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“Educate to Innovate”: How the Obama Plan for STEM Education Falls Short

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Abstract: *President Obama’s Educate to Innovate initiative has provided billions in additional federal funding for science, technology, engineering, and mathematics (STEM) education programs across the country. The Administration’s recognition of the importance of STEM education—for global competitiveness as well as for national security—is good and important. But the past 50 years suggest that federal initiatives are unlikely to solve the fundamental problem of American underperformance in STEM education. Heritage Foundation education and national security analysts explain that, though Educate to Innovate is intended to raise the U.S. “from the middle to the top of the pack in science and math,” the federal program’s one-size-fits-all approach fails to remedy the underlying problems of academic performance and does not plug the leaky pipeline in the American education system.*

In the 1950s and 1960s, Sputnik and the space race inspired a generation of Americans to pursue education and careers in science and technology. Half a century later, American students are now ranked 22nd and 31st among their peers throughout the world in science and math, respectively. Students in the United States, once a leader in science, technology, engineering, and mathematics (STEM), are now outperformed by students from Liechtenstein, Slovenia, Estonia, and Hungary, among others.¹

In 1983, the National Commission on Excellence in Education published “A Nation at Risk,” a national study that highlighted the unacceptable state of the American education system:

Talking Points

- Half a century after the Space Race, American students are now ranked 22nd and 31st among their peers throughout the world in science and math, respectively.
- The Obama Administration’s Educate to Innovate campaign falls short of its goal of increasing American students’ science, technology, engineering, and math (STEM) proficiency because it fails to address the underlying problems that plague the current educational system.
- In order to increase STEM proficiency, the Obama Administration should limit, not increase, federal influence over education, and afford state and local policymakers flexibility with their federal education dollars in order to better target resources to those areas most in need. Access to STEM courses can be expanded with the proliferation of high-quality virtual education programs.
- A STEM-educated workforce is vital to the security and the prosperity of the U.S. as industry and government increasingly demand highly trained STEM professionals to compete in the global market.

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Our nation is at risk. Our once unchallenged preeminence in commerce, industry, science, and technological innovation is being overtaken by competitors throughout the world. This report is concerned with only one of the many causes and dimensions of the problem, but it is the one that undergirds American prosperity, security, and civility... What was unimaginable a generation ago has begun to occur—others are matching and surpassing our educational attainments. If an unfriendly foreign power had attempted to impose on America the mediocre educational performance that exists today, we might well have viewed it as an act of war.²

More than two decades later, in 2010, the National Academies of Science, Engineering and Medicine published “Rising Above the Gathering Storm, Revisited: Rapidly Approaching Category 5,” which built on the findings of their 2005 “Gathering Storm” report. Notably, the report warns that, “Today, for the first time in history, America’s younger generation is less well-educated than its parents.”³

Attempting to counter the faltering academic standing of American students and seeking to elevate them “from the middle to the top of the pack in science and math,” the Obama Administration announced its Educate to Innovate initiative in November 2009.⁴ The program, while touted as an effort to enhance STEM education, falls short of achieving this goal because it fails to address the underlying problems that plague the current educational system.

The Obama Administration should limit, not increase, federal influence over education, and afford state and local policymakers flexibility with their federal education dollars in order to better target resources to those areas most in need. For their part, state and local policymakers should:

- Promote alternative and flexible means to certify new teachers;
- Create an environment favorable to online education to allow more students to have access to quality STEM education;
- Link teacher pay to performance to help recruit and retain qualified teachers; and
- Reform the traditional public school structure to promote school choice.

Educate to Innovate

President Barack Obama’s Educate to Innovate campaign is touted as a collaborative effort between the federal government, the private sector, and the non-profit and research communities to raise the standing of American students in science and math through commitments of time, money, and volunteering. The program strives to increase STEM literacy, enhance teaching quality, and expand educational and career opportunities for America’s youth.

When the program was first announced in November 2009, the participating organizations offered a financial and in-kind commitment of more than \$260 million. Taxpayer obligations for the federal government’s portion of Educate to Innovate add to that total.

1. U.S. Department of Education, National Center for Education Statistics, “Highlights From PISA 2006: Performance of U.S. 15-Year-Old Students in Science and Mathematics Literacy in an International Context,” December 2007, at <http://nces.ed.gov/pubs2008/2008016.pdf> (December 1, 2010), and press release, “Remarks by the President on the ‘Educate to Innovate’ Campaign and Science Teaching and Mentoring Awards,” The White House, January 6, 2010, at <http://www.whitehouse.gov/the-press-office/remarks-president-educate-innovate-campaign-and-science-teaching-and-mentoring-awar> (December 1, 2010).
2. National Commission on Excellence in Education, “A Nation at Risk,” April 1983, at <http://www.ed.gov/pubs/NatAtRisk/risk.html> (December 1, 2010).
3. The National Academies Press, “Rising Above the Gathering Storm, Revisited: Rapidly Approaching Category 5,” 2010, at http://www.nap.edu/openbook.php?record_id=12999&page=1 (December 1, 2010).
4. Press release, “Remarks by the President at the National Academy of Sciences Annual Meeting,” The White House, April 27, 2009, at http://www.whitehouse.gov/the_press_office/Remarks-by-the-President-at-the-National-Academy-of-Sciences-Annual-Meeting (December 1, 2010).

Additionally, five public-private partnerships were announced, as well as commitments by key societal and private-sector leaders to mobilize resources for STEM education, innovation, and awareness.⁵ These partnerships and commitments are:

- **Time Warner Cable’s “Connect a Million Minds” (CMM)**, which pledges to connect children to after-school STEM programs and activities in their area;
- **Discovery Communications’ “Be the Future”** will broadcast dedicated science programming to more than 99 million homes and offer interactive science education to approximately 60,000 schools;
- **Sesame Street’s “Early STEM Literacy”** commits to a two-year focus on STEM subjects;
- **National Lab Day** will promote hands-on learning with 100,000 teachers and 10 million students over the next four years, and foster communities of collaboration between volunteers, students, and educators in STEM education. These initiatives will then culminate in a nationally recognized day centered on science activities;
- **The National STEM Video Game Challenge** promotes the design and creation of STEM-related video games;
- **The annual White House Science Fair** will bring the winners of science fairs from across the nation to the White House to showcase their STEM creations and innovation; and
- **Sally Ride, first female astronaut, Craig Barrett, former Intel chairman, Ursula Burns, CEO of XEROX, and Glenn Britt, CEO of Eastman Kodak**, committed to foster interest and support for STEM education among American corporations and philanthropists.⁶

In January 2010, President Obama announced the continuance of the program, highlighting the half-billion-dollar financial commitment from the Administration’s partners. This expansion includes an added commitment of \$250 million in financial and in-kind support, and a promise by 75 of the nation’s largest public universities to train 10,000 new teachers by 2015. The program expansion also included further public-private partnerships intended to facilitate the training of new STEM educators, including the launch of Intel’s Science and Math Teachers Initiative and the PBS Innovative Educators Challenge, as well as the expansion of the National Math and Science Initiative’s UTeach program and Woodrow Wilson Teaching Fellowships in math and science. Furthermore, the President called on 200,000 federal government employees working in the fields of science and engineering to volunteer to work with educators in order to foster enhanced STEM education.⁷

A More Fundamental Problem

When President Obama announced his Administration’s plan to enhance STEM education, he affirmed that “we know that the nation that out-educates us today will out-compete us tomorrow.”⁸ The President’s plan to enhance STEM education, much like similar efforts in the past to improve education through short-term bursts with federal dollars, falls short of the dramatic changes needed in the educational system to truly fill the gap.

The need to improve STEM education in the United States is no recent revelation. Over the past 50 years, American leaders have repeatedly discussed the need to enhance STEM education. Yet, despite increasing federal efforts and spending, U.S. students continue to under-perform in STEM subjects. In 2007, for instance, the America COMPETES Act created new federal funding for STEM

5. Press release, “President Obama Launches ‘Educate to Innovate’ Campaign for Excellence in Science, Technology, Engineering & Math (Stem) Education,” November 23, 2009, at <http://www.whitehouse.gov/the-press-office/president-obama-launches-educate-innovate-campaign-excellence-science-technology-en> (December 1, 2010).

6. *Ibid.*

7. Press release, “President Obama Expands ‘Educate to Innovate’ Campaign for Excellence in Science, Technology, Engineering, and Mathematics (STEM) Education,” The White House, January 6, 2010, at <http://www.whitehouse.gov/the-press-office/president-obama-expands-educate-innovate-campaign-excellence-science-technology-eng> (December 3, 2010).

8. Press release, “Remarks by the President on the ‘Educate to Innovate’ Campaign.”

education. The act included the creation of a new federal initiative to train 70,000 new teachers in Advanced Placement and International Baccalaureate courses, as well as initiatives intended to provide existing teachers with STEM training and to encourage university students pursuing STEM degrees to concurrently obtain teaching certifications. Despite these efforts, there remains a major shortage of qualified STEM teachers throughout the nation—and American students continue to perform worse than their peers in STEM subjects.⁹

Encouraging the private sector to get involved in the education of tomorrow's workforce can align the education of today with the skills needed for tomorrow. Using creative approaches to tackle learning challenges is certainly a concept that should be embraced. The problem with the President's approach, however, is that the root of America's STEM education deficit is much more fundamental than the problems addressed by the President's initiatives. The American K–12 education system is meant to function as a pipeline that prepares students for higher education and careers. But with an average annual dropout rate of close to 10 percent, there is little doubt that this pipeline has sprung a leak.¹⁰ Even many of those who do graduate with a high school diploma lack the knowledge and skill-base to succeed in the STEM field.

In the United States today, just 73 percent of freshmen entering high school will graduate within four years, and those who do are often not adequately prepared for higher education and careers in STEM fields.¹¹ Too many students are not making it through the leaky pipeline of the American education system with the skills they need to suc-

ceed. The reasons for their underperformance stems from a number of problems:

A One-Size-Fits-All Approach. Despite increasing federal control over the American education system over the past 50 years, educational achievement across the country has continued to deteriorate.¹² A large part of the problem is that the federal focus centers on a one-size-fits-all approach. Most recently, this approach is part of the Obama Administration's efforts to impose national education standards and tests on states. This is a significant federal overreach into states' educational decision-making authority, and will likely result in the standardization of mediocrity, rather than a minimum benchmark for competency in math and English.¹³ Applying a blanket approach to education reform undermines innovation in STEM education, increasing conformity at the expense of meeting the diverse needs of students and parents.

Recruiting Quality Teachers. The Educate to Innovate initiative increases Department of Education grants to train teachers in the STEM fields by \$10 million, and lauds a promise by 75 of the nation's largest public universities to train 10,000 new teachers by 2015. But in pledging to train 10,000 new teachers over the next five years, public universities will be training just 2,500 more teachers in the STEM fields than are currently being trained. This means that each of the 75 schools will train just six new teachers per year.¹⁴

A major impediment to improving STEM education in the public school system, however, is the ability of schools to recruit quality teachers in the field. The average salary for K–12 teachers in the

9. Dan Lips and Jena Baker McNeill, "A New Approach to Improving Science, Technology, Engineering, and Math Education," Heritage Foundation *Background* No. 2259, April 15, 2009, at <http://www.heritage.org/Research/Reports/2009/04/A-New-Approach-to-Improving-Science-Technology-Engineering-and-Math-Education>.
10. U.S. Department of Education, National Center for Education Statistics, "Fast Facts," at <http://nces.ed.gov/fastfacts/display.asp?id=16> (May 26, 2010).
11. Press release, "President Obama Announces Steps to Reduce Dropout Rate and Prepare Students for College and Careers," The White House, March 1, 2010, at <http://www.whitehouse.gov/the-press-office/president-obama-announces-steps-reduce-dropout-rate-and-prepare-students-college-an> (December 3, 2010).
12. Lindsey M. Burke and Jennifer A. Marshall, "Why National Standards Won't Fix American Education: Misalignment of Power and Incentives," Heritage Foundation *Background* No. 2413, May 21, 2010, at <http://www.heritage.org/Research/Reports/2010/05/Why-National-Standards-Won-t-Fix-American-Education-Misalignment-of-Power-and-Incentives>.
13. *Ibid.*

2006–2007 school year was \$51,000, 86 percent of the yearly salary of occupations requiring similar education.¹⁵ More than half of the workers in science and engineering fields earned a salary of \$70,600 or more in 2007.¹⁶ Students graduating from college with STEM degrees recognize that they can earn more in non-teaching professions and are shying away from careers in education. The Business Higher-Education Forum estimates that by 2015 there will be a shortage of 283,000 science and education teachers in secondary education alone.¹⁷

Concurrently, barriers also exist discouraging those who are currently in STEM professions from becoming teachers. Individuals with a professional background in STEM have the potential to be outstanding teachers because of their in-depth understanding of the subjects and practical experience. In many cases, however, these individuals face difficulties in obtaining teaching certifications, in terms of time, cost, and prohibitions imposed, often from federal policymakers.

Fixating on the Traditional School Model.

While alternative education programs have long been in development, the American education system has continued to fixate on the traditional school model. Alternative education programs offer much promise for fostering innovation in education across the country. Online or virtual learning programs, for example, allow a break from the traditional model in which educational opportunity is tied to one's zip code and enables students to gain access to the best teachers regardless of where they are located. In 2009, the U.S. Department of Education conducted a meta-analysis of online-learning studies and con-

cluded that “students who took all or part of their class online performed modestly better, on average, than those taking the same course through traditional face-to-face instruction.”¹⁸

Online-learning options are growing rapidly and present an effective new medium for STEM education. As of 2009, 45 states had some form of online-learning program, with more than one million students enrolled in courses online.¹⁹

Plugging the Leaky Pipe

This leaky pipeline is perpetuated as students, ill-prepared by a faltering educational system, face significant challenges in pursuing STEM education in post-secondary school. While the absolute number of students attaining STEM degrees more than doubled between 1960 and 2000, the number of students attending college increased. The percentage of students obtaining STEM degrees has, thus, held relatively constant around 17 percent for the past several decades. In the 2002–2003 school year, for example, of the approximately 2.5 million degrees awarded, 16.7 percent of bachelor's degrees, 12.9 percent of master's degrees, and 34.8 percent of doctoral degrees were in a STEM field. In comparison, roughly equal numbers of bachelor's degrees were awarded in STEM as were awarded in business, and twice as many business master's degrees were awarded. Only at the doctoral level do STEM degrees exceed most other fields.²⁰

Despite the low number of STEM degrees awarded, demand for STEM professionals is growing. The Government Accountability Office (GAO) reports that between 1993 and 2004, employment

14. Dave Saba, president and CEO of the American Board for Certification of Teacher Excellence (ABCTE), in Sarah Torre, “Innovation Missing from President's Educate to Innovate Program,” The Foundry, Heritage Foundation blog, February 3, 2010, at <http://blog.heritage.org/2010/02/03/innovation-missing-from-presidents-educate-to-innovate-program>.

15. National Science Foundation, *Science and Engineering Indicators 2010*, Chap. 1.

16. *Ibid.*, Chap. 3.

17. Business-Higher Education Forum, *BHEF 2006 Issue Brief*, 2006, at http://www.bhef.com/publications/documents/brief3_s06.pdf (December 3, 2010).

18. U.S. Department of Education, “Evaluation of Evidence-Based Practices in Online Learning: A Meta-Analysis and Review of Online Learning Studies,” September 2010, at <http://www2.ed.gov/rschstat/eval/tech/evidence-based-practices/finalreport.pdf> (December 3, 2010).

19. John Watson, Butch Gemin, Jennifer Ryan, and Matthew Wicks, “Keeping Pace with K–12 Online Learning: A Review of State Level Policy and Practice 2009,” November 2009, at <http://www.kpk12.com/wp-content/uploads/KeepingPace09-fullreport.pdf> (December 21, 2010).

in STEM fields grew by 23 percent, while overall employment in non-STEM fields grew by only 17 percent.²¹ Furthermore, in 2010, the National Science Foundation reported that “the S&E [science and engineering] workforce has shown sustained growth for over a half a century, and growth is projected to continue in the future.” The same National Science Foundation report also estimated that the average annual growth rate for the science and engineering workforce is 6.2 percent, compared to 1.6 percent for the overall U.S. workforce. While the current economic recession has strained employment opportunities, the need for STEM remains strong and is a means to foster innovation in national security and industry, as well as promote job growth in research and development and related areas. The current educational system, however, continually fails to prepare students for a post-secondary STEM curriculum.

This means that America needs a real solution to the challenges in STEM education, one that develops and fosters interest in the subjects from an early age and builds a strong base of STEM-educated citizens throughout the United States. In order to achieve this goal, federal and state policymakers should work toward genuine education reform that empowers parents to choose a school that best meets the needs of their children. Data demonstrate that the one-size-fits-all federal efforts to improve STEM education have simply fallen short in educating America’s children in science, technology, engineering, and mathematics. Educate to Innovate is another broad scheme that will spend taxpayer dollars without getting to the root cause of deficiencies in the K–12 education system. In order to plug the leaky pipeline of STEM education, states should:

- **Seek alternative and flexible means to certify new teachers.** Too many science and math teachers do not have a degree in the subjects they teach. STEM majors have the potential to serve as high-quality science and math teachers; however, the rigor of such courses of study makes it difficult for these students to concurrently pursue minors or certificates in education. Traditional education degrees or certificate programs have a high cost in both time and money. Alternative certification programs, however, offer a low-cost, time-efficient means of training greater numbers of quality STEM professionals to enter the teaching field.

Organizations such as the American Board for Certification of Teacher Excellence (ABCTE) offer increasing appeal to both potential new teachers and schools seeking to hire these excellent teachers. Last year, ABCTE provided 219 new teachers with certificates, up from 144 in 2008. The cost of this program is a mere \$1,995, while a traditional university degree could cost on average \$28,080 at a public four-year university, or upwards of \$105,092 at a private university.²² Candidates for an ABCTE certificate need only to hold a bachelor’s degree, pass a background check, and pass teaching-knowledge and subject-area exams, with most completing the program in less than a year. ABCTE certification is already accepted as a teaching qualification in Florida, Idaho, Mississippi, Missouri, New Hampshire, Pennsylvania, South Carolina, Utah, and Oklahoma.²³ While alternative teacher-certification skeptics have argued that such programs are not as rigorous, research has shown these concerns to be unfounded.²⁴

20. Jeffrey J. Kuenzi, “Science, Technology, Engineering, and Mathematics (STEM) Education Issues and Legislative Options,” Congressional Research Service *Report for Congress*, May 22, 2006, at <http://media.umassp.edu/massedu/stem/CRS%20Report%20to%20Congress.pdf> (December 3, 2010).

21. Lips and McNeill, “A New Approach to Improving Science, Technology, Engineering, and Math Education.”

22. The College Board, “What It Costs to Go to College,” at <http://www.collegeboard.com/student/pay/add-it-up/4494.html> (December 3, 2010).

23. American Board for Certification of Teacher Excellence, at <http://www.abcte.org> (May 26, 2010).

24. Robert Gordon, Thomas J. Kane, and Douglas O. Staiger, “Identifying Effective Teachers: Using Performance on the Job,” The Brookings Institution, April 2006, at http://www.brookings.edu/papers/2006/~media/Files/rc/papers/2006/04education_gordon/200604hamilton_1.pdf (December 3, 2010).

ABCTE reports that only 40 percent of its candidates are able to complete their rigorous program, highlighting its quality and merits.²⁵

Nevertheless, traditional four-year universities are also stepping up in forming programs to encourage and enable STEM majors to pursue teaching after graduation. The University of Texas at Austin's UTeach program, for example, offers students the opportunity to obtain a STEM degree and a teaching certificate concurrently.²⁶ The University of Texas is now graduating 70 science and math teachers per year with a 70 percent retention rate compared to the 50 percent national retention rate.²⁷ Following on the UTeach example, 13 other universities, including the University of California at Berkeley, have begun similar programs as part of the National Science and Mathematics Initiative (NSMI).²⁸

- **Encourage greater access to online classes and programs.** In recent history, the quality of education available to a student has largely been determined by zip code. Online education programs, however, provide quality STEM education to students regardless of geography. Approximately 1 million students, or 2 percent of U.S. K–12 students, already participate in online education, with 27 states offering state-wide virtual schools and 24 states plus the District of Columbia allowing students to attend these schools full-time.²⁹

Across the nation, there is a great variety of online or virtual learning programs. Many offer supplementary education, presenting students the opportunity to take classes not offered at their schools (whether an upper-level Advance

Placement (AP) class or basic physics) or offering a hybrid education to enhance in-class instruction. Others offer full-time programs or cyber charter schools where students “attend” all of their classes online. These programs may be either publicly run, under state, school district, or charter authority, or privately run, as the for-profit education industry now accounts for roughly 10 percent of the education market.³⁰ Another added benefit to online education is the ability to customize programs to student needs and allow students to work at their own pace.

For STEM education and beyond, virtual learning programs address teacher shortages. Students are able to take a chemistry class from the best instructors online, countering the fact that many school districts have trouble finding qualified STEM teachers. Some online programs even offer virtual chemistry or biology laboratories.

- **Link pay to performance.** Teachers' salaries have long been based on seniority and credentials, completely ignoring market influence and teacher efficacy. To help recruit and maintain qualified teachers, school districts should link pay to performance. For STEM teachers or those with degrees or professional experience in the field, higher salaries are more prevalent in industry than in the teaching profession.

Recognizing this market demand, employers may need to offer STEM teachers better compensation. Providing bonuses for those teachers who are successful in recruiting more students to enroll *and* pass AP courses in the STEM fields could attract and retain high-quality teachers.³¹ In Florida, a state leader in education reform, the One Florida program offers \$50 in state

25. Lindsey Burke, “Getting Talent in the Classroom,” The Foundry, Heritage Foundation blog, October 16, 2009, at <http://blog.heritage.org/2009/10/16/getting-talent-into-the-classroom/>.

26. The University of Texas at Austin, UTeach, at <http://uteach.utexas.edu/> (December 3, 2010).

27. National Math and Science Initiative, “UTeach Program,” 2010, at <http://www.nationalmathandscience.org/index.php/uteach-programs/uteach-program.html> (December 3, 2010).

28. University of California at Berkeley, CalTEACH, 2008, at <http://calteach.berkeley.edu/about.php> (December 3, 2010).

29. Dan Lips, “How Online Learning is Revolutionizing K–12 Education and Benefiting Students,” Heritage Foundation Backgrounder No. 2356, January 12, 2010, at <http://www.heritage.org/research/reports/2010/01/how-online-learning-is-revolutionizing-k12-education-and-benefiting-students>.

30. *Ibid.*

funding to teachers for each of their students who pass an AP exam, up to \$2,000 a year.³²

- **Empower parents with school choice.** Millions of students across the country are trapped in low-quality, government-assigned public schools. School choice, however, offers parents the opportunity to choose schools for their children that offer better opportunities that meet their children's needs. Last year, 23 private-school-choice programs in 15 states and the District of Columbia offered varying degrees of school choice options to 190,000 of the nation's students. These programs not only provide better educational opportunities, but force schools to have greater accountability to students and their families through competition. In addition, 40 states and the District of Columbia permit charter schools, and 46 states have public-school-choice options.³³

In the case of public-school choice, a key component has been the availability of “backpack funding,” or allowing funding to follow a student to a public school of choice. Such mobile funding also offers great potential for the future of online education, such that students could be able to use either a portion of their educational funding for supplemental virtual education or all of their educational funding for full-time programs.

A Nation at Risk

A STEM-educated workforce is vital to the security and the prosperity of the U.S. as industry and government increasingly demand highly trained STEM professionals to compete in the global market, and look to science and technology to help stay one step ahead of national security threats.

The United States must not allow itself to continue to be outcompeted in science, technology, engineering, and mathematics. While the Administration's Educate to Innovate initiative is intended to raise the U.S. “from the middle to the top of the pack in science and math,” this one-size-fits-all, federal approach fails to remedy the underlying problems of academic performance and does not plug the leaky pipeline in the American education system.

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31. Ethel Machi, “Improving U.S. Competitiveness with K–12 STEM Education and Training,” Heritage Foundation *Special Report* No. 57, June 16, 2009, at <http://www.heritage.org/research/reports/2009/06/improving-us-competitiveness-with-k-12-stem-education-and-training>.

32. *Ibid.*

33. Lindsey Burke, “School Choice in America 2009: What it Means for Children's Futures,” Heritage Foundation *Background* No. 2332, November 12, 2009, at <http://www.heritage.org/research/reports/2009/11/school-choice-in-america-2009-what-it-means-for-childrens-futures>.