

Case Study

**Integration of Teaching and Research
at the University of Central Florida**

V.P. Konovalov

*Moscow Institute of Physics and Technology, Russia
via the University of Central Florida, USA
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* Introduction.

A modern scientific technological university ought to make good use of the approach to education combining the sound knowledge of fundamental sciences with practical research works. The integration of teaching and research in the university provides its students with their self-dependent creative ability and makes them to be effective employees.

An objective of this case study is to illustrate strategy and approaches in education and research management at the University of Central Florida. Considerable attention has been given to some features of the American management that are uncommon for Russian universities.

It should be noted that the structures of education and research are rather different in the USA and Russia. There are no federal universities in the USA, so fifty states have their fifty different educational administrations; while most of Russian universities are yet federal, i.e. controlled by the Ministry of Education. In the USA scientific research works are performed mainly by universities and firms, while in Russia the better part of research is concentrated in the institutions of Russian Academy of Science, a federal organization.

Recent years have constituted a period of serious changes in Russia associated with new market economy that transforms all the social relations. For instance, a new concept is the subject of wide speculation today about the establishment of joint research-educational centers between educational institutes of the Ministry of Education and research institutions of Russian Academy of Sciences. Under the circumstances, it may be essential to advance the available American methods of research management to Russian university administration.

* *University of Central Florida (UCF), Overview.*

The University of Central Florida (originally Florida Technological University) was founded in Orlando in 1963 and has expanded steadily ever since. It is now one of the largest campuses of the ten Florida state universities, with over 40,000 students. In its short history, UCF has attained a ranking as one of the top southern universities, due to the quality of its faculty and their dedication to excellence in both teaching and research. The University is ranked by the National Science Foundation in the top 50 of U.S. universities in terms of Federally supported research in Physics, and for being in the top 25 largest Universities in terms of numbers of students taking Physics.

The University is located 12 miles east of downtown Orlando, approximately 35 miles from the Atlantic coast and 100 miles from the Gulf of Mexico. The large main campus in Orlando contains state-of-the-art wireless classrooms and modern student facilities. All UCF students have access to the Internet and the university has been recognized nationally as one of the most "wired" campuses in the nation. With more than 1,400 faculty, UCF offers 76 bachelor's degrees, 58 master's degrees and 19 Ph.D. degrees as well as over 60 graduate certificate programs.

Founded forty years ago, UCF today is known throughout Central Florida as the metropolitan research university that is "Under Construction Forever" building new programs, partnerships and facilities, with equal thought and determination, that are setting new standards for learning, research, teaching and community service.

* *Opportunity of Excellence in Teaching and Learning for Faculty.*

The Faculty Center at the University of Central Florida was created to serve faculty and is made possible by the support of the administration. It represents an integrated community of scholars where life-long learning informs and complements excellence in teaching, an environment where teaching is open for both renewal and accountability and where research and service vitalize all students, the community, and ourselves. This is a haven, a safe place for consultation, reflection, or debate, providing a source of leadership and expertise, the first choice for navigating UCF's resource network for faculty.

The Faculty Center's primary mission is to support and promote faculty in their roles as teachers, researchers, scholars, and as members of UCF and the Central Florida community. Essential to such support is the enhancement of faculty success at any career stage and the promotion of collegiality. The Faculty Center services, resources, and events are available to all university instructors, including full- and part-time faculty and graduate teaching

assistants. It is to promote excellence in teaching and learning; successful research and creative endeavors; professional fulfillment; and partnerships with other academic institutions and the regional, national and international community.

The Faculty Center services, in particular, support and sponsor learning communities; coordinate Teaching Excellence Awards; fund faculty fellows with stipends for project development and curriculum transformation; assist faculty in developing multimedia portfolios on teaching, learning, and research. The Faculty Center publishes the Faculty Focus, a journal which highlights faculty experts on campus and is a forum for sharing ideas on teaching and learning;

* *Opportunity of Excellence for Junior and Senior Students.*

The Burnett Honors College at UCF, in affiliation with the National Collegiate Honors Council, is designed to attract and challenge students who have demonstrated an ability to achieve academic excellence. Honors students receive an education that prepares them to enter the best graduate and professional schools, as well as obtain distinguished careers in business and public service. The Burnett Honors College offers two distinct programs of study, University Honors and Honors in the Major.

University Honors provides a special course of study to the most promising undergraduate students at the university. This program is geared toward incoming freshmen or students transferring from a community college with an Honors degree. Primarily, the focus of Honors is to combine smaller classes with greater expectations for a student's performance. From the first day of class, students will be asked to participate in the learning experience instead of merely observing it. In doing so, their performances as individuals and as teams will grow. In Honors, students are encouraged to develop their intellects in a way that will enhance them as thoughtful, productive, and creative individuals.

Honors in the Major is a two-year program designed to encourage the best junior and senior students to undertake original and independent research in their major field under the supervision of a faculty committee. This research culminates in a thesis or creative project. Because of the diversity of student interests, academic departments regulate Honors in the Major course work.

* *Education in Physics and Technology.*

The Department of Physics offers a multi-track program of study leading to the B.S. degree, giving students the flexibility to choose a suitable set of courses to prepare for their career goals. A common core of courses in

theoretical and experimental physics will lead to a broad understanding of the general principles of physics. The different tracks allow students to specialize, applying problem-solving techniques in a certain area of interest; this also enhances their qualifications for employment in that area after graduation. Undergraduate physics majors benefit from small class sizes, and are encouraged to be involved in individually designed senior projects working with a faculty advisor.

The University of Central Florida offers master's and doctoral programs in Physics, with tracks in General Physics and Optical Physics. Research opportunities are available in condensed matter physics, nanostructure devices, surface science, optical physics, complex systems, biophysics, and atomic and molecular physics. After graduation the students are prepared to enter advanced study in physics, engineering, medicine, environmental sciences, astronomy, and other related disciplines. They are also prepared to begin careers in positions are varied as engineering physics, computational physics, and physics education.

The Department of Physics places a strong emphasis on research. The research programs include optics and lasers, condensed matter physics, complex systems, biophysics, atomic and molecular physics, nanostructures, and space science. The Department has many corporate and federal partners and research programs.

An inter-campus partnership of the Department of Physics with the Center for Research and Education in Optics and Lasers (CREOL) provides additional academic and research benefits for Physics graduate students, as well as outstanding post-graduate employment opportunities in major optics, laser and semiconductor industries.

The School of Optics/CREOL is a graduate school for optical science and engineering education and research. Its mission is to provide the highest quality education in optical science and engineering, to enhance optics education at all levels, to conduct scholarly fundamental and applied research, to aid in the development of Florida's and the nation's technology based industries.

The School of Optics is recognized as one of the top three independent optics academic departments in the nation. The School offers interdisciplinary graduate programs leading to MS and Ph.D. degrees in Optics. CREOL - The Center for Research and Education in Optics and Lasers is integrated in the school as its research arm. The School of Optics/CREOL has grown to an internationally recognized institute with 24 full time faculty members, approximately 50 research scientists and 150 graduate students with research activities covering all aspects of optics, photonics, and lasers.

* College of Optics and Photonics: Research for Florida Region.

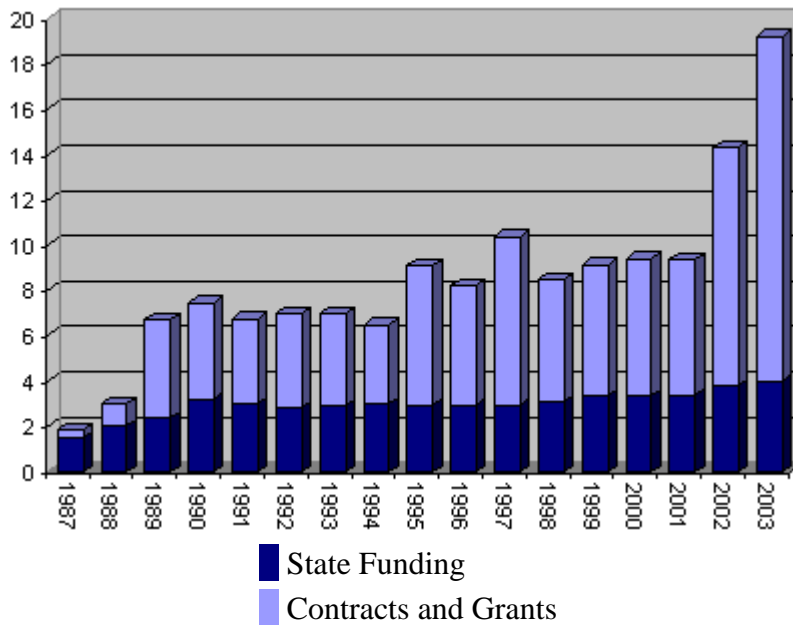
The College of Optics & Photonics is a graduate college for optical science, optical engineering, education, and research. This College is an independent academic unit at the University of Central Florida and now houses two major research centers: the Center for Research and Education in Optics and Lasers (CREOL), in existence since 1985, and the Florida Photonics Center of Excellence (FPCE), founded a year ago.

CREOL was initially founded by the State of Florida to promote growth in optics and related fields just in central Florida. In March 2003, the Governor of Florida Jeb Bush and the Florida Board of Education underscored the significance of photonics for Florida's economy - and UCF's leadership role in this key area - by allocating \$10 million to establish the Florida Photonics Center of Excellence (FPCE) at UCF's College of Optics & Photonics. This adds a second research center to the College in addition to the well established Center for Research and Education in Optics and Lasers, CREOL.

UCF's proposal to establish this technology "center of excellence" emerged as the top candidate among those reviewed earlier in the year by the state's Emerging Technology Commission (ETC). The Photonics Center will add an important new dimension to UCF's internationally renowned College of Optics & Photonics. This designation will provide resources needed to expand the photonics into the growing areas of high-technology such as nanophotonics, biophotonics, advanced imaging and 3D displays, and ultra-high bandwidth communications. The FPCE state funds are being used to develop infrastructure (new faculty, eminent chairs); to fund Partnership Projects at Florida universities via competitive proposals; and to pursue commercialization and outreach with the help of the Industrial Advisory Board (IAB). Moving research out of the laboratories and into the marketplace is a priority at UCF and the FPCE.

The College of Optics & Photonics is growing quickly, and so is the optics and photonics industry in the region. Now there are more than 150 optics- and photonics-related companies in the state of Florida, and the College provides the well-trained workforce that keeps the industry growing. The recently-founded Florida Photonics Cluster is working to coordinate this industry's efforts and needs. From the graph of CREOL funding each year, one can get a feel for its growth (see Fig.1); and next year the Center gets an extra \$10 million from the state of Florida. CREOL received more than \$4 million from industry last year, a connection which gives its students experience and a leg up on industry positions after they graduate.

Fig. 1. CREOL Funding by Year (Millions of US Dollars)



The research performed at the College by its graduate students, faculty, visiting scientists and postdoctoral students is published and presented regionally, nationally, and internationally.

* UCF Technology Incubator: Commercialization of Technologies.

The University of Central Florida Technology Incubator’s mission is to provide early stage technology companies with the enabling tools, training, and infrastructure necessary to create financially stable, high growth enterprises. The Incubator, opened in 1999, has since grown from 12 to over 30 emerging technology companies, which have generated more than 400 new jobs and more than \$100 million in revenues from sales and research and development grants.

Partnerships within the University and the community are critical to the success. The UCF Technology Incubator focuses on business development services and support. Client companies have access to professional coaches and mentors who are leaders in their respective fields. The extensive network of advisors is in place to support the development of client companies through seminars, individual consultations, and professional services. Client advisors assess various aspects of company development and offer advice and referrals to promote optimal corporate growth. In addition to the business development partners, the UCF Technology Incubator works with successful entrepreneurs both within the UCF community, and throughout the world to bring its clients

the experience and insight of individuals who have created successful businesses from the ground up.

With the wealth of talent and resources developed by UCF and the benefits of its prime locations, the UCF Technology Incubator is poised to make a significant contribution to the economic development of the region's high technology sector. Combined with efforts by other organizations such as: the Florida High Tech Corridor Council; City of Orlando; Orange County Government; the Technology Research and Development Authority (TRDA); the Economic Development Commission of Mid-Florida, Inc; The Central Florida Technology Partnership; and others, the region will soon become one of the nation's premier locations for high-tech enterprises.

UCF's Technology Incubator earned national and local recognition as a model for taking university technology to the marketplace.

** Research Activity in 2003.*

Research at the University of Central Florida continued to set new levels of success in 2003, the fourth year in a row that external funding has seen a double-digit percentage increase. The record \$88.8 million in funding is more than double the amount of funding received just four years ago (see Fig.2).

Fig. 2. University of Central Florida Research Funding by Year
(Millions of US Dollars).

Total Sponsored Research Awards, 1995-2003					
Fiscal Year	Number of Awards	Award Totals	State Awards	Federal Awards	Private/Other Awards
2003	694	\$88.8 M	\$23 M (26%)	\$47 M (53%)	\$19 M (21%)
2002	748	\$75.4 M	\$19 M (25%)	\$41 M (54%)	\$15 M (20%)
2001	803	\$64.9 M	\$8 M (12%)	\$31 M (48%)	\$26 M (40%)
2000	849	\$52.8 M	\$12 M (22%)	\$21 M (40%)	\$20 M (38%)
1999	690	\$37.4 M	\$8 M (12%)	\$16 M (43%)	\$13 M (35%)
1998	498	\$36.5 M	\$10 M (27%)	\$14 M (38%)	\$13 M (35%)
1997	495	\$33.9 M	\$7 M (21%)	\$17 M (50%)	\$10 M (29%)
1996	423	\$31.6 M	\$6.5 M (20%)	\$14.7 M (46%)	\$10.8 M (34%)
1995	444	\$37.2 M	\$10 M (27%)	\$17.6 M (47%)	\$9.6 M (26%)

UCF research is moving from promise to prominence in such fields as optics, lasers, photonics, education, nano-science, bio-molecular science and simulation. Innovative projects involving water, human factors, materials science and engineering and genes are underway. Notable research accomplishments, record funding levels and faculty accolades made 2003 a resounding success (see Fig.3).

Fig. 3. University of Central Florida Research 2003
Submissions/Awards Summary

Proposals submitted	892
Awards received	694
New awards received	393
Continuations or supplementals	301
Grant and contract dollars requested	\$398,573,000
Grant and contract dollars awarded	\$88,825,061
Grant and contract direct expenditures	\$80,286,785
Recovered indirect cost expenditures	\$11,136,867
Total grant and contract dollars expended	\$91,423,652
Faculty receiving awards	344
Sponsors	253

The College of Education ranked first among all units at UCF in research awards (\$16,386,052) during the 2002-2003 academic year.

The School of Optics/CREOL (Center for Research and Education in Optics and Lasers) brought in \$16.2 million and became the foundation for a major, new statewide initiative when the new Florida Photonics Center of Excellence at UCF led the list of three proposed university-based research centers recommended by Governor Jeb Bush's Emerging Technology Commission (ETC). The resulting \$10 million in state funding will add a new dimension to the groundbreaking research in optics and lasers taking place at the internationally renowned School of Optics/CREOL, focusing on the growing areas of nano-photonics, bio-photonics, advanced imaging and 3-D displays and ultrahigh-bandwidth communications. UCF's proposal for a Hydrogen Center of Excellence was also ranked in the top five proposals by the ETC.

Success is seen in the commercialization of UCF intellectual property. In 2003, UCF's Technology Transfer Office processed 43 new invention disclosures and filed for 63 domestic and 10 international patents. UCF received 21 new patents including the first ever issued in China. The Gossamer Wind ceiling fan, developed by Florida Solar Energy Center researcher Danny Parker, continued to generate UCF's largest share of royalties in 2003 - \$121,000. Nearly 500,000 fans had sold at the end of the fiscal year.

The UCF Technology Incubator (UCFTI), recently named one of the top ten incubators in the U.S., is a good example of current impact in practice. The UCFTI serves more than 40 technology-based enterprises - which in the last three years have created more than 400 jobs with an average annual salary of \$68,000. An indicator of success is the decision of companies to locate their

operations near a major research university. The Central Florida Research Park, adjacent to UCF, is now ranked among the top ten research parks in the nation. Its annual payroll is approximately \$520 million and it houses nearly 90 companies with 9,000 employees.

Success is measured according to current impact - the ability of research to change the way of doing business and to improve quality of life. In the College of Engineering and Computer Science a variety of projects focused on improving regional transportation issues contributed to \$15.2 million in funding. UCF's Center for Advanced Transportation Systems Simulation (CATSS) is working with the Florida Department of Transportation to improve traffic monitoring and flow. Success is also measured by the ability to build research partnerships and leverage resources. The Florida High Tech Corridor, an initiative of UCF and the University of South Florida (USF), in partnership with the area's high tech companies, community colleges and economic development organizations, is home to nearly 6,800 companies with 158,000 employees. The Corridor stretches from St. Petersburg to the Space Coast.

Success is illustrated by a university's leadership. UCF's Florida Solar Energy Center (FSEC) is leading a NASA-sponsored hydrogen research effort involving five additional State University System (SUS) schools. By 2003 the initiative had received \$10.4 million from NASA. FSEC also conducted one of the first studies in the nation on leakage of air handlers in central air conditioning systems in new homes and the Center's Building Research program continues to be the lead contractor for the Department of Energy's program to help manufactured home builders improve the energy efficiency of their products.

Simulation and training is a major component in Florida's tech economy and work at UCF is critical to national defense and homeland security. The Institute for Simulation and Training is leading multidisciplinary efforts that received \$5.5 million in defense grants, \$4.5 million for "modeling, simulation and training infrastructure and community development" in Central Florida from the U.S. Army, and \$1 million to develop a modeling and simulation immersion laboratory in partnership with the U.S. Navy. There is a \$5-million, five-year grant from the U.S. Army to study how soldiers react under stress.

Success is enhanced when research strengths are combined. Collaborative research efforts are growing at UCF, exemplified by joint UCF-University of Florida (UF) space related research projects. UCF conducted an open competition for collaborative projects from the two schools - resulting in the selection of five proposals out of more than three dozen reviewed. Combining research strengths resulted in several expected and unexpected benefits: enhanced extramural funding for the teams and the design of two

major instruments - one for increased capability of space-based and earth-based space telescopes and one that is a candidate for a Mars probe scheduled to launch in 2010.

* Conclusions.

The University of Central Florida represents a vivid example for fruitful integration of teaching and research. It affirms the following demands of the time for a contemporary university to succeed in education and fruitful scientific research:

- opportunity to support promising individual research projects for both faculties and students (opportunity of excellence) within the university;
- orientation of technological research works essentially to the problems of domestic regional companies, business and community to develop the region and to serve people directly;
- perpetual competition for various financial awards (federal, state, private) to support both educational and research projects in the university;
- commercialization of the research, inventions, technologies to focus on business development, manufacturing application and profit for the university;
- actually, modern university is to grow into a research university with its education, scientific work and business inseparably linked and related to the market economy.

* Acknowledgement.

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* Appendices.

This case study is accompanied with appendices for two reasons, first, education-research institutions in the USA and Russia show noticeable difference; second, at present the Russian education and research structure undergoes the attempts of governmental reformation.

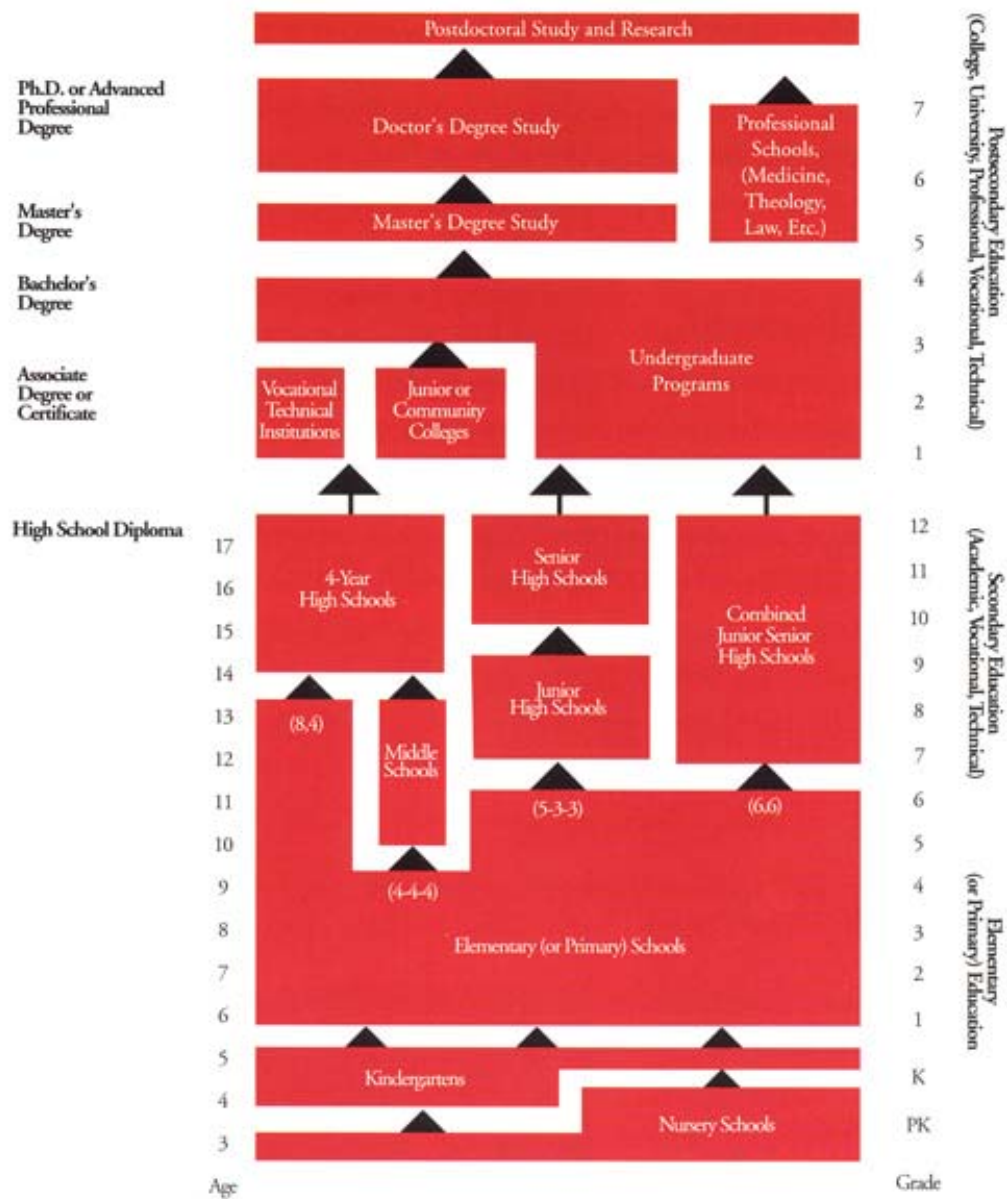
Appendix 1 gives the principal objects of the USA education system – its total structure and expenditures – for a Russian reader to start any study of the subject with. Appendix 2 is to impress upon an American reader (and a reflective Russian one as well) with current conditions of the Russian education reform just at the time of this case study being written.

Appendix 1.

Structure and Expenditures of Education in the USA

The structure of education in the United States provides different paths to graduation from high school or a post-secondary institution, and it is common for students to move between different types of schools, or to leave the system and return later in life.

Fig. A1. Structure of Education in the United States of America.



Source. 2002 Digest of Education Statistics, Figure 1. (Washington, D.C.: U.S. Department of Education, NCES, 2003).

Fig.A2. Total expenditures of educational institutions in the USA related to the gross domestic product: 1980-81 to 2001-02.

School year	Expenditures in billions of current dollars	Expenditures in billions of constant 2001-02 dollars ¹	As a percent of gross domestic product
1980-81.....	182.8	376.1	6.5
1982-83.....	212.1	385.0	6.5
1984-85.....	247.7	417.2	6.3
1985-86.....	269.5	441.3	6.4
1986-87.....	292.0	467.7	6.6
1988-89.....	346.9	510.0	6.8
1989-90.....	381.5	535.4	7.0
1990-91.....	412.7	549.1	7.1
1991-92.....	433.0	558.3	7.2
1992-93.....	456.1	570.2	7.2
1993-94.....	477.2	581.6	7.2
1994-95.....	503.9	597.0	7.1
1995-96.....	529.6	610.8	7.2
1996-97.....	562.9	631.2	7.2
1997-98.....	597.5	658.3	7.2
1998-99.....	633.5	686.1	7.2
1999-2000.....	678.4	714.1	7.3
2000-01 ²	712.8	725.4	7.3
2001-02 ³	745.2	745.2	7.4

¹ Constant 2001-02 dollars based on the Consumer Price Index, prepared by the Bureau of Labor Statistics, U.S. Department of Labor.

² Preliminary.

³ Estimated.

Expenditures for public and private education, from preprimary through graduate school, are estimated at about \$745 billion for 2001-2002. The expenditures of elementary and secondary schools are expected to total \$454 billion for 2001-2002, while institutions of higher education will spend about \$291 billion. The total expenditures for education are expected to amount to about 7.4% of the gross domestic product in 2001-2002.

/Digest of Education Statistics, 2002/

Appendix 2.

Russian Education in the Shadows

(digest of current events on Russian education reform: October-November, 2004)

"Russia in the Shadows"
Herbert G. Wells, 1920.

Education determines the position of a country in the modern world and the status of a man in the society. The education system is part of a social organization and connected with other parts. It is part of the society's basis together with the state system, economy, ideology and culture. Russia, which in the Soviet period was rated as a perfectly educated country, is now sweepingly turning into a poorly educated nation. Today, education, teaching and upbringing are very poor in this country. Less humanitarian lessons at school will deprive people of culture and ruin the educational factor.

The Russian education system is still afloat thanks to the Soviet heritage not because of some post-soviet innovations. The national education system seriously degraded during perestroika. Much has been said about support to education and science over the period since perestroika. In 2001, President Vladimir Putin spoke at a session of the State Council on the national education system improvement and emphasized that particular attention must be paid to the achievements of the Soviet education system that "was effective enough and had a strong basis." Meanwhile, crises in the education system are increasing, this is how the Principal of the state's Higher School of Economics summed up the fourth year of the drive to modernize Russia's higher and secondary educational establishments. The modernization is designed to improve the quality of Russian education, but state allocations cannot even maintain the status quo.

"Money spent on education is investment in the human capital." (1980 Nobel Prize Laureate T.Shulz). According to the World Bank, the spending on education made up 7% of the Soviet gross domestic product (GDP) in 1970, but the showing dropped to 3.4% by 1994 in Russia. In the Soviet Union 5-6% of GDP went to education (the same sums are now spent in Poland, Portugal and Sweden), however, in today's Russia the figure is 3.6%. The state earmarks a mere \$400 per high-school student every year. Financing of the national science per a researcher will increase five times to 750.000 rubles (less \$3.000) by 2008. Just compare: developed countries usually have \$100-200 thousand.

Before the new academic year began on September 1, Education Minister Andrei Fursenko stated that any innovations should be "carefully thought-out." The slogan of modernization has now become "sensible conservatism." The educational reform includes a transition to unified state exams, i.e. when final-year school exams double up as university entrance exams. This system is expected to save time and money, combat corruption at universities and give children from low-income families an opportunity to enroll in prestigious Moscow universities. The unified state exams are taken locally as written tests and checked by an independent commission. Schoolchildren can send their marks to several universities at a time and calmly wait for the results at home. The experiment has been underway for four years. This year, it involved 65 Russian Federation constituent members, 982,000 school-leavers, and 946 universities and their branches. Tests can hardly reflect knowledge and abilities in full. Hence, the result is that only one schoolchild in 10,000 gets the highest marks in the unified state exams. This is too few, given the crucial role of these exams in children's lives.

Russian President Vladimir Putin has called on the Russian Academy of Sciences to modernize work with account for present-day realia. The state will render maximum support to the revival of the Academy as the center of attraction of the scientific community on the whole, center of education and culture of the Russian civilization, the President said. According to him, Russian experts do not forecast the volumes and terms of the scientific contribution to the GDP doubling because they do not see grounds for this. Major research and production structures should be formed in the sphere of applied science to provide the concentration of state and business resources in the advanced spheres of science and technology. The fundamental science should preserve scientific schools, above all, those meeting worldwide trends and creating breakthrough conditions, and provide their development, the President continued.

Mr. Putin demanded to react to the brain drain. "Europe is being maintained at our expense and we should make conclusions and react to this," he said. However, brain drain is a common problem. European specialists also go to the countries where they can get more money. The President called to form a competitive intellectual capital in Russia. Modern organizing skills, patents, know-how, and trademarks should be effectively used. "This intellectual capital is more valuable at world markets than raw materials and qualified labor force," the head of state concluded.

The role of science in economy is increasing in countries with a high education level. Unfortunately, the Russian idea saying that business must finance the science has failed. Today the business community is not ready to support the modern education and science system. They would not finance spheres with long-term prospects. It means that only the government can accumulate financial resource for a breakthrough in the education and science sphere. The Russian science must become competitive, in other words it must be part of the global economy. But first of all the thorough auditing must be held in the national science. Over 3.000 of scientific organizations subsist on the budget; some of them are no longer science oriented. It would make sense to put them up for sale. In other words, scientific organizations must be given a chance to develop independently. Wages of researchers may increase only when ownership of research institutions changes (incorporation, partial or absolute privatization). While the number of state scientific organizations has grown significantly since 1990, they account for only 34% of all patents issued in the country. Innovative products account for only 6% of Russian exports, and scientific research is in little demand on the domestic market.

President Vladimir Putin backed a plan to cut the number of state-funded scientific institutions by at least two-thirds, while increasing funding for science by more than 50%. The plan, developed by the Education and Science Ministry, envisages that the state will fund only 800 research institutions by 2006, down from a total of 2,388 now. Federal spending on science will increase from 46.2 billion rubles (\$1.6 billion) in 2004 to 70 billion rubles in 2006 and 110 billion rubles by 2008.

This ministry's plan, titled the National Concept of Participation in Managing State Scientific and Research Organizations, envisages the privatization or transformation into nonprofit partnerships of hundreds of mostly non-academic institutions. Under the plan, a copy of which has been obtained by The Moscow Times, the government seeks to retain ownership of "strategically important" institutions and ensure they are staffed and equipped well enough to conduct "fundamental" research. Each scientist in the state-funded institutions will be allocated an annual research budget of at least 700,000 rubles (\$24,000) by 2008, the plan says. The government would also own 100% of the shares in some of the privatized institutions, but will not fund them, the plan says. Some top academics initially protested the reform because they feared it would severely downsize the Russian Academy of Sciences, but the concept's final version leaves the academy's property largely intact.