that VET builds human capital and leads to economic growth (ADB 2008; Field et al. 2009; UNESCO 2012). The development of VET is also one of eight priority areas put forward in the plan of action for the African Union's Second Decade of Education (2006–15; UNESCO Office in Dakar 2015). Countries in the Asia-Pacific region, such as Indonesia, Vietnam, and Thailand, have experienced rapid increases in enrollments in VET since the early 2000s (Ministry of National Education of Indonesia 2006; Government of Vietnam 2009; Ministry of Education of Thailand 2012).

The purpose of vocational schooling is to help students acquire a diverse range of cognitive and noncognitive competencies that will help them thrive and that will contribute to economic growth and social stability (Clayton et al. 2003; Field et al. 2009; UNESCO 2012). First, policy makers believe that students should learn vocational skills that improve their employability and job competence (Field et al. 2009). Second, students in developed and upper middle income countries (like China) are encouraged to learn general skills such as math, language, and science that are broadly useful in most jobs and that are critical for adapting to changing labor markets (Chiswick et al. 2003; Field et al. 2009). Third, students are expected to be given the chance to cultivate positive attitudes and behaviors that are associated with personal success, social good, and effective citizenship.[1] Fourth, students are expected to be given internships (defined as work placement training; Field et al. 2009) opportunities that enable them to develop their cognitive and noncognitive skills in the real world of work (Field et al. 2009; King 2011).

Although policy makers have great expectations for VET, there is little rigorous empirical research on whether VET actually helps students develop this broad set of skills and abilities. Several studies have estimated the economic returns to VET versus general schooling.[2] However, this research offers no conclusive evidence on the effectiveness of VET. Rather, these studies provide mixed results on the economic returns of VET and offer little evidence on the contribution of VET to the development of skills and abilities. We are only aware of two studies that look at the impacts of VET on improving skills (Chen 2009; Loyalka et al. 2016). Few, if any, studies examine whether VET fulfills the objectives of building skills and abilities along multiple dimensions. Even more fundamentally, the literature does not identify which school-level factors help vocational students build skills and abilities.

[1] Mayer (1995); Fontaine (2006, 2007); Field et al. (2009); UNESCO (2012); Ministry of Education of China (2014).

[2] Hu et al. (1971); Psacharopoulos (1994); Horowitz and Schenzler (1999); Moenjak and Worswick (2003); EI-Hamidi (2006); Kahyarara and Teal (2008); Li et al. (2012); Hirshleifer et al. (2014).

We begin our analysis in this article by drawing from the theory of education production. Education production analysis has been a prominent part of the literature since the US government commissioned a study called Equality of Educational Opportunity, or, as it is more commonly referred to, the Coleman Report (Coleman et al. 1966). This theory starts with the underlying assumption that schools are factories of student learning. The schools use a certain set of inputs (teachers, facilities, per pupil spending). When these inputs are used in schools, student outcomes (cognitive and noncognitive outcomes) are produced by the school system (Hanushek 1986, 2003). Many scholars have made use of the education production function approach in order to analyze which policy choices (which types of investments) are likely to result in the best educational outcomes.[3] However, these types of studies are conspicuously absent in the context of VET (ADB 2008, 2014). To the best of our knowledge, no published study has rigorously examined the relationship between school-level factors and the skills and abilities of vocational students in developing countries. In the absence of such evidence, it is difficult for policy makers to determine which school-level factors need to be strengthened to improve the quality of VET.

The goal of this article is to examine whether attending VET helps improve student cognitive and noncognitive skills and abilities across multiple dimensions in a developing country context. Specifically, we seek to understand whether VET enables students to: (a) improve vocational and general skills; (b) cultivate positive social behaviors; (c) have a safe and productive introduction to the world of work through internships; (d) take satisfaction in their educational experience; and (e) stay in school (or drop out). The article also focuses on understanding which school-level factors are correlated with the vocational and general skills of students at the end of the school year as well as dropout in the academic year.

To fulfill these objectives, we analyze representative, longitudinal data collected on more than 12,000 students from over 180 VET programs (in 118 schools) in one province of central China. This province is an interesting case study because it is held by the national government as a model for other provincial systems of VET. Using vertically equated, standardized test instruments, we first measure vocational and general skill gains for students in the first 2 years of their (3-year) programs. We then use descriptive statistics to document the prevalence of positive and negative social behaviors among students, whether student internships adhere to minimum government requirements for student safety and well-being and student satisfaction with VET. We also present descriptive findings on the dropout rate from VET schools.

[3] See, e.g., Hanushek (1986); Hedges et al. (1994); Goldhaber and Brewer (2000); Hanushek (2003); Aaronson et al. (2007).

Finally, we use multilevel modeling to examine what school-level factors are correlated with student skills gains and dropout.

We present two sets of key findings. First, we show that VET programs in China are not fulfilling the goal of building student skills and abilities along multiple dimensions. Approximately 90% of VET students appear not to make any vocational or general skill gains. The students in VET programs are also often exposed to negative behaviors (misbehavior in the classroom, antisocial behavior, and other risky behaviors) from their peers. A nontrivial proportion of student internships fail to meet minimum government requirements for student safety and well-being. Perhaps as a result of these dismal outcomes, more than 60 percent of students report dissatisfaction with their VET programs or drop out.

Second, we find that few school-level factors are correlated with student outcomes. Private school ownership is positively correlated with vocational skill at the end of the academic year. This result is similar to most studies in the context of general schooling (Hanushek 1986; Thapa 2013). However, we find that school inputs (such as school size, teacher qualifications, and per pupil expenditures) are not correlated with either vocational or general skill at the end of the academic year or with student dropout in the academic year.

Research Design

Background on VET in China

One of the problems of the VET system in China may be that, like in other countries (Field et al. 2009), the VET system is considered a second-tier education sector by students and the general public in China. At the end of junior high school, students take a high school entrance exam. If they score well on the exam, they qualify for entry into academic high school, but if they do not, their only option is to attend vocational high school or enter the labor market. VET is thus perceived, both by policy makers and the public, as a second-best option for individuals who wish to consider their studies after nine years of compulsory schooling (primary and junior high school). Previous research in rural China (e.g., Yi et al. 2015) also demonstrates that at the beginning of junior high school, only 14 percent of students planned to attend vocational high school, while 46 percent planned to attend academic high school (the rest stated that they either had no plans or had plans to enter the labor market).

In the vocational track, students apply for different VET schools and programs. There are three types of VET schools in China: specialized vocational schools (*zhongzhuan*), vocational high schools (*zhigao*), and technical schools (*jixiao*). The specialized vocational school and vocational high schools are managed by the Education Department (ED), and the technical schools are mainly managed by the Human Resources and Social Security Department (HRSSD). In 2013, the new enrollments in ED-managed VET schools account for 80 percent of all new enrollments in VET schools (National Bureau of Statistics of China 2013). Nearly three quarters (73.5 percent) of ED-managed VET schools are public schools (National Bureau of Statistics of China 2013).

In addition to cultivating good citizens, VET schools take on the responsibility of teaching students skills and capacities that they need in the future economy through a 3-year program. To meet this goal, policy requires that the curriculum of a typical VET school is divided into three parts. One third is allocated to teach general academic skills defined nationally by the Ministry of Education; one-third is allocated to teach students vocational skills; the remaining third (always in the last year of vocational schooling) involves sending students to companies or industry to complete internships (defined as workplace training—Ministry of Education, and Ministry of Finance of China 2007; Ministry of Education of China 2009). There are a number of regulations placed on these internships to ensure that the basic rights of vocational students are upheld, including that experienced teachers provide guidance to students conducting internships (Ministry of Education, and Ministry of Finance of China 2007).

Although VET schools are usually not students' first choice, policy makers in China have made the development of VET a top priority over the last 15 years. In 2002 and 2005, the State Council highlighted the role of VET in building a skilled labor force that can power China's future growth (Chinese State Council 2002, 2005). The belief that VET is vital for China's economic growth continues to be a major theme in national education policies today (Xinhua Agency 2011). In fact, China has committed to building a modern, world-class vocational education system by 2020 (Chinese State Council 2014), in which VET is expected to produce "hundreds of millions of high-quality laborers and skilled technical talent" in the coming decades (Chinese State Council 2014).

The government's commitment to VET has resulted in a rapid expansion of enrollment and increased investment in VET programs. According to the government's official statistics, new enrollment in VET increased from 1.6 million in 2003 to 6.7 million in 2013 and now accounts for 45% of all new enrollment in upper-secondary school (National Bureau of Statistics of China 2003, 2014a). Annual investment in VET quadrupled over the same period, reaching USD$27 billion by 2011 (National Bureau of Statistics of China 2003, 2013). Because of this investment, VET schools have been able to meet minimum government benchmarks for facilities, teacher qualifications, and teacher training (Yi et al. 2013).

A substantial proportion of the investments into VET have been earmarked for improving quality. For example, between 2010 and 2013, education officials invested approximately USD$1.7 billion to establish one thousand "model" VET schools (*shifan xiao*) across the country (Ministry of Education of China 2010a, 2010b). During the Twelfth Five-Year plan (2011–15), the government also invested heavily in efforts to improve the quantity and quality of VET teachers (Ministry of Education, and Ministry of Finance of China 2011). Further, the government has promised to develop a modern, world-class vocational education system between 2014 and 2020 by promoting project-oriented courses, raising the share of schooling devoted to participating in internships, reconciling the VET curriculum with career standards, and providing more teacher training (Chinese State Council 2014; Ministry of Education of China 2015a, 2015b).

Despite the increased attention to quality, little is known about how effective the current VET system is at achieving its goal. Only one study documents student skill gains from VET:[4] Loyalka et al. (2016) show that students in the first year of VET make negligible gain in vocational skill and negative gain (i.e., losses) in general skill. However, the generalizability of this finding is limited by the fact that it only reflects skill gains in the first, transitional year of vocational high school, rather than examining skill gains over the first two years when students are taking vocational and general classes. Notably, no study has measured whether students are building the broad range of cognitive and noncognitive skills and abilities that the government believes are important for national development. Finally, few, if any, studies on China's VET system examine what school-level factors may help students build skills and abilities.

Sampling

We chose Henan province—in central China—as the site of our research. There are three main reasons for choosing Henan. First, Henan is one of the nation's nationally designated pilot provinces for VET development and reform in China. In other words, national-level policy makers look to the achievements and lessons learned in Henan's VET system to revise VET policy across China (Ministry of Education of China 2014). Second, Henan has a very large population of 94 million persons. If Henan was a country, it would rank as the 14th largest country in the world. Third, because of its large population, Henan is an important source of labor for all of China. Although it is one out of 31 provinces, it produces 8 percent of the nation's VET graduates (Henan Provincial Government 2014; National Bureau of Statistics of China 2015; World Bank 2015).

In the second step of our sampling procedure, we obtained a comprehensive list of all upper-secondary VET schools in seven representative prefectures from the provincial government (590 schools in total). From this list,

[4] Most published studies (Guo et al. 2012; Kuczera and Field 2012; Yi et al. 2013; Ran and Shi 2014) and government-led assessment activities (National Education Supervision Group of China 2011) concerning VET mainly focus on the quantity of inputs that are being invested into VET.

we then limited our sample to those VET schools with the two most popular programs in the province (and China), applied computing (henceforth, computing) and digital control. In 2013 these two programs composed 22 percent of all VET school student enrollment in the sample province and 31 percent of student enrollment nationally (National Bureau of Statistics of China 2014a, 2014b). After limiting the list in this way, we were left with 219 VET schools (fig. 1). Our sample was then further reduced to 132 schools by focusing on VET schools that had at least 30 students in each grade in at least one of the two selected programs. We found that 14 of the schools with a low number of students (less than 30) had been closed during the year before sample selection and did not want to risk having one of our sample schools close during the study period. Therefore, the final analytical sample included students and principals in 118 schools and 185 programs.

Next, in each sampled school, we randomly sampled one first-year and one second-year class in each program.[5] In the subset of schools that had only one of our sample programs (52 out of 118 schools), we only sampled one first-year and one second-year class in that particular program (either computing or digital control). After sampling the classes, we surveyed all students in the class. Altogether, we sampled 12,071 students across 345 classes in 185 programs in 118 schools (fig. 1).

Table A1 presents descriptive statistics on student background and school characteristics. In our sample, 89 percent of students were between 15 and 18 years old; 87 percent of students came from rural areas in Henan province. When comparing the characteristics of their parents (using our data) with descriptive statistics that used data on a population of 15–18-year-old individuals from rural China (using data from the 2012 China Family Panel Studies: Xie and Hu 2014), we see that the parents of students in our sample are more likely to have graduated from at least high school (23 percent vs. 17 percent) and are less likely to be in their home villages, instead of working as a migrant outside of their home village (62 percent vs. 70 percent). Based on these findings, we can tentatively conclude that the VET students in our sample, in fact, are not the most vulnerable group in China. Those students whose parents have lower levels of education and are living and working in their village (most likely being engaged in farming) appear to have stopped their schooling before they entered VET.

Data Collection

In October 2013 (at the beginning of the academic year) we conducted a baseline survey among our sample students and their school principals. The

[5] In China, VET at the upper-secondary level is a 3-year program. Government policies suggest that students should take vocational and general skill classes in their first two years (Ministry of Education of China 2009). Half of the classes are meant to cover vocational or major-specific skills such as computing, accounting, and engineering, whereas the other half of the classes are meant to cover general skills such as math, language, and English (Ministry of Education of China 2009).

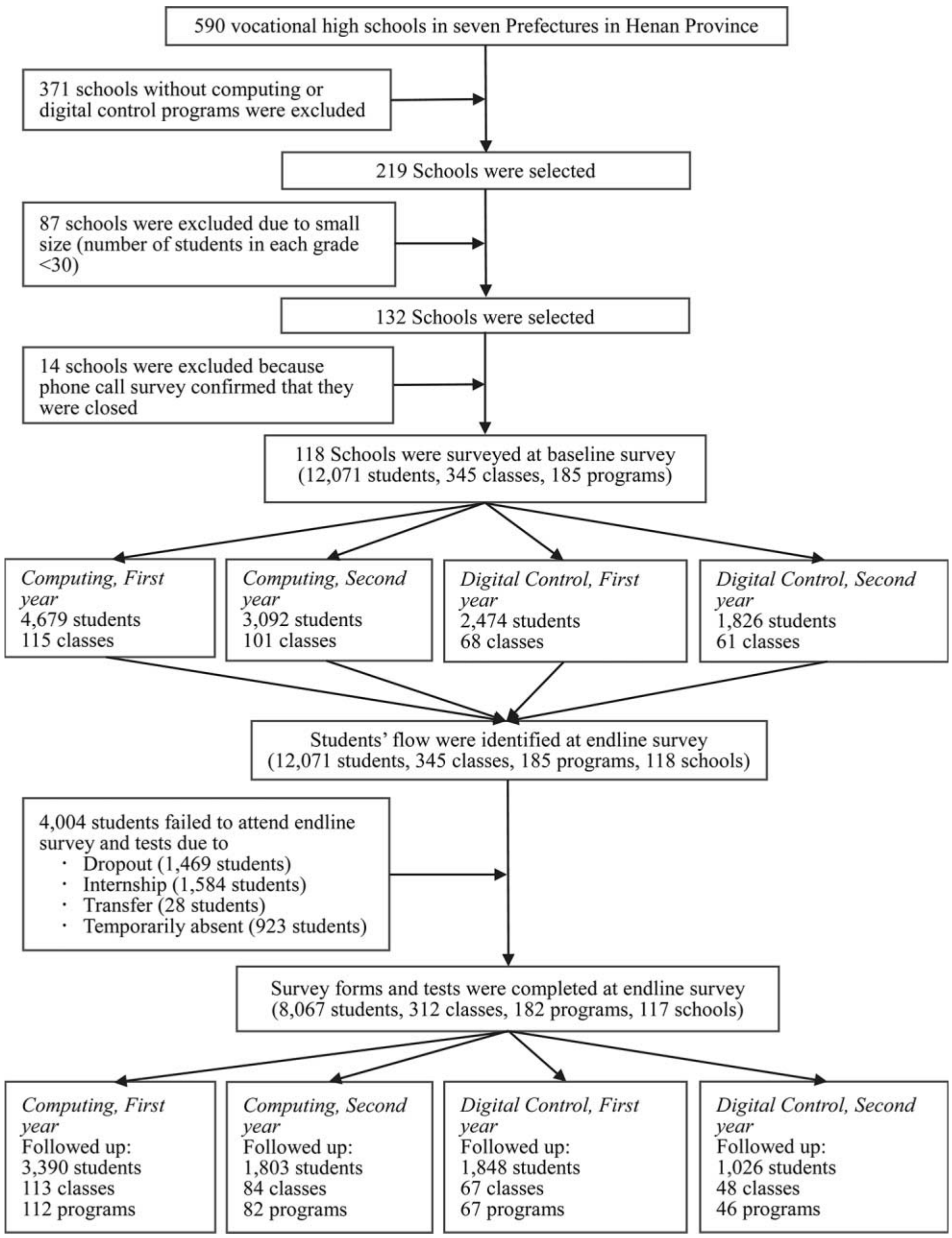

FIG. 1.—Procedure for sampling and data collection.

survey of principals included a series of questions about the basic characteristics of the school. Specifically, the survey asked about whether the school was public or private; whether the school was directly administered by the province's Department of Education (DoE) or by the province's Department of Human Resources and Social Security (DoHRSS); whether the school was a model school; the total number of students enrolled in the school; the ratio of students to teachers; and the share of teachers that graduated from 4-year universities or had advanced graduate degrees, per student expenditure in the previous year.

The baseline survey of students included two blocks. The first block gathered data about student vocational and general skills. Specifically, students took two standardized exams, one to test their skill in their program area, computing or digital control, and one to test their skill in math. More details on how the exams were constructed are available in the appendix. The exams were timed and closely proctored by enumerators.

The second block gathered basic information about student background characteristics (i.e., gender, age, whether they completed junior high school, parental education, migration, household assets). We used principal components analysis, adjusting for the fact that the variables are dichotomous and not continuous, to calculate a single metric of *socioeconomic status* for each student (see Kolenikov and Angeles 2009).[6]

In April 2014 (near the end of the academic year) we returned to our sample schools and conducted an endline survey. In addition to testing student vocational and general skills, we added three additional blocks to the endline student survey. In the first block, we asked students whether they had seen their classmates cheat on tests, skip class, copy homework, or argue with their teacher over the previous week. We also asked students if they had ever seen classmates engage in antisocial behaviors such as fighting, extortion, or bullying. Another set of questions sought to identify the prevalence of risky behaviors among peers, such as drinking alcohol or smoking. Finally, we collected data from students on the amount of time they used their computer or smartphone and on how long they used their computer or smartphone for entertainment (such as playing games, chatting, or watching movies).

In the second block, we collected detailed information about student internship experiences. We asked students whether they had participated in an internship at some point during the last academic year. If they had, students were asked about the details of their most recent internship experience (i.e., whether they were accompanied by teachers, whether internship work was related to their studies, and whether they would recommend this internship program to other students).

[6] We conduct standard robustness tests to see whether the use of polychoric PCA results in a viable socioeconomic status metric (Kolenikov and Angeles 2009).

The third block asked students about their attitudes toward VET schools. Specifically, we asked students to report the extent to which they were satisfied with their learning experiences in VET schools. Finally, to assess dropout rates, our enumerators filled in a student-tracking form for each class.

We should note that the attrition rate in our analytical sample was high for three general reasons: high rates of dropout (which is an important outcome of the study); the fact that some students were participating in internships and were not at school during the endline survey; or students had transferred or were temporarily absent. Out of 12,071 students, 4,004 (33 percent) students did not complete the survey or take the standardized tests at endline (April 2014) and are therefore not included in most of our analyses. In terms of the breakdown of reasons for attrition, 1,469 students dropped out of school, 1,584 students were away on internships, 28 students transferred to other schools, and 923 students were temporarily absent (fig. 1).

Because of these high attrition rates, we examined whether there were significant differences in baseline characteristics between attrited and non-attrited students (table A2). Attrited students were likely to be older (significant at 1 percent level), male (significant at 10 percent level), and junior high dropouts (significant at 1 percent level). Attrited students also had lower vocational and general skills at baseline (significant at the 5 and 1 percent levels, respectively). Although there is imbalance between attrited students and non-attrited students, it is likely that the attrited students had even worse endline outcomes than the non-attrited students (Loyalka et al. 2016). As such, results that rely on the sample of non-attrited students in most cases provide a liberal estimate of the quality of VET.

Statistical Approach

We first calculate each student's absolute gains in both general and vocational skills by comparing their baseline exam scores with their endline exam scores on a logit scale.[7] Second, we use a two-step procedure to examine whether the vocational and general skills of individual students showed significant improvement. More information on the transition of exam scores and the tests are available in the appendix.

We calculated the sample means to describe whether VET school students: (a) exhibited behavior that would be conducive to learning and social stability; (b) engaged in internships that would enable them to gain experience and learn valuable job skills; (c) self-reported being satisfied with their VET schools; and (d) stayed in school (or dropped out of school).

To examine whether differences in student outcomes are related to differences in school-level factors, we used hierarchical linear modeling (HLM)

[7] Our exam scores are on a logit scale that contains fractional and negative values. For the ease of interpretation, we transformed the scores to a 1,000-point scale, which is common practice in the educational assessment literature (Cook and Eignor 1991; Baker and Kim 2004).

to identify the school-level correlates of student performance (Raudenbush and Bryk 2001).

Within the HLM framework, we used the random intercept model as the basic specification for our analysis:

$$Y_{ij} = \gamma_{00} + \gamma_{10} X_{ij} + \gamma_{01} S_j + U_{0j} + r_{ij}, \quad (1)$$

where Y_{ij} represents the outcome variable of interest (e.g., endline measures of vocational skill, general skill, or dropout). The term X_{ij} is a vector of student characteristics (level-1 predictors, e.g., baseline measures of skills, age, gender, junior high completion, parental education, migration, and socioeconomic status). The term S_j is a vector of school characteristics (level-2 predictors, e.g., whether the school is public or private, whether the school is directly administered by the DoE or DoHRSS, total enrollment, student-teacher ratio, the share of teachers with university degrees, and per student expenditures). The first part of the model ($\gamma_{00} + \gamma_{10} X_{ij} + \gamma_{01} S_j$) refers to the overall expected effect of student and school-level characteristics on student performance. The terms U_{0j} and r_{ij} represent random school and individual-level error, respectively. The descriptive statistics of the variables are listed in table A3.

Results

Does Attending VET Improve Student Outcomes?

Vocational and General Skills.—Table 1 reports the vocational and general skill gains of students in our sample. The average absolute vocational skill

TABLE 1

Percentage of Students with Significant Vocational and General Skill Gains (%)

			Vocational Skill		General Skill	
Row	Program	Grade	Average absolute gains of students (total number of points = 1,000) (1)	% of students with significant progress[b] (2)	Average absolute gains of students (total number of points = 1,000) (3)	% of students with significant progress[b] (4)
1	Computing	1	9.1	10.0	6.4	10.2
2	Computing	2	11.4	10.3	4.8	8.1
3	Digital control[a]	1	NA	NA	4.6	9.1
4	Digital control[a]	2	14.2	10.1	1.3	5.9
5	Average		10.6	10.1	5.0	8.9

Source.—Authors' survey.

Note.—Although 12,071 students attended our baseline test, 4,004 (33%) students did not take the tests at the time of our endline survey due to dropout, internship, on leave, or other reasons (April 2014). In this analysis, only students (8,067 students) who attended the baseline tests and endline tests were included.

[a] We administered a computing test over first-year students in the digital control program at the beginning of the academic year, and administered a digital test for first-year students in digital control programs at the end of the academic year. These two tests are not comparable in IRT scale. Thus, the progress of first-year students in the digital control program are not available.

[b] We used t-statistics to examine whether the difference in endline and baseline measures is significant, taking into account the error of measurement. It has asymptotically normal distribution with mean = 0 and SD = 1. So all values of t-statistics out of range $(-2, 2)$ indicate a significant difference between baseline and endline measures. If $t > 2$, then the student's progress is significant. If $t < -2$, then the student's regress is significant. And finally, if t has value from $(-2, 2)$, then the difference in the student's measures is not significant.

gain over one academic year is 10.6 points, which only accounts for around 1.1 percent of the total number of points.[8] Furthermore, only 10.1 percent of students made significant progress in vocational skill over one academic year (whether it was the first or second academic year).

Students also made negligible gains in the case of general skills. Specifically, students made an average absolute gain of only 5.0 points in general skill over one academic year, which accounts for less than 0.5 percent of the total number of points. As in the case of vocational skill gains, the share of students that made gains in general skill was also small: only 8.9 percent of students made significant progress over one academic year (again, whether it was the first or second academic year).

When we look at student gain in vocational skill by grade, we find that students in both grades made limited progress. Although the absolute gain of second-year computing students is 2.3 points higher than that of first-year computing students, the share of students that made significant progress is almost the same (10.0 percent vs. 10.3 percent). This result indicates that in the first two years of in-school, on-campus learning, few students make any gain in vocational skill.

In addition, our results show that students in both programs were gradually losing general skills. The results show that the share of second-year computing students that made significant progress in general skill is less than first-year computing students by 2.1 percentage points (or 20 percent). In comparison with first-year digital control students, the share of second-year digital control students that made significant progress in general skill declined by 3.2 percentage points (or 35.2 percent). Overall, our results suggest that the education provided by VET programs does not result in students learning skills: students are not learning any vocational or general skills.

Internship Experiences of VET Students.—Table 2 describes the internship experiences of VET students. Nearly one-third of students in our sample completed an internship in their first or second year of VET schooling. Specifically, among the 12,071 students included in the baseline survey, 1,584 students were on internships on the day of endline survey, and an additional 1,791 had participated in an internship since the baseline survey. Altogether, 28.0 percent of our sample participated in an internship during their first two years of VET. This finding indicates that it is common for first- or second-year vocational students to participate in internships, although these internships are supposed to be completed in the third year of vocational schooling.

[8] We could not measure the gains in vocational skill among first-year digital control students because these students almost have no opportunities to learn relevant skills about digital control before starting at vocational schools. Instead, the first-year computing test was administered to first-year digital control students, but a digital control test was used in the endline.

TABLE 2

INTERNSHIP EXPERIENCES OF VOCATIONAL SCHOOL STUDENTS

							Most Recent Internship Experience[a]			
Row	Program	Grade	No. of Students at Baseline Survey (1)	No. of Students on Internships the Day of Endline Survey (2)	No. of Students at School the Day of Endline Survey Who Ever Participated in Internships since We Visited at the Baseline Survey (3)	% of Students with Internship Experience (4) = [(2) + (3)] / (1) × 100%	% of Students Age 16 When Internship Began (5)	% Not Accompanied by Teacher in Internship (6)	% Student Internship Unmatched with Program (7)	% of Students Who Would Recommend Internship to Other Students in Program (8)
1	Computing	1	4,679	108	496	12.9	13.5	39.9	65.7	54.1
2	Computing	2	3,092	775	540	42.5	1.1	41.5	78.0	41.6
3	Digital control	1	2,474	79	372	18.2	15.1	35.8	59.1	58.8
4	Digital control	2	1,826	622	383	55.0	1.0	37.1	66.7	48.6
5	Total/Average		12,071	1,584	1,791	28.0	7.4	38.9	68.2	50.1

SOURCE.—Authors' survey.

[a] These analyses only include a subsample of 1,791 students who took our endline survey at school and reported that they had ever participated in internships since we visited at baseline survey.

We also collected detailed information about the internship experiences of students (if they were at school on the day of endline survey). While internships are supposed to be part of the process of vocational education (Field et al. 2009; King 2011), our data show that VET schools are not abiding by the policy edicts from the government regarding the conduct and purpose of internships. For example, of the first-year students that took part in an internship (which itself, as reported above, is not part of the official VET education process), 13.5 percent of computing students and 15.1 percent of digital control students were underage (under 16 years old) at the time of the internship. Even in the second year, a small share (1 percent) of computing and digital control students were under 16 years of age at the time they participated in their most recent internship.

In addition to minimum age limits for participating in offsite internships, VET student-intern/workers are supposed to be accompanied by a teacher from their school while completing their internship (Ministry of Education, and Ministry of Finance of China 2007). However, 38.9 percent of students had no teacher accompany them on their internship. Interestingly, first-year students (computing: 39.9 percent; digital control: 35.8 percent) were less likely to be without a teacher than second-year students (computing: 41.5 percent; digital control: 37.1 percent), but the differences are not significant at the 10 percent level.

Furthermore, most student internships appeared to lack a clear educational purpose. In total, 68.2 percent of students reported that during their most recent internship they were working in a job that had nothing to do with their VET program. In fact, during interviews with students, it was clear that in most cases students were sent to work in low-wage manufacturing jobs, which means that they would have no educational purpose. Clearly, many schools were not following government regulations designed to protect students and ensure an educational component to the internships.

Given the widespread disregard for rules set up in students' interests, it should be no surprise that students were not satisfied with their internship experiences. In response to the question about whether they would recommend their most recent internship to their classmates, students were clear in their responses. More than half of first-year students (54.1 percent of computing students and 58.8 percent of digital control students) said they would not recommend their internship to students in their same program, even if they were asked to do so. The rate for second-year students was even higher. Taken together, approximately half of the students (50.1 percent) were dissatisfied with their internships.

Behavior in China's Vocational Education Programs.—In all schools in China, promoting high morals and producing good citizens are important objectives of the educational process (Ministry of Education of China 2014; National

People's Congress of China 2015). Policy makers are especially keen to see these aspects taught in VET schools (Ministry of Education of China 2014; Xinhua Agency 2015) However, according to our data, VET programs are falling short of this goal. In addition to neither teaching the intended skills nor adequately providing students with practical or educational internship experiences (see discussion above), VET schools also do not help students develop habits of good behavior (table 3).

Our survey found that misbehavior inside and outside of the classroom is a common occurrence among students in VET schools. The forms of misbehavior evaluated in our study include cheating on exams, cutting class, copying homework, and arguing with the teacher. According to our survey, 64.8 percent of students reported that they had observed their classmates misbehaving in the classroom at some point over the previous week. The two most prevalent forms of misbehaving in class are copying (50 percent) and cheating on tests (40 percent).

Even more seriously, a significant share of VET students said that they had observed classmates display antisocial behavior during the previous week, such as engaging in fighting, extortion, or bullying. According to our data, 21.2 percent of students observed such antisocial behaviors among their classmates in the previous week.

Finally, our survey also revealed that many VET students engage in risky health behaviors. Overall, 45.7 percent of students said they had observed classmates either drinking alcohol or smoking on campus. The share of first-year students (who are 16 years old, on average) is about the same as that of second-year students (who are 17 years old, on average). In short, our research suggests that displays of misbehavior, antisocial behaviors, and risky health behaviors are common among VET students in our sample.

In addition to displaying negative behaviors, VET students also spent a large amount of time on their computers or smartphones for purposes other

TABLE 3
Self-Reported Eyewitness of Negative Behaviors of Classmates in the Previous Week of Endline Survey

Row	Program	Grade	Classroom Misbehavior[2] (1)	Antisocial Behavior[3] (2)	Risky Health Behavior[4] (3)
1	Computing	1	68.3	24.2	46.4
2	Computing	2	64.7	15.0	44.4
3	Digital control	1	60.7	22.8	44.2
4	Digital control	2	61.2	19.2	48.0
5	Average		64.8	21.2	45.7

Source.—Authors' survey.

Note.—Only students who attended the endline survey were included in this analysis. Students self-reported eyewitness in the previous week of endline survey; we define they witnessed.

[a] Classroom misbehavior includes cheating on tests, missing class, copying homework, and/or talking back to the teacher.

[b] Antisocial behavior includes fighting, extorting, and/or bullying others.

[c] Risky health behavior includes drinking alcohol and/or smoking.

than learning. Our survey found that, on average, students spend 3.8 hours per day on their computers and smartphones for entertainment, such as playing games, watching television shows or movies, and social chatting (fig. 2). This amount of time spent on electronic devices for entertainment purposes is more than the total time (3.1 hours) that the average high school student in China spends on either a computer or smartphone whether for entertainment or any other purpose such as practical use or learning (China Internet Network Information Center 2016). The time spent by high school students in OECD countries (2 hours) is even lower (OECD 2015). This amount of time spent on electronic devices for entertainment purposes accounts for 63.6 percent of student daily use of electronic devices (regardless of grade or program; see fig. 2).

Self-Reported Satisfaction with VET and Dropout.—Given negligible gains in skills, poor internship experiences, and the high prevalence of negative behavior, it should be no surprise that more than 60 percent of students are dissatisfied with VET schools, measured by either self-reporting or dropping out (fig. 3). Of the students who completed the endline survey, 43.3 percent reported that they were dissatisfied with their overall learning experience. Additionally, 1,469 students (12.2 percent of the baseline students) arguably expressed their dissatisfaction by dropping out of their VET program during the academic year. Specifically, the dropout rate was 16.3 percent over the

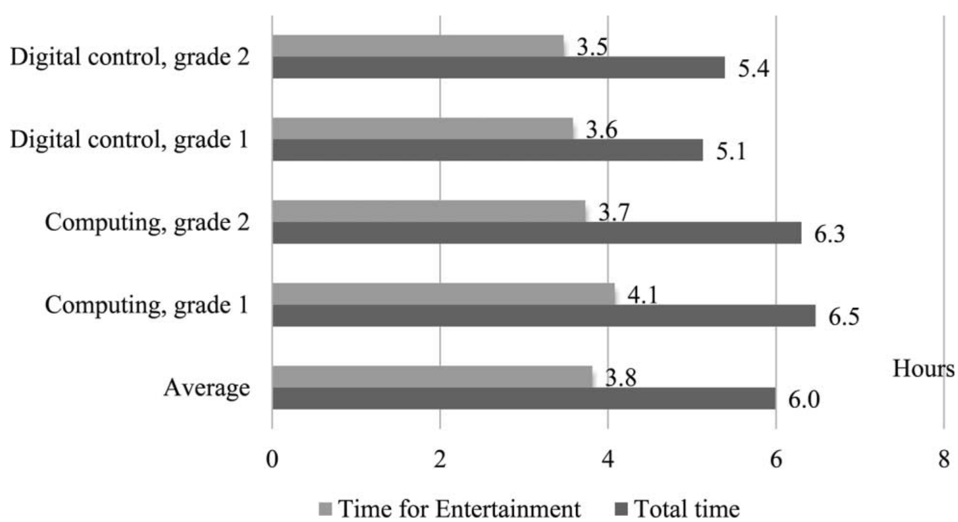

Fig. 2.—Self-reported daily use of computer or smartphone (hours).

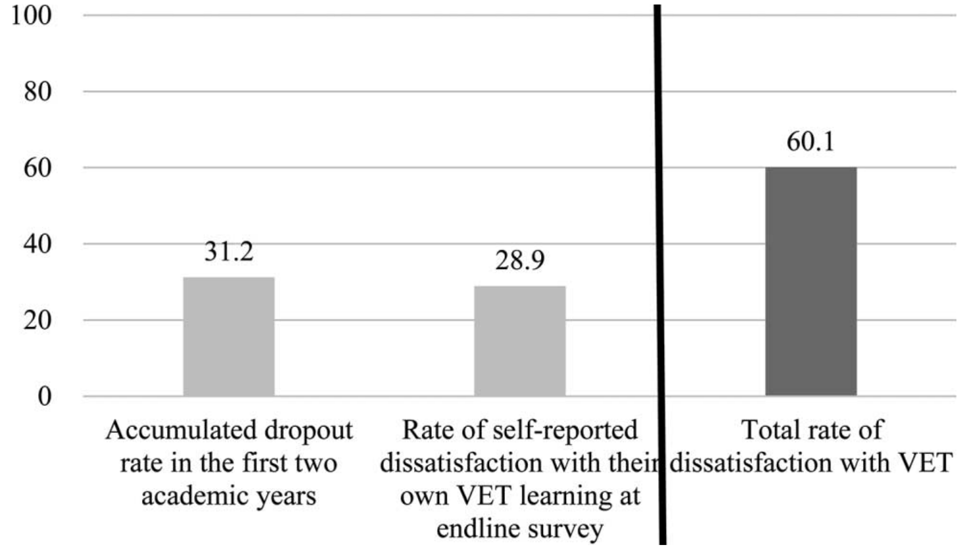

FIG. 3.—Dissatisfaction with VET (%).

academic year among first-year students and 6.2 percent over the academic year among second-year students. Moreover, an additional 10.3 percent of the baseline students dropped out during the vacation period between the two academic years, meaning the cumulative dropout rate in the first two academic years was 31.2 percent (fig. 3). Hence, in total, 60.1 percent of students expressed their dissatisfaction either in their survey response or by dropping out.

Correlates of Skill Gains/Losses and Dropout

We find that two school-level factors are correlated with vocational skill at the end of the academic year (table 4). First, students from public schools have lower vocational skill than their counterparts from private schools by 9.1 points (significant at the 5 percent level). This finding is consistent with the results of similar studies on general schooling (Hanushek 1986; Thapa 2013). One possible explanation might be that principals in private schools may have more power to decide what kind of resources they employ to improve vocational skills (OECD 2012). Second, students from schools directly administered by the DoE have lower vocational skill at the end of the academic year than students from schools directly administered by the DoHRSS (by 10.1 points). To some extent, this may be explained by the fact that the DoHRSS has a stronger background and tradition in vocational training

TABLE 4
DETERMINANTS OF STUDENT PERFORMANCE

	Vertically Scaled Score of Vocational Skills at Endline[a] (1)	Vertically Scaled Score of General Skills at Endline (2)	Dropout (3)
Fixed Effects			
Intercept	140.625***	219.410***	.849***
	(12.399)	(12.354)	(.068)
Student-level characteristics (level 1):			
1. Digital control (yes = 1)	2.523	2.465**	−.038***
	(1.728)	(1.205)	(.008)
2. Age (year)	1.823***	.925***	−.010***
	(.397)	(.331)	(.002)
3. Sex (male = 1)	−1.511	−7.488***	.021***
	(1.272)	(1.158)	(.008)
4. Not completing junior high schools (yes = 1)	−1.100	−4.018***	.042***
	(1.394)	(1.175)	(.007)
5. Vertically scaled score of vocational skills at baseline (points)	.538***	.098***	−.001***
	(.014)	(.012)	(.000)
6. Vertically scaled score of general skills at baseline (points)	.198***	.461***	−.000***
	(.014)	(.011)	(.000)
7. At least one parent received at least a high school or higher education (yes = 1)	−2.737**	−3.199***	−.019***
	(1.361)	(1.140)	(.007)
8. No parents migrated in the past year (yes = 1)	−2.409**	−2.160**	−.010
	(1.206)	(.997)	(.006)
9. Bottom tercile of the socioeconomic index (yes = 1)	−1.084	.728	−.003
	(1.276)	(1.045)	(.007)
School-level characteristics (level 2):			
10. Public school (yes = 1)	−9.126**	−3.083	.031
	(4.545)	(5.527)	(.026)
11. Directly administered by Department of Education (yes = 1)	−10.105***	3.029	.005
	(3.693)	(4.373)	(.021)
12. Model school (yes = 1)	−2.780	−4.130	.027
	(3.689)	(4.421)	(.021)
13. Total enrollment in June 2013 (× 1,000)	1.341	−.471	−.008
	(.974)	(1.181)	(.006)
14. Student-teacher ratio	−.455***	−.118	−.001*
	(.144)	(.176)	(.001)
15. % of teachers with university degrees	−.022	.034	−.001
	(.070)	(.084)	(.000)
16. Per student expenditure in 2012 (10,000 yuan/person)	−1.051	−.876	.000
	(.727)	(.885)	(.004)

TABLE 4 (*Continued*)

	Vertically Scaled Score of Vocational Skills at Endline[a] (1)	Vertically Scaled Score of General Skills at Endline (2)	Dropout (3)
Random Effects			
17. Intercept	148.069***	249.901***	.005***
	(27.433)	(39.614)	(.001)
18. Residual	1,688.480***	1,507.190***	.095***
	(32.167)	(25.051)	(.001)
N of observations	5,620	7,346	10,848
N of groups	101	103	104

NOTE.—Standard errors in parentheses.
[a] First-year digital control students are excluded from this regression because their vocational tests are not comparable between baseline and endline.
* $P < .10$.
** $P < .05$.
*** $P < .01$.

(Ministry of Human Resources and Social Security of China 2015). It is important to keep in mind, however, that although there are statistically significant differences between public and private schools and between DoE and DoHRSS schools, the magnitude of the differences is quite small.

Other school-level factors, and almost all school inputs with the exception of student-teacher ratios, are not correlated with vocational skill at the end of the academic year. These school inputs include whether the sample school is a model school, total enrollment, the share of teachers that graduated from university or above, and per student expenditures.

When we examine the association between either general skills or dropout on the one hand and school-level factors on the other, we find almost no associations are statistically significant (table 4). One exception is that the student-teacher ratio is negatively correlated with the dropout in the academic year (significant at the 10 percent level). However, the effect size of student-teacher ratio is negligible (0.1 percent).

We also ran a robustness check to examine whether our results remain constant when we use multiple imputation to account for missing data arising from attrition and missing values for student and school characteristics. One concern might be that our current interpretations about which school-level factors are correlated with skills or dropout are driven by the nature of our data set (i.e., sample of observations that did not include the students that attrited between baseline and endline). If we were to include data from the missing students, perhaps our results would change. While multiple imputation cannot fully reconstruct the missing data, we conduct the analysis to determine how sensitive our existing analysis is to missing data under the "missing at random (MAR)" assumption (Carpenter et al. 2007). The tables for this analysis are in table A4; when using the larger data set (constructed by using multiple imputation), the results are similar to and support the results presented above.

Discussion

Since VET is often considered the second-best option, it may be tempting to attribute the failure of the VET system to low student and parent morale. However, there is little evidence that this is the case. A randomized field experiment on vocational school stereotype threat conducted by Chu et al. (2017) shows that VET students do not internalize negative stereotypes related to VET (such that it affects their cognitive outcomes).

We posit three reasons why the quality of VET is so low in China. First, we point out that models of successful VET systems in the world—those in Germany, Switzerland, and Austria, for example (Pedró et al. 2009; Kathrin and Schwartz 2010), were developed and improved over centuries with regards to a particular social, political, and economic climate. The much larger scale mass expansion of VET in China and other Asian-Pacific countries, by contrast, has occurred in the relatively short span of one or two decades. Developing the right teaching resources and know-how for building a successful VET system in a short amount of time and integrating that system with the constantly evolving needs of industry in a large and rapidly changing economy are each Herculean tasks.

Second, there may be a fundamental absence of understanding—even by policy makers (either regional and/or national)—that VET students do not require focused training in general skills. In many policy documents, the impetus to expand VET in China has been characterized as a movement to help students find a job (Chinese State Council 2003; Ministry of Education of China 2005). There is much less rhetoric that pushes educators to emphasize general academic skills. Because of this, VET school principals and teachers may have tended to focus too much on the teaching of professional ethics, specific vocational skills, and the ability to find and hold a job (Central People's Government of China 2010). Hence, it may be that the gains in general skills are so low because of the absence of any imperative to teach them. However, international experiences have shown that general skills increase the prospect of lifelong learning and enable students to adapt to the long-term demands of the economy (Chiswick et al. 2003; Field et al. 2009).

Third, unlike almost every other area of schooling in China, vocational schooling lacks assessment and accountability. The vast majority of students in China participate in high-stakes high school and college entrance exams (Ding and Lehrer 2007; Li et al. 2015). Teachers and school administrator incentives and rewards are often tied to how well students perform on these exams (An 2015; Sina 2016; Xue and Wang 2016). By contrast, there is little assessment, and therefore little accountability, in VET. Introducing assessment and accountability, both from government and industry, may help improve student outcomes in VET (Field et al. 2009).

The lessons that we have learned in China's VET system may well apply to other countries in the Asia-Pacific region (Stewart 2015). First, in the case of countries such as Indonesia and Thailand, there is more or less a shared industrial structure (World Bank 2016). Due to these similarities, it might be possible to conclude that a VET education would have similar demands for and impacts on human capital in these countries.

Second, other Asia-Pacific countries may also benefit from understanding the experiences of China in how it has been successful (and has not) in being able to use VET to build human capital. The case of China might be especially relevant to developing countries that are trying to rapidly build a VET system in a globalized world. For example, nations such as Indonesia, Thailand, and Vietnam have all made concerted efforts to rapidly expand vocational schooling and on a massive scale in the past decade or so (UNESCO-UNEVOC 2014). Like China, they do not appear to have the requisite resources or know-how for building a thriving VET system in a short period of time. Adapting the VET system to the rapidly evolving needs of industries in fast-developing economies is also undoubtedly a challenging task for policy makers and school administrators in these countries.

Finally, vocational schooling in many Asia-Pacific countries such as in Vietnam, Nepal, and Sri Lanka is also characterized by a lack of assessment and accountability (ADB and Australian Aid 2014). The China case might raise concerns on the quality of vocational education in these countries.

Conclusion

The overall goal of expanding VET in developing countries is to help students increase vocational and general skills, develop positive social behaviors, and increase work experience.[9] However, to date little research has been conducted to examine to what degree these goals have been achieved. To fill in this gap, we used representative, longitudinal data on over 12,000 students from 118 VET schools in one province of central China to measure student gains in vocational and general skills, the quality of internships available to students, the prevalence of negative behaviors among students, as well as student dissatisfaction with VET.

We find that the VET is not meeting its goals. Around 90 percent of VET students did not make any improvements in vocational and general skills over one academic year. Students are surrounded by peers that engage in negative social behaviors, and student internships are also of low quality, often because

[9] Chiswick et al. (2003); Sheldon and Thornthwaite (2005); Field et al. (2009); UNESCO (2012).

they do not adhere to basic government requirements to ensure student safety and well-being. Students also report that they are not learning from internships. On the whole, close to two-thirds of students expressed dissatisfaction with their VET programs or dropped out.

An examination of the correlation between school-level factors and student outcomes provides a modicum of insight for how to improve the quality of VET in China. The type of agency in charge of managing the school (public vs. private or DoHRSS vs. DoE) explained a small amount of the variation in vocational skill gains. However, almost none of the observable school inputs could predict skill gains or student dropout.

Taken together, the results tentatively suggest that policy makers interested in improving the quality of VET may need to move beyond increasing resources in VET to introducing and evaluating programs that can improve how VET schools are managed. We further suspect that improving how VET schools are managed may well extend beyond determining which type of agency steers the VET school toward introducing greater assessment and accountability into the VET school system. Indeed, VET school systems in China and elsewhere, unlike general schooling systems, are often characterized by an almost complete lack of assessment and accountability. Whether introducing assessment and accountability into the VET school system can improve a wide range of student outcomes is, however, an open empirical question and the subject of future research.

Appendix
Design of Tests

A multistep procedure was used to construct the tests and ensure that they were valid (represented the types of skills that students are expected to acquire in upper-secondary vocational education and training [VET] schools in China). First, we used national and provincial curricula standards for VET schools to define the content domains for our tests. We then collected a pool of exam items, including 135 math items, 162 computer items, and 164 digital control items. These items mirror these content domains from official textbooks and VET college entrance examinations. To further verify that the items were being covered in actual curricula taught in VET schools, we asked 28 VET schoolteachers to serve as content experts. We asked these content experts to review our test items based on whether the item measures content taught in VET schools, the difficulty of the item, and the time it took students to complete the item. Based on the feedback we received, we selected a subset of items to make up a pilot version of the tests.

To ensure that our tests had good psychometric properties, we conducted a pilot round of tests with over 1,000 VET students in September 2013. We analyzed data from the pilot to filter out items that exhibited poor psychometric properties. We carefully selected the items that strengthened the reliability of the tests while maintaining balance of test items from different curricular content areas. With the selected items, we created final tests that had a high degree of reliability (person reliability of 0.7 to 0.8).

All examinees were estimated using the Rasch model. Student measures were obtained by the method of maximum likelihood implemented with Winsteps software. As a result, three scales were constructed: one scale for math (from first-year baseline, first-year endline [same to second-year baseline], second-year endline tests), one for computing (from first-year baseline, first-year endline [same to second-year baseline], second-year endline tests), and finally one for digital control (from first-year endline [same to second-year baseline)] and second-year endline tests). Each student who participated in both cycles of assessment on a particular test (math, computing, and digital control) has two scores. If a student participated only in one cycle (baseline or endline), he has only one score.

The estimates: test scores of test takes are on the logit scale and are not appropriate for reporting to test takers and stakeholders since they contain fractional and negative values. The estimates are traditionally transformed from the logit scale to another, more convenient one. To this end, a 1,000-point scale was selected, which is widely used in the world testing practice, in particular, in international monitoring assessments.

Transition to the 1,000-point scale was performed using a linear transformation that maintains the scale metricity and does not distort intervals between the objects. Scores of all students for each test (math, computing, and digital control) were transformed from the logit scale to the 1,000-point scale with the average value of 500 and standard deviation of 50.

The *t*-statistics are calculated to test a hypothesis if the difference in endline and baseline measures is significant taking into account the error of measurement. The *t*-statistics are calculated as

$$t = \frac{\text{measure\_endline} - \text{measure\_baseline}}{\sqrt{(\text{SEM\_endline})^2 + (\text{SEM\_baseline})^2}},$$

where measure_endline is a student's test score on endline test (at logit scale), measure_baseline is the student's test score on baseline test (at logit scale), and SEM_endline and SEM_baseline are associated errors of measurement. It has asymptotically normal distribution with mean $= 0$ and SD $= 1$. So all values of *t*-statistics out of range $(-2, 2)$ indicate a significant difference between baseline and endline measures. If $t > 2$, then the student's progress is significant. If $t < -2$, then the student's regress is significant. And finally, if t has value from $(-2, 2)$ then the difference in the student's measures is not significant.

TABLE A1

Descriptive Statistics of Students and Schools at Baseline

Variable	Mean	SD	Min	Max
Student characteristics:				
1. Digital control (yes = 1)	.36	.48	0	1
2. Age (year)	16.47	1.55	12	47
3. Sex (male = 1)	.72	.45	0	1
4. Not completing junior high schools (yes = 1)	.35	.48	0	1
5. Vertically scaled score of vocational skills at baseline (points)	495.36	45.66	199.33	666.96
6. Vertically scaled score of general skills at baseline (points)	497.10	48.00	233.58	735.32
7. At least one parent received at least a high school or higher education (yes = 1)	.23	.42	0	1
8. No parents migrated in the past year (yes = 1)	.62	.49	0	1
9. Bottom tercile of the socioeconomic index (yes = 1)	.33	.47	0	1
School characteristics:				
10. Public school (yes = 1)	.79	.40	0	1
11. Directly administered by Department of Education (yes = 1)	.76	.43	0	1
12. Model school (yes = 1)	.55	.50	0	1
13. Total enrollment in June 2013 (× 1,000)	2.49	2.20	.10	13.00
14. Student-teacher ratio	16.74	12.26	1.04	126.03
15. Share of teachers with university degrees (%)	81.96	22.61	4.60	100.00
16. Per student expenditure in 2012 (10,000 yuan/person)	.91	1.73	.03	15.46

TABLE A2

Comparison of Basic Characteristics at Baseline between Non-attrited Students and Attrited Students

Variable	Non-attrited Students (1)	Attrited Students (2)	Difference (3) = (2) − (1)	*P*-value
Student characteristics:				
1. Digital control (yes = 1)	.36	.36	−.000	.996
2. Age (year)	16.40	16.61	.209***	.000
3. Sex (male = 1)	.71	.75	.033*	.052
4. Not completing junior high schools (yes = 1)	.32	.40	.076***	.001
5. Vertically scaled score of vocational skills at baseline (points)	497	493	−3.688**	.044
6. Vertically scaled score of general skills at baseline (points)	500	491	−9.125***	.000
7. At least one parent received at least a high school or higher education (yes = 1)	.22	.24	.017	.105
8. No parents migrated in the past year (yes = 1)	.61	.63	−.017	.223
9. Bottom tercile of the socioeconomic index (yes = 1)	.34	.32	−.026	.109
School characteristics:				
10. Public school (yes = 1)	.81	.77	−.036	.359
11. Directly administered by Department of Education (yes = 1)	.77	.74	−.028	.381
12. Model school (yes = 1)	.56	.51	−.051	.183
13. Total enrollment in June 2013 (×1,000)	2.52	2.43	−.094	.601

TABLE A2 (*Continued*)

Variable	Non-attrited Students (1)	Attrited Students (2)	Difference (3) = (2) − (1)	*P*-value
14. Student-teacher ratio	16.63	16.97	.337	.672
15. Share of teachers with university degrees (%)	81.34	83.25	1.909	.424
16. Per student expenditure in 2012 (10,000 yuan/person)	.94	.83	−.111	.194

Data Source.—Authors' survey.
* $P < .10$.
** $P < .05$.
*** $P < .01$.

TABLE A3
Descriptive Statistics of Variables

Variable	Row	Obs.	Mean	SD	Min	Max
Outcome variables:						
Vertically scaled score of vocational skills at endline (points)	1	8,046	508	54	169	777
Vertically scaled score of general skills at endline (points)	2	8,045	505	52	256	735
Dropout	3	12,071	.12	.33	0	1
Student characteristics:						
Digital control (yes = 1)	4	12,071	.36	.48	0	1
Age (year)	5	12,070	16.47	1.55	12	47
Sex (male = 1)	6	12,071	.72	.45	0	1
Not completing junior high schools (yes = 1)	7	12,044	.35	.48	0	1
Vertically scaled score of vocational skills at baseline (points)	8	12,056	495	46	199	667
Vertically scaled score of general skills at baseline (points)	9	12,061	497	48	234	735
At least one parent received at least a high school or higher education (yes = 1)	10	12,068	.23	.42	0	1
No parents migrated in the past year (yes = 1)	11	11,959	.62	.49	0	1
Bottom tercile of the socioeconomic index (yes = 1)	12	12,040	.33	.47	0	1
School characteristics:						
Public school (yes = 1)	13	118	.80	.40	0	1
Directly administered by Department of Education (yes = 1)	14	118	.74	.44	0	1
Model school (yes = 1)	15	118	.50	.50	0	1
Total enrollment in June 2013 (× 1,000)	16	118	2.26	2.19	.10	13.00
Student-teacher ratio	17	116	16.49	15.46	1.04	126.03
Share of teachers with university degrees (%)	18	111	82.79	21.74	4.60	100.00
Per student expenditure in 2012 (10,000 yuan/person)	19	108	1.11	1.99	.03	15.46

Data Source.—Authors' survey.

TABLE A4

Determinants of Students Performance-Multiple Imputation Results

	Vertically Scaled Score of Vocational Skills at Endline[a] (1)	Vertically Scaled Score of General Skills at Endline (2)	Dropout (3)
Fixed Effects			
Intercept	124.388***	171.453***	.793***
	(12.768)	(25.128)	(.067)
Student-level characteristics (level 1):			
1. Digital control (yes = 1)	.046	3.899**	−.044***
	(1.962)	(1.592)	(.007)
2. Age (year)	2.192***	1.607***	−.005**
	(.442)	(.375)	(.002)
3. Sex (male = 1)	−2.457*	−8.068***	.021***
	(1.322)	(1.285)	(.007)
4. Not completing junior high schools (yes = 1)	−.031	−1.613	.047***
	(1.601)	(1.796)	(.007)
5. Vertically scaled score of vocational skills at baseline (points)	.531***	.126***	−.001***
	(.017)	(.026)	(<.001)
6. Vertically scaled score of general skills at baseline(points)	.212***	.500***	−.0003***
	(.013)	(.012)	(<.001)
7. At least one parent received at least a high school or higher education (yes = 1)	−2.520*	−3.998***	−.021***
	(1.407)	(1.498)	(.007)
8. No parents migrated in the past year (yes = 1)	−2.223*	−2.502**	−.008
	(1.246)	(1.117)	(.006)
9. Bottom tercile of the socioeconomic index (yes = 1)	.675	1.733*	−.006
	(1.246)	(1.118)	(.007)
School-level characteristics (level 2)			
10. Public school (yes = 1)	−3.804	−.294	−.001
	(3.060)	(3.540)	(.026)
11. Directly administered by Department of Education (yes = 1)	−5.146**	3.446	.005
	(2.557)	(2.905)	(.021)
12. Model school (yes = 1)	−3.055	−4.584	.026
	(2.569)	(2.967)	(.021)
13. Total enrollment in June 2013 (× 1,000)	.850	−.412	−.008
	(.643)	(.731)	(.005)
14. Student-teacher ratio	−.417***	−.076	−.001*
	(.095)	(.113)	(.001)
15. Share of teachers with university degrees (%)	−.034	−.016	−.0002
	(.050)	(.063)	(<.001)
16. Per student expenditure in 2012 (10,000 yuan/person)	−1.176**	−.748	−.002
	(.544)	(.616)	(.004)

TABLE A4 (*Continued*)

	Vertically Scaled Score of Vocational Skills at Endline[a] (1)	Vertically Scaled Score of General Skills at Endline (2)	Dropout (3)
Random Effects			
17. Intercept	8.186***	10.709***	.079***
	(.882)	(1.038)	(.007)
18. Residual	43.030***	42.737***	.313***
	(.505)	(1.528)	(.002)
N of observations	9,597	12,071	12,071
N of groups	118	118	118

[a] First-year digital control students are excluded from this regression because their vocational tests are not comparable between baseline and endline. Standard errors in parentheses. Imputations = 20.
* $P < .10$.
** $P < .05$.
*** $P < .01$.

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