A Brief Review of Teacher Education in the U.S. and China

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We compare the different teacher training models between China and the U.S. through their history of teacher education, including discussion of licensure/certificate requirements and the related content knowledge in both countries are discussed in details. Comparison is made between the two countries with regard to current pre-college education factors such as the enrollments of students, the ratio of students to teachers, the percentage of qualified teachers and those with higher degrees. It is shown that, in China, teacher education is rather independent of other higher education systems, while in the U.S. the education departments/colleges of comprehensive universities are responsible for teacher education. Though these two countries agree that teacher education should contain both academic quality and rigorous professional education, their emphases vary in practice. Chinese teacher education programs focus more deeply on the major's content knowledge. American graduates by comparison have broader knowledge coverage outside of their major in education. The student to teacher ratio is higher in China, and the percentage of qualified teachers or those with higher degrees in China is lower compared to that in the U.S.; however, American teachers are more likely to be assigned to teach out-of-field subjects.

I. A BRIEF HISTORY OF MODERN TEACHER TRAINING IN CHINA AND THE US

The earliest modern school for teachers in China was founded in 1897 and affiliated with Shanghai Nanyang Public School, while the first higher institute for teacher education was created in 1902, affiliated with Imperial Capital University (Jingshi Daxuetang), thus initiating the beginning of Chinese higher education.

The earlier period of Chinese teacher education is usually called as "Japanese model", where teacher universities/colleges/schools are responsible for the teacher education and they are independent of other higher education institutions. Then, with the first modern educational system of China being issued in 1922, Chinese teacher education was reformed to the "American model", characterized by comprehensive universities overseeing teacher education instead of the teacher universities /colleges/schools. Here the pre-service and in-service teacher-training were integrated together. However, after 1951, Chinese teacher education was dramatically affected by the former Soviet Union, and teacher education became independent from comprehensive universities once again. In the present day, the teacher education system is divided into two levels: the higher education teacher schools and the secondary education teacher schools. The higher teacher education schools include higher teacher universities, higher teacher colleges, short circle higher teacher education institutions, and education colleges. The pre-service and in-service trainings are independent from each other. The education colleges are responsible for the training of in-service teachers and the others are responsible for the pre-service teachers. Since the China National Third Conference on Education in 1998, the comprehensive universities have been allowed to conduct teacher education, and the pre-service and in-service programs are being slowly integrated again (Xie, 1999).

The students in the teacher institutions have always enjoyed subsidies since the creation of teacher education through 1997. After 2007, in order to improve the quality of teachers in rural and remote areas, China began teacher training programs free of tuition in the six key teacher universities sponsored by the National Ministry of Education; here students need not pay for their tuitions and are granted handsome living subsidies. Currently about 10,000 tuition-free students are enrolled in these six key teacher universities each year[1].

Modern teacher education in the US started at the beginning of the 19th century and it has undergone three stages: teacher schools, teacher colleges, and education colleges in comprehensive universities.

In 1832 the first private school of education was created and the first public school for teachers was created in 1839. In 1875, there were 95 public teacher schools throughout 25 states containing about 2300 students in the US.

In about 1900, teacher colleges appeared and gradually replaced the teacher schools. However，since the 1950s, the teacher colleges have lost their dominance in teacher education, according to statistics from the 60's, only 20% of teachers were then trained by the teacher colleges, 48% were trained by the public colleges, and the other 32% were trained by the private colleges. After that time, the teacher colleges slowly extended to include art and science colleges or comprehensive universities, or became the education de-

partment/college of the comprehensive universities that are in charge of the teacher education in US now (Ma, 2001).

In the US, an institute must be accredited by the National Council for Accreditation of Teacher Education and the Teacher Education Accreditation Council to provide a teacher education program. New York and North Carolina have the most institutes providing teacher education programs, with 45 and 44 respectively, while in Guam, Hawaii, Vermont, Wyoming there is only one institute with a teacher education program[2].

II. REQUIREMENTS FOR A TEACHER CERTIFICATE OR LICENSE

IN CHINA

A. Classification of the teacher qualification certificate

(1)Preschool (called kindergarten in China) teacher certificate (PC) ;(children age 2 to 5)

(2)Elementary school teacher certificate (EC); (children age 6 to 11)

(3)Junior secondary school teacher certificate (JSC); (children age 12 to 14)

(4)Senior secondary school teacher certificate (SSC); (children age 15 to 17)

(5)Secondary vocational school teacher certificate (SVC); (children age 15 to 17)

(6)Secondary vocational school instructor certificate (SVIC); (children age 15 to 17)

SSC and SVC may be interchangeable, so in the following we will not differentiate them and call them SSC[3].

B. Requirements for teacher qualification certificate

1) Degree requirements

Graduation from the teacher schools for early children or above is required for the preschool teachers.

Graduation from the secondary teacher schools or above is required for the primary school teachers.

An Associate degree or above is required for the junior secondary school teachers.

A bachelor's degree or above is required for the senior secondary school teachers and secondary vocational school teachers.

The degree for the secondary vocational school instructors may not be rigidly enforced provided they can demonstrate expertise in their field.

2) Mandarin Chinese level for future teachers is required at least above the average level.

3) Passing the tests of general pedagogy and psychology prescribed by the Provincial Department of Education. Graduates from the teacher education system are exempted from these tests.

4) Passing the teaching skills test. This test asks applicants to explain how to teach a given topic to the appraiser. Graduates from the teacher universities/colleges/schools who can complete a period of a teaching internship are exempted from this test.

5) Certification of physical and psychological health.Applicants must choose the subjects (usually their majors) to be accredited when applying for the teacher qualification certificate.

C. The authorities to accredit the teacher qualification certificate

PC, EC, JSC are accredited by the local county-level education division.

SSC and SVIC are appraised by the county-level education division and accredited by the upper educational division.

Applicants can apply for the teaching certificate twice each year, and the teaching certificate can be recognized throughout the country once it is accredited by the local education division. The newly accredited teachers have a probationary period of teaching before the formal teaching 4.

IN USA

A. Classification of teacher licenses

All 50 states and the District of Columbia require public school teachers to be licensed. The teachers can be licensed by both the children's age and by the subject areas. Such as teachers may be licensed to teach the early childhood grades(usually preschool through grade 3); the elementary grades(grade 1 through 6 or 8); the middle grades (grade 5 through 8); a secondary-education subject area (usually grades7 through 12); or a special subject, such as reading or music (usually grades kindergarten through 12)5.

The following is the classification of teacher license of the State Ohio.

(1) Early childhood license, valid for teaching in prekindergarten through grade three.

(2) Middle childhood license, valid for teaching in grades four through nine in the curriculum areas named in the license. A middle childhood license may be issued in one or more of the concentration areas to the holder of a standard teaching certificate, or a provisional or professional teaching license.

(3) Adolescence to young adult license, valid for teaching in grades seven through twelve in the curriculum areas named in the license. Licenses are issued in the following teaching fields: Earth sciences, integrated language arts, integrated mathematics, integrated science, integrated social studies, life sciences, physical sciences (chemistry, physics or chemistry and physics).

(4) Multi-age license, valid for teaching from prekindergarten through grade twelve in the curriculum areas named in the license.

(5) Intervention specialist license, valid for teaching learners considered gifted, mild, moderate, intensive, visually impaired, and hearing impaired for all ages three or five through twenty-one.

(6) Early childhood intervention specialist license, valid for teaching learners with mild/moderate/intensive educational needs from prekindergarten through grade three and for providing service coordination.

(7) The career-technical license, valid for teaching the subjects named in the license to learners ages eight and beyond, or grades four and beyond[6].

B. Requirements of teacher license

Requirements for regular licenses to teach kindergarten through grade 12 vary by states. However, all states require general education teachers to have a bachelor's degree and to have completed an approved teacher training program with a prescribed number of subjects and education credits, as well as supervised practice teaching. Some states also require technology training and the attainment of a minimum grade point average. A number of states require that teachers obtain a master's degree in education within a specified period after they begin teaching. Almost all states require applicants for a teacher's license to be tested for competency in basic skills, such as reading, and proficiency in their subject.

A bachelor's degree may not be needed by preschool teachers and vocational education teachers, who need experience in their field rather than a special degree.

Private schools are generally exempt from meeting State licensing standards. For secondary school teacher jobs, they prefer candidates who have a bachelor's degree in the subject they intend to teach, or in childhood education for elementary school teachers.

Nearly all states currently offer alternative licensure programs for teachers who have a bachelor's degree in the subject they will teach, but who lack the necessary education courses required for a regular license. The coursework for alternative certification programs often leads to a master's degree.

The National Board for Professional Teaching Standards offers a voluntary national certification. To become nationally certified, experienced teachers must prove their aptitude by compiling a portfolio showing their work in the classroom and by passing a written assessment covering teaching knowledge. Currently, teachers may become certified in a variety of areas, on the basis of the age of the students and, in some cases, the subject taught. All states recognize national certification, and many states and school districts provide special benefits to teachers who earn certification[5].

The requirements for teacher licensure in Ohio are as follows:

A professional teacher license, valid for five years, shall be issued to an individual who

1) Holds the appropriate provisional license;[7]

2) Has a baccalaureate degree;

3) Is deemed to be of good moral character;

4) Has successfully completed an approved program of teacher preparation, an entry year program; and

5) Has successfully completed an examination prescribed by the State Board of Education[6] (Praxis III Classroom Performance Assessment[8]).

C. The organization to accredit the certificate

Usually licensure is granted by the State Board of Education or a licensure advisory committee.

III. THE CONTENT REQUIREMENTS FOR THE SECONDARY SCHOOL TEACHER EDUCATION PROGRAM

We select the physics major as an example for comparison of the content requirements between these two countries.

A. The physics courses in the physics department of Huazhong (Central China) Normal University, one of the six key teacher universities sponsored by the Ministry of Education of China, are listed as following.

1) Subjective mandatory courses: Advanced Mathematics A(1,2), Linear Algebra A, Mechanics, Thermodynamics and molecular physics, Optical, Electro-magnetism, Analytical mechanics, Methods of mathematical physics, Atomic Physics, Electrodynamics, Quantum Mechanics, Statistical physics, Analog Electronics; 1st order experimental physics, 2nd order experimental physics (1,2), 3rd order experimental physics (1,2), Analog Electronic Experiments. The total credits for the above courses is 65, in addition to the 16-credits of professional education courses such as introductory education, psychology, teaching in physics, physics teaching skills, and modern educational technology.

2) Subjective elective courses: 24 credits including advanced subjective courses, professional education courses, teaching practice, and graduation design (Huang, 2009).

B. The content requirements for the physics major in the Ohio State University

The following courses cover the state-mandated competencies for adolescence and young adult licensure in physics (grades 7-12) and should be completed at the undergraduate level prior to beginning the Master of Education (M.Ed.) teacher preparation program.

Astrophysics, climatology, particles& motion, Electricity & Magnetism, Thermal physics, waves, and quantum physics, Dynamics of Particles and waves I, II, III (I--Vectors and kinematics; foundations of Newtonian mechanics; momentum, work, and energy; conservative and non-conservative forces; potentials; angular momentum; rotation about a fixed axis. II--Rigid body motion, non-inertial systems and fictitious forces, central force motion, the special theory of relativity, relativistic kinematics, relativistic mo-

mentum and energy. III--Introduction to quantum systems; photons; the Bohr atom; matter waves). Introduction Electronics, Physics for Teachers, and other approved physics electives to complete a total of 32 credits.

Other required courses are biology 101(introductory biology) or biology 113(energy transfer & development), chemistry 121,122,123(general chemistry), geology science 110(history of life on earth) or geology science 122(earth through time), math 153(calculus & analytical geometry III) for a total of 20 credits.

The master of education (M.Ed.) teacher preparation programs in the School of Education and Human Ecology of the Ohio State University is a full-time graduate program that begins in the summer and continues through July of the following summer. The M.Ed. includes a coherent series of interdisciplinary core courses, content-specific courses, a research and inquiry component, field experiences, a clinical practicum and a culminating project focused on critical issues in education

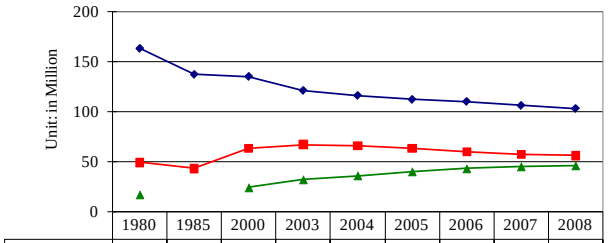
To be eligible for a master's degree, the students must earn a minimum of 50 graduate credit hours with at least 36 quarter hours earned through regular course enrollment at The Ohio State University [9].

IV. GENERAL COMPARISON OF PRECOLLEGE SCHOOLS IN THE TWO COUNTRIES

A. The enrollments of different level schools[10].

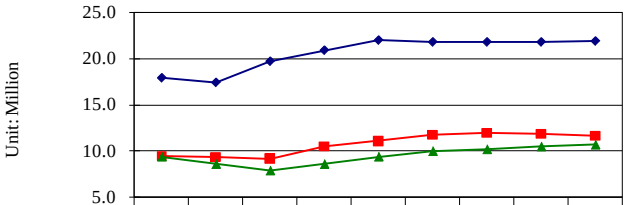
Fig. 1 shows that in China, from 1980 to 2008, the enrollments of the elementary schools are keeping to a decreasing trend. The enrollments of the junior secondary schools peaked in 2003 and then decreased, which is mainly due to the Chinese One Child policy. The enrollments of senior secondary schools are continuing to increase during this period however, which implies that more and more students are seeking education beyond the compulsory education period (grades 1 to 9), most likely due to the recent rapid economic and social development in China. In 2008, the gross enrollment ratios are 99.5%, 98.5%, and 74% respectively in elementary, junior secondary, senior secondary schools.

In the US, enrollments of elementary students increased from 1985 to 2000 and then remained constant (Fig. 2), whereas the enrollments of the senior secondary school students have continued to increase even after 1990. The trend of junior secondary school enrollment is very similar to the senior secondary schools. In 2006, the number of students enrolled in the Chinese elementary, junior secondary and senior secondary schools is respectively about 5.0, 5.1, and 4.0 times that of the number of students in US schools.



	1980	1985	2000	2003	2004	2005	2006	2007	2008
Grade1-6	163	137	135	121	116	112	110	106	103
Grade7-9	49	43	63	67	66	63	60	57	56
Grade10-12	17		24	32	36	40	43	45	46

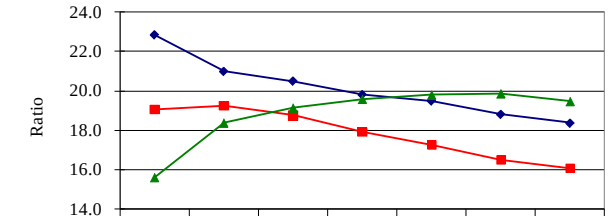
Fig. 1 Students Enrollment in China



	1980	1985	1990	1995	2000	2003	2004	2005	2006
Grade1-6	17.9	17.4	19.7	20.9	22.0	21.8	21.8	21.8	21.9
Grade7-9	9.5	9.4	9.2	10.5	11.1	11.8	12.0	11.9	11.7
Grade10-12	9.4	8.6	7.9	8.6	9.4	10.0	10.2	10.5	10.7

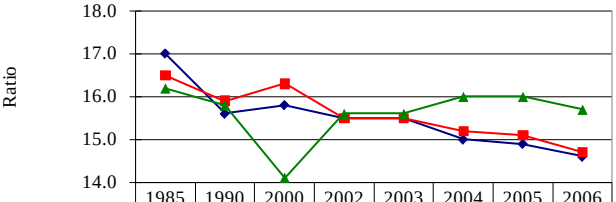
Fig. 2 Students Enrollment in US

B. The student to teacher ratio.



	2000	2003	2004	2005	2006	2007	2008
Grade1-6	22.8	21.0	20.5	19.8	19.5	18.8	18.4
Grade7-9	19.1	19.3	18.8	17.9	17.3	16.5	16.1
Grade10-12	15.6	18.4	19.2	19.6	19.8	19.9	19.5

Fig. 3 Student-Teacher Ratio in China



	1985	1990	2000	2002	2003	2004	2005	2006
Grade1-6	17.0	15.6	15.8	15.5	15.5	15.0	14.9	14.6
Grade7-9	16.5	15.9	16.3	15.5	15.5	15.2	15.1	14.7
Grade10-12	16.2	15.8	14.1	15.6	15.6	16.0	16.0	15.7

Fig. 4 Student-Teacher Ratio in the US

Fig. 3 demonstrates that the student to teacher ratio in China has been decreasing since 2000 in elementary and junior secondary schools. However, in the senior secondary schools, the ratio has increased rapidly since 2000, and since 2005, the ratio has been the largest in the three different school levels, mainly due to the significantly increase of enrollment in those schools, particularly the vocational senior secondary schools. In 2008, the ratio of students to teachers in vocational senior secondary schools was 24.0 though the regular senior secondary schools held their ratio around 16.8 students to teachers.

From Fig. 4, we can see that the US student teacher ratio has kept almost constant at 15 in all different level schools though the ratio in senior secondary schools is greater than the others after 2000.

Compared with the American student to teacher ratio, the Chinese teacher education system has a huge space to increase the enrollments in teacher institutions of different levels.

C. The percentage of qualified teachers with various degrees

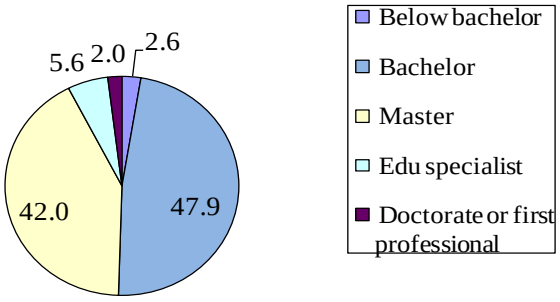
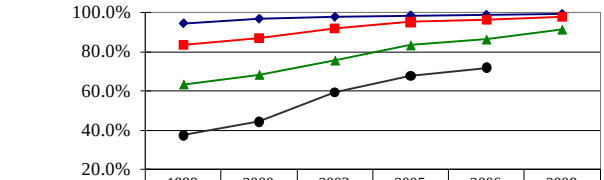


Fig. 5 Percentage of Teacher's Degree, US

In Fig. 5, education specialist degrees or certificates are generally awarded for 1 year's work beyond the master's level. Fig. 5 shows that in 2003-04, in the US, the percentage of high school teachers with a bachelor's degree or above was more than 97.5% and the percentage with a master's degree was 49.6%.



	1998	2000	2003	2005	2006	2008
Grade1-6	94.6%	96.9%	97.9%	98.6%	98.9%	99.3%
Grade7-9	83.4%	87.0%	92.0%	95.2%	96.3%	97.8%
Grade10-12	63.5%	68.4%	75.7%	83.5%	86.5%	91.6%
Voc. Grade10-12	37.4%	44.3%	59.4%	67.7%	71.9%	

Fig. 6 Teachers with Qualified degrees in China

In China, as illustrated in Fig. 6, the percentage of the teachers with a qualified degree is going up in all different level schools according to the Law of Teachers of China. However, even in regular senior secondary schools the percentage of teachers with bachelor's degree was only 91.6% in 2008, and in the vocation senior secondary education the percentage with bachelor's degree is far less with just 71.9% in 2006. Data also show that in junior secondary schools, the teachers with a bachelor's degree is about 35.3% and the teachers with a master's degree in regular senior secondary schools is only 1.2% in 2005.

If we look at into the data from rural areas, the situation is much worse: in 2005 the percentages of the teachers with a qualified degree are 98.41%, 96.06%, 93.2% respectively in cities, counties, and rural areas in junior secondary schools, while in regular senior secondary schools the percentages are 91.11%, 80.49%, 70.94% for those same areas.

Table 1 High School Teacher's Qualification in the US

	English	Mathematics	Science	Social Science
Major&Certified	71.1	64.5	71.7	70.7
Only Major	13.4	11.5	15.5	12.9
Only Certified	9.1	12.7	8.3	11.1
Neither	6.4	11.3	4.5	5.2

In the US, however, there is a certain percentage of teachers receiving assignments out of their majors or teaching certificates (Fig.7). In 2003-04, about 11.3% of mathematics teachers neither majored in nor were certificated in their main assignments in high schools, and about 4.5% of science teachers lacked a major or certificate in science. If we look at the subdivision of sciences or social sciences, the percentage is significantly larger. 41.1% of teachers in earth sciences and more than 20% in physical sciences and chemistry do not have a major or certification in their subject, but in several subdivisions of the social science, such as economics, government, geography, the percentage is closer to 70% [11,12].

V. DISCUSSIONS

1. American licensure procedures allocate more weight and time on the teaching practice. For example many school systems are presently moving toward implementing performance-based systems for licensure, which usually require teachers to demonstrate satisfactory teaching performance over an extended period in order to obtain a provisional license, in addition to passing an examination in their subject. At the same time, the professional license is mainly dependent on the successful completion of the entry year teaching and the classroom performance assessments after the provisional license5. Conversely, the Chinese teaching certificate emphasizes testing more, instead of classroom teaching performance.

2. Though these two countries have a similar belief that high academic quality in major subjects and rigid professional education training are the two key points in the education of a teacher, they have different focuses in practice. Chinese teacher education gives preference to deeper majored-based content knowledge, instead of providing a greater range of subjects related to the major along with professional education courses. The American teacher program requires less in the major and more on professional education and other related topics. It could be speculated that this is the underlining reason why American classes are more liberal and active, while Chinese classes are more mechanical and inactive.

3. The enrollment rates of these two countries are comparable. However, the ratio of students to teachers is larger in China, especially in vocational education. Therefore one of important tasks in Chinese teacher education is to improve the numbers of the qualified teachers in this area.

4. A greater percentage of the licensed American teachers have higher degrees compared with their Chinese counterparts. So, China should enhance the in-service training to improve the qualification of in-service teachers, especially the vocational teachers and teachers in rural areas. In American classes, the largest problem is that the teachers' main assignments are frequently outside of their majors or certificate.

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5. Bureau of Labor Statistics, U.S. Department of Labor, Occupational Outlook Handbook, 2008-2009 edition, Teachers-Preschool, Kindergarten, Elementary, Middle, and Secondary, on the internet at http://www.bls.gov/oco/ocos069.htm.
6. LA Writer Ohio Laws and Rules, chapter 3301-24-05 Licensure. http://codes.ohio.gov/oac/3301-24-05
7. The provisional teacher license, valid for two years, shall be required for entry to an entry year program and may be used for substitute teaching. The provisional license shall be issued, except as noted in paragraph (A)(4) of rule 3301-24-04 of the Administrative Code, to an individual who holds a degree required by the license, who has successfully completed an approved program of preparation, who is deemed to be of good moral character, who has successfully completed an examination* prescribed by the state board of education, who has demonstrated skill in integrating educational technology in the instruction of children, who has been recommended by the dean or head of teacher education at an institution approved to prepare teachers, and who has completed:(1) A minimum of twelve semester hours in the teaching of reading, as required in section 3319.24 of the Revised Code, including at least one separate three semester hour course in the teaching of phonics, and coursework on knowledge and beliefs about reading; knowledge base; individual differences; reading difficulties; creating a literate environment; word identification, vocabulary, and spelling; comprehension; study strategies; writing; assessment; communicating information about reading; curriculum development; professional development; research; supervision of paraprofessionals; and professionalism for the early childhood license, the middle childhood license, the intervention specialist license; and the early childhood intervention specialist license; and(2) A minimum of three semester hours on the teaching of reading in the content area that includes instruction in organizing instruction, use of protocols for oral language development, strategies for word skill development, strategies for reading comprehension, and assessment strategies for instructional purposes for the multi-age license, the adolescence to young adult license, and the career-technical license. *Usually the examination is the Praxis II national Teacher Exams. The Praxis Series™ assessments provide educational tests and other services that states use as part of their teacher licensure and certification process. The Praxis I tests measure basic academic skills, and the Praxis II tests measure general and subject-specific knowledge and teaching skills.
8. Teaching Exam Information, http://www.alleducationschools.com/faqs/exams
9. Content requirements for life science, earth science, physical science, physics, chemistry, and integrated science. http://ehe.osu.edu/edtl/academics/downloads/med-msat-content-science.pdf
10. In this paper elementary corresponds to grades 1 through grade 6. Through Fig. 1 to Fig.4 and Fig.6, junior secondary corresponds to grades 7 through 9, and senior secondary corresponds to grades 10 through 12.While in Fig. 5 and Fig. 7, high schools corresponds to grades 9 through 12.
11. Chinese data is from the website of the Minister of Education of China. http://www.moe.edu.cn
12. American data is from the website of the National Center of Education Statistics. http://www.nces.ed.gov

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