

# Special Class for the Gifted Young: A 34-Year Experimentation With Early College Entrance Programs in China

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This article introduces the Special Class for the Gifted Young (SCGY), an early college entrance program in mathematics and science in China, which has been a focus for media coverage and public discussion of accelerated education in China. We first describe the admission policy and academic programming of SCGY and delineate its distinct features. Next we summarize findings regarding the long-term trajectories and accomplishments of its graduates. We then present our interview studies with graduates of SCGY and raise a set of questions for future research. The evidence shows that, when admission policy, academic programming, and student support are fashioned to optimize student learning and growing experiences, early college entrance programs can be effective ways of producing a pipeline of talents to the benefit of society while also benefiting the individuals involved.

**Keywords:** acceleration, case study, China, college, early entrance, gifted education, grounded theory, honors class, residential, science, STEM, technology

## INTRODUCTION TO THE SPECIAL CLASS FOR THE GIFTED YOUNG

The Special Class for the Gifted Young (SCGY) is a residential early college entrance program at the University of Science and Technology of China (USTC), which is affiliated with the Chinese Academy of Sciences. SCGY was founded in March 1978, at the suggestion of Tsung-Dao Lee, a Nobel Laureate in physics. It was a result of the Chinese government's initiatives to reform and reinvigorate China through advances in science and technology. The motivation was to create a pipeline of scientific talents as quickly as possible in order to boost the economic development of the country (Liu & Zhang, 2011). SCGY has been one of the most prestigious math and science early college entrance programs in China. In 2009, 31 years after its inception, SCGY was officially renamed as the School of the Gifted Young. We will continue to use the name SCGY in this article to honor the continuity of its history.

## Admission Policy and Procedures

The admissions policy of SCGY has gone through changes over the past 3 decades and has become quite stable now. SCGY annually admits a highly selective group of about 40–50 students between the ages of 14 and 16 years who have demonstrated exceptional academic abilities, particularly in math and science. Applicants usually have finished their precollege education at least one year ahead of those enrolled in regular high-school programs. Typically, students begin their application process in the beginning of the 11th grade and take the National College Entrance Exam, the main screening assessment of SCGY, at the end of the 11th grade. The admission process consists of three steps.

- Step 1: Applicants who score at the top 3% in the National College Entrance Exam are eligible to enter the second round of the screening process.
- Step 2: Eligible applicants take an internal written test in math and physics with an emphasis on proficiency and flexibility in problem solving.
- Step 3: Finalists are invited and required to spend one week with the SCGY staff on the campus of USTC, during which they take lessons in math, physics, and English, taught by professors at the USTC, and then are tested for their facility in comprehension and the rate and ease of learning.

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In addition, interactions and observations during the finalists' 1-week campus visit are documented and used as a form of more dynamic assessment to assess student characteristics not amenable to paper-and-pencil tests, such as interest in math and science. When different opinions occur among the admission staff regarding specific individuals, interviews are conducted with these finalists to facilitate consensual decisions. In recent years, the 40–50 students admitted to the SCGY are typically from an applicant pool of 2,000–3,000 nationwide. On average, SCGY students are approximately 15 years old at the time of entrance, usually 2 to 3 years younger than regular college entrants in China.

### Academic Programming

The SCGY students begin their undergraduate studies once they enter the program. Aligning with the practices of regular undergraduate programs at USTC, from 1978 to 1999, SCGY students generally had completed their studies in 5 years and were granted a bachelor's degree upon graduation. Starting in 2000, the program switched from a 5-year to a 4-year program, as a result of university-wide curriculum reforms at USTC.

SCGY was the earliest in China to adopt a more “Western” approach to undergraduate studies: students do not declare their majors until the end of their second year (and since 2000, until the end of the first year). During the first 2 years of their study, students take foundational courses on mathematics, physics, English, and computer sciences. After that, students can choose a major of their own interest and proceed to complete their bachelor's degree. For decades, the freedom of choosing a major has been a special privilege for SCGY students, in comparison to regular Chinese college students whose majors are declared before they enter college.

The SCGY academic program has five distinct features that have taken shape over the past 3 decades. First, there is an emphasis on solid disciplinary foundations in the first 2 years of the program as well as diversity and multiple- or cross-disciplinary inquiry. SCGY students are granted flexibility in choosing from a range of course offerings, while also being provided with a combination of courses that are optimal for their academic development. Pedagogically, *self-study plus intensive instruction* (自学-精讲) is a sequence used to enhance in-depth foundational knowledge (e.g., mathematical theory) beyond the “introductory-level” survey.

Second, there is a strong research component. Students are encouraged to attend seminar courses, sign up for various student research projects, and get involved in graduate students' or professors' research projects. In junior and senior years, SCGY students are required to take lab research internships inside and outside of the university. Over the years, SCGY has built strong connections with internships that have many partners within and outside of the university.

For example, SCGY students spend their junior year summer in Beijing, interning at one of the research institutes associated with the Chinese Academy of Sciences, such as the Institute of Physics, the Institute of High Energy Physics, and the Institute of Mechanics. During their internships, they are involved in many aspects of scientific research at the institutes. Completing internships is part of the graduation requirements for SCGY students.

Third, there is a mentorship program, in which leading scientists, including several Nobel Laureates, from many disciplines at USTC and its associated research institutes serve as SCGY students' academic mentors. Mentors introduce the history of their respective departments, recent status updates, disciplinary knowledge, research directions, and career prospects. In addition, office spaces are arranged for two mentors to receive students who seek academic consultations in an individual or small group basis two afternoons each week. The information and backgrounds of the mentors are posted on the SCGY website 1 week in advance to allow students to make their consultation plans align with their own study interests and the mentors. Furthermore, mentors create opportunities for the early entrants to participate in their research projects from the early stages of their college career. For example, some early entrants are involved with their mentors' research from the sophomore year, working with some master's and doctoral students in the labs. These early exposures to research and graduate study training appear to be quite beneficial to the cultivation of their creativity and research productivity.

Fourth, SCGY encourages students to participate in extracurricular activities. SCGY students are active participants of various science- and technology-related competitions, such as robot competitions, Challenge Cup, and an international mathematical contest in modeling. Lastly, SCGY students have the opportunity to choose diverse majors and pathways. Historically, the majority of SCGY students were offered one of the following four majors: math, physics, computer science, and electronic engineering. In more recent years, the range of chosen majors has been more diverse. For example, biology, chemical engineering, and mechanical engineering majors are also available for students to choose. Students are also allowed to switch majors.

### Supervision and Counseling

Each year, entering students are grouped into one or two classes. One class supervisor is designated to play leadership and management roles for each class. Class supervisors usually are formal employees of the university. Their main responsibilities include monitoring students' academic progress and behavior; intervening if problems arise; communicating with parents; providing guidance on study, time management, and social skills; providing help for students with social or emotional challenges; conducting evaluations

of students each semester and year; and selecting candidates for awards, fellowships, and financial assistance. Class supervisors also serve as valuable references for job and graduate school applications. In addition to class supervisors, the university has a psychological counseling program that is free for all students. Several trained counselors are available to help students with social or emotional difficulties.

A unique feature of SCGY is that even after the students have chosen their own majors after the first 2 years of foundational courses, organizationally, they remain in the SCGY class throughout their undergraduate program. They can take different courses relevant to their chosen fields, but they are members of the same SCGY class who have class meetings regularly. Often students of different majors live in the same dormitory. As a result, the early entrants interact with each other on a daily basis. The residential component makes this easier, because SCGY students are required to live in a dormitory on campus. The university designates closely supervised residential areas for students who are usually separate from other college students. Students live in a dormitory when classes are in session. They can choose to go home during the 1- to 2-month summer break. This creates opportunities for them to learn something different from their own chosen fields, which appears to be beneficial for SCGY students.

### THREE INNOVATIONS THAT HAVE STRENGTHENED THE SCGY

Three innovations in the history of SCGY are particularly worth mentioning with regard to the evolving and adaptive nature of the SCGY programming and management: (a) the establishment of “Software Class” within the SCGY in 1984, (b) the establishment of the Honors Class (Double-Zero Class) in juxtaposition with SCGY in 1985, and (c) Partnering with Beijing Jingshan School and Suzhou Secondary School in establishing “prep schools” for SCGY in 1985.

The Software Class is a “class within a class” in that it is a branch of SCGY specializing in software design, created in collaboration with the Department of Computer Science at the university at the suggestion of Chen-Ning Yang, a Nobel Laureate in physics. It was a deliberate effort to produce a new generation of software scientists and engineers through a multidisciplinary program in conjunction with a mentorship system and student research program. A unique feature of the Software Class is that it holds its own classes as a group, unlike other SCGY students who go to various departments for course-taking depending on the academic subjects. Given the highly technical nature of software designing, such early specialization with heightened intensity appears to be quite effective, as summarized later in the Research section of this article.

The Honors Class, established in 1985 and initially called the “Experimental Class” or the “Double-Zero Class” (a name originated from the numerical departmental system of the university), is a class within a class in that it is integrated into the SCGY. Each year, the Honors Class selects approximately fifty 18-year-old honors students from about 2,000 freshmen admitted to the university. These students are the top scorers on a university-wide achievement test administered in the first month of the freshman year. Once they are selected, they leave their original departments, officially join the Honors Class, and remain with SCGY until their graduation. They receive the same education program as the early college entrants, share dorm rooms together, and often become helpers and pals to the earlier college entrants. Many SCGY early entrants have commented that the honors students are more mature and have been excellent role models. This tradition of having the two groups under the same hat of SCGY continues to date. As of 2008, 1,151 students were enrolled in the Honors Classes and 809 of them had graduated. In a way, the honors students are a natural comparison group of the early entrants.

The third innovation is the establishment of two prep schools (i.e., Beijing Jingshan School and Suzhou Secondary School) for the SCGY, which can be seen as “class before class,” in that, starting from the middle-school levels, these prep schools select and prepare potential candidates for the SCGY and ensure their smooth transition into their college careers. An important feature of these prep schools is their flexibility in selecting and placing the students in a manner matching their achievement levels. For example, if qualified, seventh- and eighth-grade middle-school students can skip ninth grade and enter 10th grade. In these two prep schools, all students are expected to finish high education in 2 instead of 3 years. It is worth noting that Xiaowei Zhuang and Tianxi Cai, graduates of SCGY, two full professors at Harvard University now, both came from one of the prep schools (i.e., Suzhou Secondary School).

### Other Early College Entrance Programs in China

After the establishment of SCGY in 1978, there was an upsurge of early college entrance programs in the 1980s in China. Specifically, 12 Chinese universities launched programs similar to SCGY. After about a decade of experimentation, most of the programs have closed down for various reasons. To date, SCGY is one of the three remaining early college entrance programs in China. The other two programs reside in Xi'an Jiaotong University and Southeast University. In recent years, more than 2,000 students nationwide have competed for 40–50 spots offered by SCGY each year. In 2012, more than 1,730 students nationwide competed for the 100–130 openings offered in the early college entrance program in Xi'an Jiaotong University. The program in Southeast University continues but recruits a smaller number of students. For example, it attempted to recruit fewer

than 10 students in 2011. It can be expected that SCGY will continue to play a leading role in accommodating science, technology, engineering, and mathematics (STEM)-talented adolescents in China.

## RESEARCH

Although informal and journalistic reports have made SCGY a household name in China, there is very little systematic empirical research conducted on the program. At the 30th anniversary of SCGY in 2008, USTC published an edited volume titled *The Special Class for the Gifted Young, USTC From 1978 to 2008* (Xin, 2008), which reviewed the evolution of SCGY and provided initial descriptive data about its graduates. In the following subsection, we first review the outcome measures based on Xin (2008) and other sources and then summarize our own research based on our interview studies with SCGY graduates.

### Advanced Studies and Degrees Attained After the SCGY

SCGY has enrolled approximately 1,220 students and graduated 1,027; 875 graduated by 2008 (SCGY, 2008). Of all of the students who have graduated from SCGY for more than 10 years at the time of data collection, 90.9% of them earned a master's degree (26.9%) or a doctoral degree (64%) in China or abroad, compared to approximately 70% of USTC (within which the SCGY is hosted) graduates earning master's degrees and above. It is relevant to note that USTC is one of the top STEM-focused universities in China and its percentage of graduates earning master's and doctoral degrees was ranked number one among all Chinese universities in 2008. The success rate for graduate school applications of the SCGY students was 80% in the 1980s and 1990s, as opposed to the 10% of regular college graduates in China. Of the first 10 cohorts of the SCGY, 60% of the SCGY students obtained doctoral degrees, of which 92% were earned abroad.

In terms of professional areas the SCGY graduates entered, close to 20% specialized in academic fields, and the other 80% entered technical and business fields. Table 1 presents the degrees earned, the location of the studies, and the fields entered for the early college entrants of the SCGY graduates, with the Honors Class students as comparisons.

As shown in Table 1, the advanced degrees earned by the early college entrants are comparable to those earned by the Honors Class graduates. In fact, they earned more doctoral degrees than their peers in the Honors Classes.

### Achievements in Academic Fields

For long-term outcomes, 120 graduates had gained professor positions in China or abroad, and 98 graduates attained the rank of assistant professor or higher at universities in

TABLE 1  
Degrees, Study Location, and Fields of the SCGY Early Entrants and the Honors Class Graduates<sup>a</sup>

Degree/Location/Field	Early College Entrants of SCGY		Honors Classes	
	<i>n</i> = 547	Percentage	<i>n</i> = 214	Percentage
Doctoral	350	64	124	58
Master's	147	26.9	60	28
Bachelor's	50	9.1	30	14
<hr/>				
	<i>n</i> = 590	Percentage	<i>n</i> = 220	Percentage
Graduate studies in China	306	52	70	32
Graduate studies abroad	168	29	106	48
Enter workforce	116	19	44	20
<hr/>				
	<i>n</i> = 590	Percentage	<i>n</i> = 220	Percentage
Basic science	292	49.5	118	53.6
Information science/ technology	231	39.1	95	43.4
Engineering/management	67	11.4	7	3

<sup>a</sup>This information was collected on students who graduated 10 or more years ago (graduated during 1983–1998) in a survey reported in Xin (2008).

developed countries by 2008. In fact, a single SCGY cohort of 1988 contributed 12 individuals to this rank.

More pertinent to early college entrance is the question of whether or not they were able to have an early career onset or make distinguished contributions at a younger age. In our incomplete count, over 20 graduates became full professors at top-tier universities in the United States by their mid-30s. These universities include Harvard, Yale, Stanford, MIT, Princeton, and the University of Chicago, arguably top universities in the world. Although they have not been in their respective fields for long, they have already received many accolades and awards; they include MacArthur Fellows, fellows of the Institute of Electrical and Electronics Engineers, the American Physical Society, the Max Planck Society, the World Innovation Foundation, the Optical Society of America, the Howard Hughes Medical Institute, the American College of Medical Informatics, and the Alfred P. Sloan fellowship. More than a dozen received the National Science Foundation Career Award. Other awards and honors include the following: Searle Scholar, Parkard Science and Engineering Fellowship, Presidential Early Career Award for Scientists and Engineers, Early Career Principal Investigator Award, and the Materials Research Society Outstanding Young Investigator Award. Xiaowei Zhuang (physics and biophysics) and Tianxi Cai (biostatistics), two female graduates of SCGY mentioned earlier, earned their full professorships at the ages of 34 and 35, respectively.

### Achievements in Technical and Professional Fields

Long-term achievements of SCGY graduates in technical and professional fields are equally impressive. A survey of

348 early college entrants and Honors Class graduates found that a sizeable number took important positions in large high-tech companies, such as IBM, Intel, and Microsoft. One example is Zhang Yaqin of the SCGY Class of 1983, who was a Vice President of Microsoft Research Asia during 2000–2004. There also are over 60 SCGY graduates who have served as board directors, CEOs, or vice presidents with companies in China or worked within multinational financial companies such as Goldman Sachs, CitiBank, and the Bank of Germany. Fourteen SCGY graduates are publically recognized as accomplished entrepreneurs. Huang Qin of the SCGY Class of 1989 became a senior vice president of Prudential (a multinational financial company) at the age of 24. Likewise, Tianwu Cai (Tianxi Cai's brother) of the class of 1990 and Yang Jingshuang of the class of 1991, became vice presidents of Goldman Sachs at very young ages (see Xin [2008] for more information).

### Attritions and Perceived "Failures"

Not all SCGY students succeeded in completing their studies. Although there are no publicized statistics, program administrators commented that about two to three students in every cohort dropped out of the program without a degree. Unsatisfactory academic performance appears to be the main reason for dropping out. In SCGY, students whose grade point averages fall below the acceptable minimum standard are given up to 2 years to catch up. If they still fail after these efforts, they have to leave the program. It is rarely the case that an SCGY student falls behind and drops out because of his or her academic aptitude. Instead, anecdotal evidence indicates that dropping out is more likely due to the lack of self-regulation or self-control and socioemotional reasons. It should be noted that the attrition rate of early entrants is not abnormally high when compared with that of regular college students in China, but it is indeed higher than the rate of students in the Honors Classes.

SCGY has been in the Chinese media's spotlight since its inception. Despite the fact that most SCGY graduates have enjoyed extraordinary success in various domains, some cases of alleged failure in early cohorts were under media scrutiny. The repercussions could still be felt when the media revisited the issue of those early college entrance failures many years later (e.g., Ye, 2007). A couple of high-profile professors even called for repealing any early college entrance program in China (Yao, 2000). Connections were made between child prodigies found in the early college entrance programs and psychological abnormality and eccentricity (Yao, 2000). Three students in the earliest cohorts of SCGY drew the most attention from the public media. One of them was touted by the media as the first identified child prodigy since the Cultural Revolution. The fact that he later became a Buddhist monk was seen as a case of indictment against early college entrance. Another student attended SCGY at the age of 11, skipping middle and high

school altogether. After graduation, he pursued advanced degrees with several renowned scientists as his mentors, to no avail, largely due to interpersonal tensions between him and his mentors. The third case is a student who attended SCGY at the age of 12 and later received a fellowship to study theoretical physics at Princeton University. Similar to the second case, he eventually withdrew from all programs he attended and lived a reclusive life.

These cases, to be sure, provide important lessons for early college entrance programs; for example, with respect to developing early entrants' psychosocial and interpersonal skills. Some of these lessons are about changing the program and making it more responsive to student needs—for example, giving students more choice—which SCGY did in the ensuing years. However, it is hyperbole to claim ineffectiveness of SCGY or inappropriateness of early college entrance programs in general based on these cases. The overall success of the SCGY is quite compelling and indisputable, although it is impossible to tease apart selection effects (which could be attributed to the selected individuals and what they brought to the program) and program effects. Its positive impact and contributions to the pipeline of STEM talents in China and all over the world will continue to be reckoned with and acknowledged.

### Interview Studies With the SCGY Graduates

The 30th anniversary report on the SCGY (Xin, 2008), although highly valuable, is too broad-brushed to permit conclusions on specific aspects of SCGY. Generally speaking, the effort to gather, analyze, and report evidence as reflected in the report does not rise to the level of scholarly research. There allegedly are some internal studies conducted on SCGY, but there are few scholarly publications in Chinese, let alone in English. Since 2008, we have started to conduct a series of retrospective studies with graduates of SCGY.

Previous research on acceleration was typically done with a focus on overall outcomes as evidence for the effectiveness of particular acceleration programs (e.g., Brody, Muratori, & Stanley, 2004; Steenbergen-Hu & Moon, 2011) rather than on real-time contextual events, psychosocial effects, and developmental changes and transitions. There is a lack of systematic inquiry into acceleration from a developmental perspective. Robinson, Shore, and Enersen (2007) identified the lack of solid evidence on the social and emotional development of accelerants as an issue to be addressed in research. In this study, we intended to address these shortcomings in research on acceleration, particularly early college entrance programs. Our purpose is not to ascertain in general whether SCGY as an early college entrance program is effective or successful but, rather, to understand (a) the underlying factors and processes, from developmental as well as educational points of view, that contributed to differential degrees of success for early entrants, and (b) how contextual factors



and processes can be optimized to enhance the chance of personal success for most if not all early college entrants. Therefore, our research strategy and methodology were to take a close look at the program through the lived experiences and perceptions of graduates of SCGY. Given the exploratory nature of the study, we tried to be as open as possible, without holding preconceptions of potential strengths and weaknesses of the program. In the following section, we report the initial findings of our studies, with a caveat that some of the findings reported here are still preliminary, subject to further verification.

### *Study 1: A Grounded Theory Study of a SCGY Cohort*

The first study (Dai, Steenbergen-Hu, & Zhou, in press) focused on one cohort of the SCGY in the early 2000s. Interviews were conducted with 34 graduates of the same cohort who entered SCGY in the year of 2000 and graduated in 2004. Based on a grounded theory approach, open coding generated 120 open codes (i.e., free nodes) and 1,193 references (i.e., total instances of the 120 codes), with the number of references per code ranging from one to 27 (mean = 9.9). In the selective coding stage, a total of 14 open codes were selected to identify patterns of responses on the four categories. These four categories were (a) positive versus negative experiences with the curriculum, (b) active versus passive academic coping, (c) positive and negative big fish–little pond effect, and (d) intrinsic motivation to learn versus lack of motivation. Two themes emerged from the codes: academic growing and academic coping; hence the Cope-and-Grow model.

**Academic growing.** *Academic growing* refers to experiences, thoughts, and actions leading to intellectual and personal growth and is indicated by strengths of the curriculum, peer mutual stimulation for excellence, positive interaction with professors, deep engagement in learning, typically motivated by intrinsic interests and enlightening lab experiences. A large majority of the interviewees viewed their overall learning experiences as positive. About half of them mentioned that, retrospectively, the academic program enhanced their professional development well. Development of a solid foundation of mathematics and physics served particularly well for those who later took on an academic career. The SCGY also mentioned the benefits of having freedom and flexibility in course taking, although some of them felt this freedom and flexibility could be extended, and the course load need not be as heavy, to make room for a more individualized curriculum. The interviewees also mentioned the role of research experiences, which helped them recognize the critical difference between knowing a lot about science and doing science. Professors had a huge impact on their learning and motivation. Many mentioned that some of the professors were inspiring and pedagogically highly adaptive, leaving an

indelible memory for them. Not the least is the fact that 25 of the interviewees mentioned that the peer group provided an intellectually stimulating and personally motivating environment, and 27 mentioned the lasting friendships they have built with their classmates beyond graduation.

**Academic coping.** *Academic coping* refers to meaningful efforts to keep up the hard work to meet the academic challenges, leading to resilience in the face of adversity. The opposite was the lack of active academic coping or demonstration of passive coping behaviors. Academic coping is indicated by academic challenge, decreased self-concept (big fish–little pond effect), academic competition, challenges related to the transition to college, pressure and stress, active coping such as hard work versus passive coping such as copying assignments, skipping classes, or excessively playing video games and sports. Many interviewees reportedly experienced challenges in making the transition to college personally as well as academically. Some of them experienced social–emotional problems such as having a crush on a classmate of the opposite sex that caused much distress and internal conflicts or dealing with pressure from parents. Many of them reported feeling lost at various junctures of important academic and career decisions. They wished that they could have the supervisors' or counselors' timely guidance. Quite a few expressed reservations about getting into SCGY at too young an age (e.g., 12 or younger). Apparently, early entrance to college means dealing with all aspects of living an independent life in college, which are presumably more challenging for early college entrants in China, whose life is largely structured by adults until the point of entry to college. However, what we found in these coping experiences is that active coping yielded positive outcomes; thus, coping became growing experiences (hence Cope-to-Grow). In other instances, effective coping did not take place until the person became intellectually and socially more mature (hence Grow-to-Cope; for detailed discussion see Dai et al., in press).

**Discussion.** It appears, based on the interviews, that the early college entrance program represented by SCGY did make a difference in early entrants' personal, academic, and career development. The Cope-and-Grow experiences are by and large positive and help explain why these graduates cherish these undergraduate years at SCGY. The study also points out areas where students' growing and coping experiences can be strengthened. For example, the curriculum can be more flexible and adaptive to individual differences in strengths and interests and the counseling and guidance component can be stronger to deal with students' emerging social and emotional issues and career directions. Prevention and intervention measures can certainly help reverse such behavioral patterns. With that said, the observed attrition is not necessarily all negative but indicative of the rigor of the program: it may be only natural that some students are not

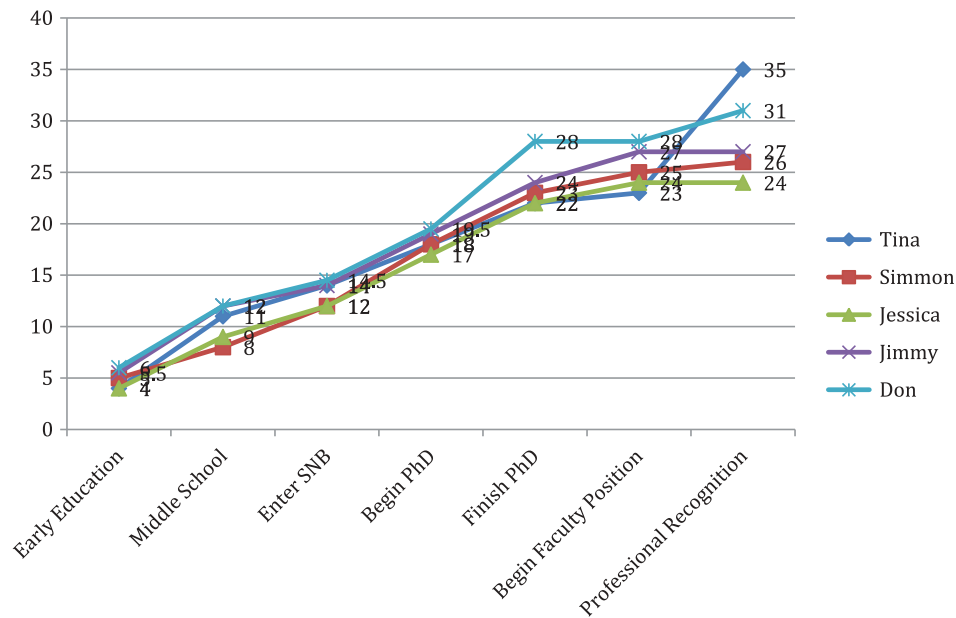


FIGURE 1 Trajectories of five SCGY graduates who are currently professors with first-tiered research universities in the United States (pseudonyms are used).

ready for the challenge of entering college earlier. For them, dropping out does not indicate the failure of the student or the program but a mismatch between students and the program.<sup>1</sup>

### *Study 2: Cases Studies of Those SCGY Graduates Who Became Academics in Research Universities in the United States*

In the second study (Dai & Li, *in preparation*), we interviewed graduates of the SCGY who are currently working at research universities in the United States. The purpose of the study was to understand distinct trajectories of the development of an academic career and the role an early college entrance program plays in this trajectory. A total of 10 SCGY graduates accepted our invitation and participated in this study. Their ages at the time of interview ranged from 30 to 50, with a mean age of 36. They entered the SCGY at the ages of 12 to 15, with a mean age of 14 years. They represent many SCGY cohorts; some are from the first SCGY cohort who entered the SCGY in 1978, and the latest are from the class of 2000 who entered the SCGY in 1996. All but one are currently working with Carnegie Research One universities (including Harvard University, Yale University, the University of Michigan, Northwestern University, Boston College, the University of California at San Diego, and Stony Brook University, among others). Four are full professors and six are associate professors. Their affiliated disciplines or professions are biostatistics and bioinformatics ( $n = 1$ ), computer science ( $n = 3$ ), chemistry ( $n = 2$ ), medicine

( $n = 1$ ), information science ( $n = 2$ ), and physics ( $n = 1$ ). Among other honors and awards, seven of them have received National Science Foundation career awards and the other three are fellows of their respective professions.

We first coded the interview data from a phenomenological perspective, focusing on 46 open codes mentioned at least by five interviewees and generating main themes. We then selected five participants for more intensive biographical case investigation through the collection of more contextual and developmental information about the subjects. The rationale for building biographical studies beyond the phenomenological approach was to gain more knowledge about the richness and complexity of contextual events that helped shape an academic career (Creswell, 1998). We collected information from before they entered SCGY and after they graduated (including their graduate studies in the United States). The data helped us interpret their early college experiences in the large context of their academic and career development. Trajectories of these five SCGY graduates are presented in Figure 1.

As shown, early college entrance made these individuals' STEM academic trajectories much steeper than without the acceleration. The following is a summary of the initial findings of Study 2:

- Overall, the members of this group of SCGY graduates were as well adjusted as the SCGY and high achievers in their respective cohorts, although incidents of fluctuations in adjusting to college life also were reported. Their competitiveness also was noticeable during their tenure with the SCGY.

<sup>1</sup>We thank Miraca Gross for making this point. See also Snow (1992).

- Most of the interviewees had acceleration experiences prior to their SCGY program. These accelerations took the form of early entry to elementary school (at age 4 for a couple of them), skipping grades, and acceleration in secondary school, some deliberately promoted by parents. Whatever the case, their cognitive precocity did not seem at odds with their social and emotional development. In general, they were quite mature for their age when entering college.
- Overall, this group of SCGY graduates showed intellectual independence and the capability for self-direction early. Many of them were autodidactic. The youngest early entrant in this group used 3 years to complete 6 years of secondary school. He reported having completed studies of most of the high school curriculum and some college course materials by himself during these years. Their parents were highly devoted to their education but granted autonomy in the early years. It is difficult, however, to determine whether it was their precocity and self-direction that alleviated the need for parental supervision or their parents' encouragement of autonomy that shaped their dispositions for self-direction. Whatever the case, this personal characteristic bodes well in terms of reaping the benefits of the early college program.
- When it comes to the topic of career trajectories, some mentioned role models and mentorship, either in the SCGY or during their graduate studies in the United States, as crucial for their decisions to be academics. But most frequently mentioned by the interviewees is the factor of intrinsic motivation and enjoyment of what they were doing. Some pointed out a simple fact that they were pretty good at what they were doing all along, so an academic career was a natural course of their lives. Several of them explored opportunities to conduct research in corporate settings and decided to take academic positions because they could enjoy more individual freedom and flexibility in exercising their intellectual power. As indicated in Figure 1, most of them received professional recognition and accolades in their 20s and 30s.

**Discussion.** This group of well-established or promising scholars and research scientists seemed to have benefited from the early college entrance program as an important stepping-stone or gateway to their academic careers. Their success brings back our initial research questions: To what extent is their academic success in SCGY and beyond attributable to a good match between their personal characteristics and features of the SCGY program, and to what extent did SCGY provide unique opportunities and milestone events that ushered them at a young age to the realm of STEM research? For the former question, we surmise that personal characteristics such as autodidactic capabilities and self-direction make acceleration a natural option for them.

Conversely, in the absence of these characteristics, early entrants might find it tough to make a transition from secondary school to college. Not only did these SCGY graduates get an early head start with their academic careers but they also attended the best universities in the United States for their graduate studies, such as Harvard, MIT, and Stanford. These advantages combined make them more likely to have an early debut of creative contributions, as indeed many of them did. The findings are consistent with what has been found with grade skippers (Park, Lubinski, & Benbow, 2013). This has implications for selection criteria as well as for student support and intervention. Early entrants who are capable of self-direction are more likely to make the most of opportunities afforded by early college entrance.

### Future Research

More than 3 decades in the making, SCGY truly is a lab program for precocious youth. It was ahead of time in many ways as part of the educational system in China, and it has been evolving continually with the changing times. We plan to continue this line of research on the SCGY and other early college entrance programs in China, particularly with respect to the following questions:

- How do early college programs in China compare with those in other countries? What is universal about these programs and what is culture specific? For example, in general, the Chinese educational system tends to pay more attention to academic competence and less attention to social competence or social skills and sets high expectations for students rather than attempting to accommodate individuals' needs. Is this tendency also reflected in SCGY practice? How does it compare with its counterparts in the Western nations, which are presumably more attuned to individual needs? We attempt to generalize the Cope-and-Grow model of affective development across contexts and developmental stages (Dai, 2013; Dai & Speerschneider, 2012). It is meaningful to ask what is universal about Cope-and-Grow experiences and what is culture specific? For example, does the collectivist cultural orientation make coping easier for adolescents, and do they struggle less with identity issues?
- What are distinct advantages and benefits of participating in early college entrance programs across nations? We see a clear advantage in SCGY in providing a good pipeline of STEM talents. The findings of the SCGY graduates' long-term prospects suggest the viability of early college entrance programs in facilitating an early onset of STEM careers and early contributions to the relevant fields. Do we need this kind of self-contained programming if college admission policy can accept early entrants and integrate them into regular college settings (e.g., Muratori et al., 2006)? What



is considered advantageous or “value-added” to have such self-contained programs? On a different issue, should we consider early college entrance to be specific to scientific and technical fields, and less applicable to the humanities and social sciences, given that the emergence of talent in the latter areas and peak productivity occurs much later in one’s life span (Sawyer, 2006)? Our studies seem to indicate that some early entrants, due to some personal characteristics and histories, stand to gain more than others. We surmise that there must be something universal about the goodness of fit for early college entrance. Convergent evidence across nations and cultures would help determine who are most likely to benefit from such programs and who should be advised not to take on such an opportunity.

- What are long-term academic and career trajectories and pathways of early college entrants? Is it predictable to some extent so that early interventions can be designed accordingly, from identification to curricular adaptations? Given the findings of Study 2 that those who were heading to an academic career tended to be more independent and strong in self-study and self-direction, should we provide diverse options for them rather than structuring their academic learning too rigidly? We know from our studies that early college entrants are by no means a homogeneous group in terms of their strengths, interests, and personalities. What are the implications of differential trajectories and pathways for designing early college programs, with respect to admission policy, curriculum goals, course offerings, instructional differentiation, mentorship, and graduation policy? These questions can be addressed better through a comparative lens.

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