

The Academic Research Paths of Nanjing Foreign Language School Science Olympiad Class Graduates—A Case Study of Doctoral Degrees and Dissertations

Boshuo Wang, Ph.D., and Rongzhang Wang, Ph.D.

Science Olympiad Class of 2006, Nanjing Foreign Language School

Emails: boshuowang@gmail.com, ripple.wrz@gmail.com

Abstract

2018¹ marks the twelfth year of graduation of our class—Nanjing Foreign Language School Senior High School² Class (1)³ of 2006. As graduates of the Science Olympiad Class⁴, many of our fellow classmates have furthered their education in mathematics, physical sciences and engineering, biological sciences and medicine, and economy and political science. According to data collected over the past few years, nearly half of our classmates obtained a doctoral degree. As Class Monitors⁵, we have gathered and analyzed the data on our classmates' doctorates and dissertations and summarized the results in the form of a scientific report. We dedicate this report to the 55th anniversary of our alma mater, providing a case study of the academic research paths of Science Olympiad Class graduates.

Keywords—Nanjing Foreign Language School, Science Olympiad Class, academic research, doctorate degree, dissertation and thesis

Introduction

We entered the junior high school⁶ division of Nanjing Foreign Language School (NFLS) in 2000 and graduated from senior high school in 2006 and were therefore fortunate to witness many milestones of our alma mater. In junior high school, we were among the last witnesses of the original teaching buildings, auditorium, and gallery from the founding years of the mid-20th century. We entered senior high school at the time of the 40th anniversary of NFLS and were among the first to move into and use the brand-new buildings and facilities on campus.

Under the guidance of NFLS's leadership, the Science Olympiad Class comprised of outstanding students who joined via a competitive selection process. Most had already excellent performance in science competitions at the junior high school level. The entering class of 56 students, 17 girls and 39 boys, was divided into two smaller sub-classes⁷ A and B for English teaching, with 27 students each, and one student each majored in German and French. We actively participated in the Science Olympiads and most classmates chose to compete in one or more of the five subjects—mathematics, physics, chemistry, biology, and informatics. The science teachers assigned to our Class were all “grandmaster” level: Class Director⁸ and physics teacher Ms. Xiaoqin Yao, mathematics teachers Mr. Gang Wang, and chemistry teacher Ms. Fangwei Chen; and our Grade Director⁹

and biology teacher Mr. Jinling Sun was an especially experienced educator. During the senior high school years, our class obtained great success in the Science Olympiads, winning more than 20 First Prize awards at the provincial level, covering all five subjects; especially outstanding was Zeyuan Zhu, winning two gold medals in the International Olympiad in Informatics (IOI) for the Chinese national team in 2005 and 2006, among many other awards. After three years of studies, 15 and 25 classmates entered Chinese universities through the National College Entrance Examination (NCEE)¹⁰ and NCEE-exempt admission¹¹, respectively, and 16 students were admitted by universities abroad. Besides exceptional science Olympiads and academic performance, we have followed our class's motto of “unity, diligence, practicality, innovation” to excel in many extracurricular activities, including student union elections, intramural sport competitions, and arts performances, and our class won the title for all-rounded development during academic year 2005–2006.

It has been more than a decade since we graduated from NFLS. The participation in the science Olympiads had deeply influenced many of us and seeded our aspiration for scientific research and to pursue a doctorate in various fields after 4 years of undergraduate study. More than two dozen classmates have obtained their doctoral degrees. As our alma mater celebrates her 55th anniversary, we

present in this article a summary of our classmates' doctoral degrees and dissertations to thank the stroke of fate that brought us into NFLS and our alma mater for her nourishment and cultivation.

Methods

We mainly collected the data on our classmates' doctoral degrees and dissertations through online searches, which include the following: university library collections, laboratory or department websites of universities and research institutes, personal websites, dissertation databases, e.g., ProQuest Dissertation & Theses Global and Wanfang Data, and also social media websites, such as LinkedIn, ResearchGate, and Facebook, etc. We also supplemented a small amount of data that were unavailable through the internet via personal communication.

Results

According to the collected data, more than 20 students of NFLS's Science Olympiad Class of 2006 obtained their doctoral degrees, comprising about four ninths of the entire class. As shown in figure 1, the percentages of students in doctoral research programs, whether by gender or by the two English sub-classes, are between two fifth to a half and similar to that of the entire class.

The distribution of disciplines for the doctoral cohort is shown in figure 2, showing that most students chose a field in the mathematical and physical sciences or engineering, each comprising approximately one third of doctorates, respectively. Here, we define mathematical and physical sciences as mathematics, statistics, operation research, and computer science, and physics and chemistry, respectively. Engineering included electronic engineering, computer engineering, energy engineering, biomedical engineering, system and engineering management, etc. About one sixth studied life sciences, including physiology, neuroscience, and medicine, and a few studied social sciences, such as economics and political science.

According to the graduation year (figure 3), the earliest doctoral degree was obtained in 2003, 7 years after graduating from NFLS. The number of doctorates increased and peaked between 2016 and 2018, with five or six students graduating each year. The distribution of lengths of the doctoral studies

(figure 4) does not correlate with the distribution of the graduation years due to two major reasons: First, the paths leading up to the doctoral study were unique for each individual, with some classmates directly starting their doctoral programs and others getting a master's degree or being employed for a few years after their undergraduate studies. Second, the length of doctoral research varies greatly between different fields, countries, and universities, covering a range of three and a half years to seven and a half years.

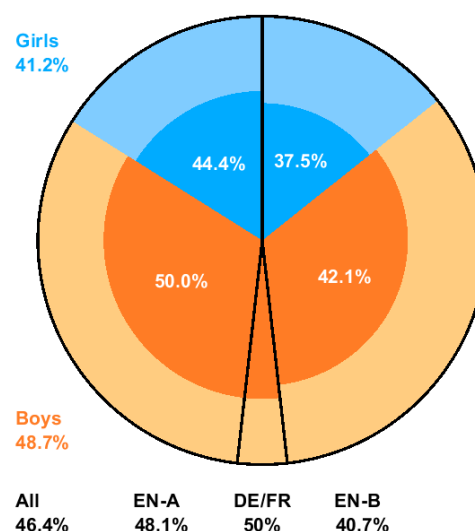


Figure 1. The percentage of students in the NFLS Science Olympiad Class of 2006 with doctoral degrees, by gender and language majors. Color of pie chart shows gender and black lines delineate subclass division. EN: English. DE: German. FR: French.

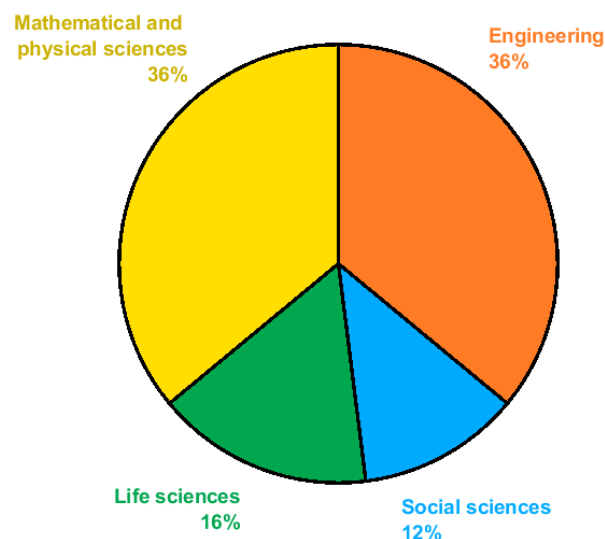


Figure 2. The distribution of disciplines in which students of the NFLS Science Olympiad Class of 2006 performed their doctoral research.

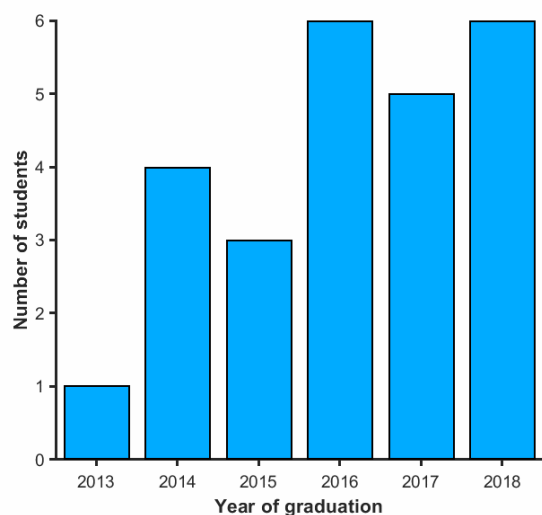


Figure 3. The histogram of graduation year in which students of the NFLS Science Olympiad Class of 2006 obtained their doctoral degree.

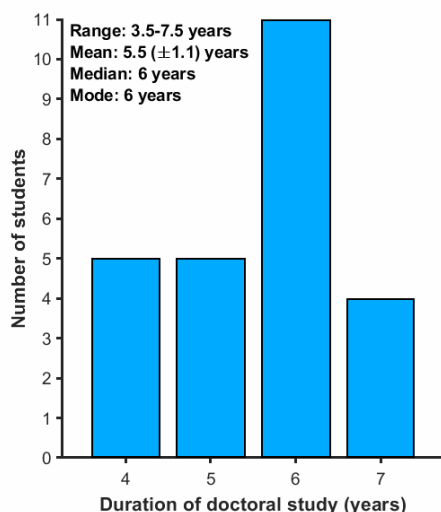


Figure 4. The histogram and statistics of duration for students of the NFLS Science Olympiad Class of 2006 to complete their doctoral program.

Among the doctoral cohort, about one quarter and a half of the students entered Chinese universities via the NCEE and NCEE-exempt admission, respectively, and the remaining one quarter finished their undergraduate studies abroad. In contrast, only less than one tenth of doctoral degrees were obtained in China. Scientific research has no national boundaries and academic communication and interchange resulted in more than 90% of students to perform their doctoral research at various locations around the globe, including the United States of America (USA), the United Kingdom, Canada, Australia, Switzerland,

and Singapore. Especially, a large majority of almost 70% of the doctoral degrees have been obtained in the USA, demonstrating the strong leadership and attraction of the USA in research, especially in the fields of science and engineering.

Around the time of the doctoral defense, the research projects are written up as a dissertation or thesis and collected by the institute's library and/or specialized databases. Doctoral research contributes new knowledge to humankind and expands the frontier of our cognition. Thus, doctoral dissertations are typically quite long. The dissertations of our doctoral cohort have an average length of 168 ± 78 pages (mean and standard deviation) and a median of 141 pages. The shortest and longest dissertations are 51 pages and 397 pages long and are from the fields of mathematics and chemistry, respectively.

Discussion

Almost half of the classmates of the Science Olympiad Class performed and finished doctoral research. Such a high ratio reflects the outstanding talent of the students competitively admitted to our Class and speaks also to the passion for science and analytical skills cultivated by the training and participation in the Science Olympiads. Many have continued their paths following the competition subjects in high school: some classmates in the mathematics Olympiads continued to study mathematics, computer science, statistics, operation research, etc.; a few physics and chemistry competitors later majored in the corresponding fields for their doctoral research, such as in theoretical physics, molecular engineering, and biochemistry; several who participated in the biology Olympiads entered the fields of neuroscience and clinical medicine. Engineering is based on the natural sciences and contains a myriad of fields and disciplines. Thus, our classmates who obtained doctoral degrees in engineering included participants in all five competition subjects. In the social science fields, analytical skills have also become more and more important nowadays and researchers need to have solid mathematical understanding and be able to utilize various quantitative computational tools.

Doctoral research is a long process of aggregation over many years, not to be rushed through in days or months. The average years of doctoral studies, whether a master's degree is required, or if prior work

experience is preferred, etc., all differ across disciplines, institutes, and countries. In general, research areas that are more theoretical or engineering disciplines with relative short research and development cycles have shorter duration for the doctoral studies, whereas the biological fields with longer experimental cycle and higher uncertainties would require longer time. According to three different statistics, namely the average, median, and mode, the majority of our classmates finished their doctoral degrees between five and a half years and six years, which agrees with broader statistics of natural sciences, engineering, and social sciences. Whether relative faster or slower, doctoral research is an arduous and lasting process compared to undergraduate or master studies. During the several years of doctoral training, an individual has to be highly focused to readily absorb past knowledge and produce new ones. Only with early determination and high ambition would someone be willing to devote so much time and energy. It requires even more patience to undertake research as a career. So far, about one third of our doctoral classmates have continued research on postdoctoral positions; and a few have attained professorship¹².

Besides the teaching on scientific subjects, NFLS also provided us with fine language skills, allowing us to perform research at the top-ranked universities around the world. The spiritual core of “Chinese Soul, Global Vision” of NFLS students is invaluable when it comes to scientific communication on the international platform. Most of our classmates finished their undergraduate education in China, whereas in recent years, the absolute number as well as ratio of students who apply for undergraduate studies abroad has significantly increased. According to some personal observation, the Chinese students accepted to some doctoral programs in the USA seem to have shifted towards those who completed their undergraduate study in the US versus those who finished their undergraduate or master’s degrees elsewhere. However, we view this more as a recognition of the excellence of these undergraduate international students, rather than a restriction on the geographical origins of talents.

Last, it is worth mentioning that many of our other classmates entered various industries with bachelor’s or master’s degrees. As most master programs do not

have research and thesis requirements, we only found seven records of master theses. Nevertheless, these classmates are working in China or the USA in highly specialized areas of science, technology, and finance, etc., and similarly require in-depth professional knowledge as well as an unremitting research spirit.

Against the torrent, up I seek thee, the path resistive, long, and lengthy¹³; as such is the hardness and challenges in research and innovation. We are grateful for the science Olympiads training at NFLS, which helped us to deepen our understanding and lay a solid foundation in the subjects of our interest and to better recognize our own characters and potentials through the numerous discussion and brainstorming with our teachers and among our peers. No doubt, a diploma is not the end goal and a doctoral degree is just a steppingstone for entering academic research or industrial positions. Just like *Kun and Peng begin hitting the waves from here on¹⁴*, we are embarking on a new journey. We hope that, at times of future anniversaries of NFLS, we are still having endless enjoyment in the careers we chose as youngsters and have more proud achievements to report to our alma mater.

Conclusion

More than two dozen students of the NFLS Science Olympiad Class of 2006 have obtained a doctoral degree, comprising about four ninths of the entire class. The doctoral research of our classmates covered a wide range of disciplines, with the majority in natural sciences and engineering. Most doctoral degrees were obtained after eight or more years after high school and the average time to complete the degree was between five to six years. Whereas most of our doctoral classmates obtained their undergraduate degrees in China, most of the doctoral degrees were obtained outside of China, with a majority in the USA.

Acknowledgments

On behalf of our entire class, we would like to thank all our high school teachers and science Olympiads instructors for their hard work and unremitting dedication to our education: Class Director and physics teacher Ms. Xiaoqin Yao, Chinese teacher Ms. Baoqing Hu, chemistry teacher Ms. Fangwei Chen, mathematics teachers Mr. Gang Wang and Mr. Jitao Lu, English teachers Ms. Yuanyuan Shang, Ms. Yan Li, and Ms. Xiaoyan He, French teacher Ms. Xilan Gu, German teacher Ms. Yang

Lu, Grade Leader and biology teacher Mr. Jinling Sun, and Informatics Olympiad instructors Mr. Xiaoshi Wu, Mr. Polei Shi, and Mr. Shu Li, Physics Olympiad instructor Mr. Changsheng Shi, and Biology Olympiad instructor Ms. Rong Xing. We thank our fellow classmates who obtained their doctorate for their industrious research and sharing of their dissertations.

References, given in the order of the student ID number. Names given in the order of family name, followed by given name.

- Chen, Lingyao. Microelectromechanical system-based wireless microsystem for brain interfacing. Ph.D. Dissertation. University of Utah, Salt Lake City, UT, USA, 2013.
- Lu, Fenglong. Autonomous Control of Series-Connected Low Voltage Micro-inverters (LVAC) for Photovoltaic Panels. Ph.D. Thesis. University of Colorado at Boulder, Boulder, CO, USA, 2016.
- Ren, Tianyi. Resolvent Estimates for the Laplacian in the Euclidean Space and on the Sphere. Ph.D. Dissertation. Johns Hopkin University, Baltimore, MD, USA, 2018.
- Shi, Zhe. Small-molecule inhibitors of tubulin polymerization as vascular disrupting agents and prodrugs targeting tumor-associated hypoxia. Ph.D. Dissertation. Baylor University, Waco, TX, USA, 2018.
- Wan, Quan. First principles simulations of vibrational spectra of aqueous systems. Ph.D. Dissertation. University of Chicago, Chicago, IL, USA, 2015.
- Wang, Boshuo. Investigation of the electrode-tissue interface of retinal prostheses. Ph.D. Dissertation. University of Southern California, Los Angeles, CA, USA, 2016.
- Wang, Xiang. Achieving Bright Blue Phosphorescent Platinum(II) Compounds With Cyclometallating Phenyl-1,2,3-Triazole Ligands. Ph.D. Thesis. Queen's University, Kingston, ON, Canada, 2017.
- Wang, Yuanxi. Theory of two-dimensional materials: synthesis, properties, and structural engineering. Ph.D. Dissertation. Pennsylvania State University, State College, PA, USA, 2016.
- Zhang, Chen. Phenomenological Studies of Extended Higgs Sectors at Future Colliders [in Chinese]. Ph.D. Dissertation. Peking University, Beijing China, 2017.
- Chen, Jin. Radiation Response and Reliability of High Speed AlGaIn/GaN HEMTs. Ph.D. Dissertation. Vanderbilt University, Nashville, TN, USA, 2016.
- Liu, Jun. Nutritional regulation of neural stem cell reactivation in *Drosophila melanogaster*. Ph.D. Thesis. University of Cambridge, Cambridge, UK, 2015.
- Tong, Yanyan. Towards a sustainable and resilient fleet management. Ph.D. Dissertation. Nanyang Technological University, Singapore, 2017.
- Wang, Hongyun. Study on the distribution of HPV genotype prevalence in invasive cervical carcinoma and precancerous lesions in the Yangtze River Delta Area, China [in Chinese]. Ph.D. Dissertation. Zhejiang University, Hangzhou, China, 2014.
- Chen, Hao. Improving data center efficiency through smart grid integration and intelligent analytics. Ph.D. Dissertation. Boston University, Boston, MA, USA, 2016.
- Gan, Quan. AMPA Receptor Tetramerization: Structural Mechanism and Modulation by Auxiliary Subunits. Ph.D. Dissertation. State University of New York at Stony Brook, Stony Brook, NY, USA, 2016.
- Li, Xiaohan. High efficiency III/V thin film solar cells: light trapping, antireflection, and band structure engineering. Ph.D. Dissertation. University of Texas at Austin, Austin, TX, USA, 2015.
- Lin, Dong. Advanced metallization for screen-printed solar cells. Ph.D. Thesis. University of New South Wales, Sydney, Australia, 2014.
- Peng, Sida. Three Essay in Econometrics. Ph.D. Dissertation. Cornell University, Ithaca, NY, USA, 2017.
- Shi, Xiaofeng. Large portfolios' risks and high-dimensional factor models. Ph.D. Dissertation. Princeton University, Princeton, NJ, USA, 2014.
- Yan, Chen. Developing and using a head-mounted miniature microscope to investigate memory formation in a mouse model of Alzheimer's Disease. Ph.D. Thesis. University of Toronto, Toronto, ON, Canada, 2018.
- Allen-Zhu, Zeyuan. Novel Frameworks for Auctions and Optimization. Sc.D. Thesis. Massachusetts Institute of Technology, Cambridge, MA, USA, 2015.
- Fan, Jingnan. Process-based risk measures and risk-averse control of observable and partially observable discrete-time systems. Ph.D. Dissertation. Rutgers University, New Brunswick, NJ, USA, 2018.
- Wang, Rongzhang. The Impact of Economic Policies on Heterogeneous Consumers. Ph.D. Dissertation. University of California, Los Angeles, Los Angeles, CA, USA, 2018.
- Xu, Tiantian. Novel Algorithms for Human Action Recognition in Videos. Ph.D. Dissertation. New York University, New York, NY, USA, 2017.
- Sun, Yixian. Beyond the North: The Diffusion of Private Sustainability Governance in China. Ph.D. Thesis. Graduate Institute of International and Development Studies, Geneva, Switzerland, 2018.

Translation notes

1. The original Chinese version of this article was published as an essay in *Xiǎoyuán Hóngyǔ — Commemoration of the 55th Anniversary of the Foundation of Nanjing Foreign Language School*, Ed. Nanjing Foreign Language School, Phoenix Education Publishing, Ltd., Nanjing, pp. 100–110, Sep. 2018. This English version was translated and posted online in Feb. 2020. The content is updated with the latest available data, a two-column format is adopted, and the figures and references that were omitted in the essay due to length limitation are translated into English and included.
Xiǎoyuán translates to morning garden and is a metaphor for the school campus. *Hóngyǔ* means feathers of the swan geese and, referring to the geese's soaring capabilities, is a metonymy for high-achieving careers. The book title paints a beautiful image of the geese feathers resting in the garden, capturing the exciting but also slightly melancholic moment of the students leaving their alma mater full-fledged.
2. Senior high school or senior middle school, *gāojí zhōngxué*, consists of grades 10–12.
3. Throughout the primary and secondary education system in China, each classroom typically has a fixed group of students with an assigned class number. For different subjects, the teachers come to the class for the lectures instead of students going to different classrooms, with exceptions such as laboratory classes and physical education.
4. The Chinese title, *lǐkē shíyànbān*, directly translates to Science Experimental Class, as the teaching and management of the class is in many ways unique and different compared to the regular classes, and thus considered “experimental” from a pedagogical standpoint.
5. The class monitors, *bānzhǎng*, are elected or appointed student leaders who support the teachers, especially the class director, with day-to-day management in the classroom.
6. Junior high school or junior middle school, *chūjí zhōngxué*, consists of grades 7–9 and covers the last three years of the 9-year compulsory education in China.
7. In foreign language schools, it is common practices to divide a class into *xiǎobān*, i.e., smaller classes, for English teaching.
8. The class director or head teacher, *bānzhǔrèn*, is in charge of management of one class, besides teaching his/her own subject at this class and/or other classes.
9. The grade director, *niánjí zhǔrèn*, is in charge of all class directors and (non-class-director) subject teachers of a grade.
10. The NCEE, also more commonly known as *gāokǎo*, is a set of academic standardized tests for entrance into almost all higher education institutions at the undergraduate level in China and is held annually in June.
11. NCEE-exempt admission, also more commonly known as *bǎosòng*, exempts students from the NCEE but has various university- and department-specific criteria and procedures for admission that includes science Olympiads or high school academic performances and typically involves additional examinations and/or interviews. Thus, while *bǎosòng* is an early alternative admission process, contrary to some common belief, it is not exam-free and is also subject to equally, if not more, fierce competition.
12. This is a recent update not included in the original writing of the essay.
13. This is a line “*Sù yóu cóng zhī, Dào zǔ qiě cháng*” from the poem *Jiānjiā, The Reeds and Rushes*, from the oldest existing collection of Chinese poetry *Shījīng, The Classic of Poetry*, which comprises of 305 works dating from the 11th to 7th centuries BCE. The poem is provided [online](#) with English translation and interpretation by B. Wang and Y. Zhang.
14. In Chinese mythology, the titanic fish *Kūn* transforms into the gigantic bird *Péng* and, upon roiling the sea and beating the whirlwind, rises thirty thousand miles high into the sky. The Daoist classic *Zhuāngzǐ*, from circa 3rd century BCE, has the oldest record of the *Kūn* and *Péng* myth in its first chapter *Xiāoyáo yóu, Free and Easy Wandering*.