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The National Academy of Sciences' (2007) report, *Rising Above the Gathering Storm*, called for more scientific and technical innovation to maintain America's economic growth and vitality. Countless other reports over the past few decades have all called for more science, technology, engineering and math (STEM) education, culminating in President Obama's "this is our generation's sputnik moment" speech at the 2011 State of the Union. The more STEM knowledge students gain, the more prepared they will be for the 21st century knowledge-based economy, the thinking goes.

STEM jobs, however, account for a mere 5 % of all U.S. jobs, which suggest that prudent allocation of resources is a principle consideration. Do all students need STEM education or should it be focused primarily on the mathematically and scientifically inclined? Here, demographics may hold the key to such questions from which a 21st century education model should be based on.

The Importance of Demographics

Simply, demographics tell us what issues we are dealing with and what kind of society we are becoming. For instance, a higher population of immigrants suggests the need to increase bilingual education. A shrinking middle class precipitates growing inequality and radicalism. Graying baby boomers spurs higher government spending in Medicare. Thus, a better understanding of demographics helps us address employment opportunities and problems by matching supply with demand.

In the case of STEM education, policymakers can logically consider one of two strategies: The "quantitative" approach seeks just to expand the number of scientists and engineers by requiring compulsory STEM education for all students (i.e., providing some STEM for all); whereas the "qualitative" approach strives to optimize STEM development for only the mathematically and scientifically-inclined student segment. Researchers from The Information Technology and Innovation Foundation (2010) believed that this "all STEM for some" approach is more feasible, efficient and equitable. Although education needs to produce certain skills to work in the information society, most students will not need calculus or physics knowledge for their work. Again, it's a question of matching the supply and demand of skills.

Educators should to take a cue from other industries and learn to respect the inherent differences in their markets. Industries such as entertainment, food, and apparel develop targeted communications plans to consider the diverse inclinations, mindset, and values of specific demographics (such as ethnicity, gender, and age) in order to increase patronage. Advertisers in particular are widely known to cater to their "target audience," oftentimes by collecting demographic and financial information from product warranties, banks, and credit card agencies.

Politicians likewise craft distinct messages that might target by geography (swing states), religion (the Christian

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vote), political view (Tea Party), lobbies (meat industry), and of course, ethnicity (the Hispanic vote) when running for public office. In this way, many industries recognize that groups are more receptive when you respect their distinctiveness and address their particular needs. It's actually the most democratic approach.

However, this differentiated model has curiously eluded the education industry. Though it adjusts services for certain groups (e.g., special education students, bilingual students), education still primarily follows an outdated "one-size-fits-all" approach, ignoring vast differences, abilities, and interests. Forcing all students to take abstract subjects such as algebra may do more harm than good if they lead to sustained apathy and dropout; contextualizing mathematical reasoning would be a better solution. In the highly specialized world of the information society, educators must get to know their "target audience" and how to accommodate students' varying abilities in order to optimize receptivity and potential. Only through this recognition will educators be able to develop students whose skills match employers' demands.

Two interrelated demographic segments in particular illuminate the importance of the differentiated model and have critical implications for the 21st century knowledge-based economy: 1) The cognitive class; and 2) highly skilled immigrants, particularly those from Asia. In light of emerging research, the analysis of both groups reveals the folly of a standardized and homogenized education model, and attempts to shed light on a new educational paradigm.

The Cognitive Class

The cognitive class, also known as the intellectual class, the smart fraction, the creative class or the gifted & talented, is not a traditionally recognized demographic segment such as immigrants, Latinos, or women. In education for the 21st century knowledge economy, however, recognizing this group is critically important.

Research has shown that a person's mental ability has a significant and positive relationship with income and educational attainment (Heckman et al. 2006; Ng et al. 2005; Scullin et al. 2000). On an individual level, it functions to open the doors of opportunity and to solve problems by increasing insight, foresight and rationality that result in proximal consequences like higher quality work and better health (Rindermann 2008; Rindermann and Thompson 2011) as well as social skills and emotional intelligence.

On an aggregate level, cognitive ability has an enormous impact on economic growth, according to an emerging class of economists and cognitive science researchers. Lynn and Vanhanen (2002) revealed three major insights in a seminal study that collected data from 81 countries: 1) national IQ correlated significantly with per capita gross domestic product (GDP) (r=.62); 2) IQ was similarly correlated with economic growth (r=.64); and 3) nations' IQs differed widely, with East Asian countries like Japan (IQ=105) and South Korea (106) scoring high, and sub-Saharan African countries like South Africa (72) and Ghana (71) scoring low.

Although Lynn and Vanhanen's data drew wide scrutiny for its methodological limitations and racial implications, numerous studies have since confirmed the overall *IQ-productivity* relationship (e.g., Jones and Schneider 2010; Hunt and Wittman 2008; Hanushek and Woessmann 2009). Lynn and Vanhanen (2006) and Rindermann (2007) further reinforced the validity of national IQ by associating it with international tests such as the *Trends in International Mathematics and Science Study* (TIMSS), the *Programme for International Student Assessment* (PISA), and the *Progress in International Reading Literacy Study* (PIRLS), with an r ranging from .80 to .90. Apparently, mathematical, scientific, and verbal abilities are suitable proxies for IQ.

However, rather than focus on the average cognitive ability of a nation, several contemporaries have centered on the academic elite known as the cognitive class. Studies demonstrate that the IQ and test scores of those within the top ten percentile had a decisive effect on GDP and STEM achievement compared with national IQ (Gelade 2008; Rindermann and Thompson 2011). STEM achievement was determined by four indicators: 1) The number of patents per million; 2) Nobel Prizes in science related to population size; 3) the number of scientists and engineers per million; and 4) the rate of high-technology exports as a percentage of manufacturing exports.

In concrete terms, Rindermann and Thompson (2011) discovered that an increase of one IQ point per person in the intellectual class raises average per capita GDP by US $468 compared with only $229 by those from the mean group. Assuming that 5 % of the 55 million pubic school students are considered gifted and talented (G&T), then each additional increase in IQ points for the G&T students would add almost $1.3 billion to the GDP. From another perspective, Hanushek and Woessmann's (2009) calculations suggested that the top 5 % of students who increased their international scores by ten percentage points would have over four times greater impact on a nation's annual economic growth compared with those at the basic literacy level (1.3 vs. 0.3 percentage point annual growth, respectively).

Taken together, these studies suggest that the current lack of investment in academically high-potential students, particularly in the STEM fields, will have consequences for the U.S. economy. NCLB's current focus on low-achievers is admirable but outdated in a global and technological world. More resources are needed to accurately identify and

rigorously develop academically high potential students, especially those who may have certain disadvantages such as a language barrier.

Highly Skilled Immigrants: H-1B Visa Program, Patent Rates, and Start-ups

Immigrants who have shown high cognitive abilities, particularly those with technical STEM skills, can significantly impact America's knowledge-based economy. No program in the U.S. is more indicative of the federal push for 21st century STEM skills than the H-1B visa program, authorized under the Immigration and Nationality Act in 1990 to increase the inflow of highly skilled "guest workers" from abroad.

The questionable design of the program, however, frustrates private employers who need far more skilled workers than the program supplies. Firms are limited to 85,000 visas per year despite the fact that they comprise 90 % of all requests in 2010–2011 (universities, which comprise only 10 %, remain uncapped). The annual supply of visas is usually exhausted in months or even weeks; in pre-recession 2007, it took *only 2 days* (see Table 1). Jilted employers have no choice but to wait until the following year to reapply. As a result, researchers at the Metropolitan Policy Program at the Brookings Institute (2012) have urged policymakers to create a nonpartisan H-1B advisory panel that can recommend annual adjustments to the cap level based on: 1) labor market conditions to identify skills shortages; and 2) demographic needs that address local demand.

Patenting rates are another economic indicator of STEM innovation. Highly skilled foreign inventors are increasingly playing crucial roles in cutting-edge research (particularly those in American universities) by developing groundbreaking products and services that create jobs for American workers. A revealing report by the Partnership for a New American Economy (2012) found that over three-quarters of STEM-related patents awarded to the top ten patent-producing universities in 2011 had foreign-born inventors. Among all institutions, foreign-created patents increased 337 % from 1998 to 2006 (7.6 % to 26 %, respectively) (Wadhwa et al. 2007a). Most of them originated from California by far, followed by Massachusetts, New Jersey, New York and Texas. No doubt economically vibrant metropolitan areas and renowned universities both play a large role.

Hand in hand with immigrants' patent contribution in America is their entrepreneurial presence. From 1995 to 2005, foreigners founded one-quarter of all U.S. engineering and technology companies; in Silicon Valley, it was over half (Wadhwa et al. 2007b). When counting all senior management, the proportion was even higher. The largest percentage of these immigrant-founded start-ups was specifically in semiconductors (35 %), followed by computers/communications (32 %), software (28 %), innovation/manufacturing-related services (which included electronics, computer and hardware design and engineering services) (26 %), and bioscience (20 %); see Fig. 1. Based on these figures, it is clear that immigrants' entrepreneurial involvement in the STEM fields is likely to trend upward in the foreseeable future.

The biggest obstacle, apparently, is that current immigration policies make it difficult for highly skilled knowledge workers to secure work in the U.S. after they get degrees. One such policy is the aforementioned restriction on the H-1B visas, influenced largely by critics who fear the loss of American jobs to foreigners. Yet emerging research confirms that highly skilled foreigners actually support American jobs. For example, the American Enterprise Institute for Public Policy Research and the Partnership for a New American Economy (2011) found that every additional foreign-born worker in STEM fields with advanced degrees from a U.S. institution is associated with an additional 2.62 American jobs. Kerr and Lincoln (2010) discovered that growth in H-1B employment was associated with increased total employment in science and engineering. Additionally, other researchers claimed that immigrant-founded companies actually created 450,000 jobs from 1995 to 2005 (Wadhwa et al. 2007b).

Another barrier for immigrant workers and students is the lack of opportunities once their visas expire. In fact, obtaining work visas was the largest concern expressed by 85 % of Indians and Chinese and 72 % of European nationals currently studying in U.S. higher education institutions (Wadhwa et al. 2009). The stay rate of foreign doctoral recipients has generally been high (though varying widely among countries), but it has also declined among those with

Table 1 Number of days before H-1B visa caps were reached, 2005–2012

Year Applications Were Filed*	Days Until General H-1B Visa Cap Met
2005	132
2006	56
2007	2
2008	7
2009	256**
2010	301**
2011	236**
2012	72

Department of Homeland Security press releases, as cited by Partnership for a New American Economy (2012)

*Applications are filed on April 1 for visas valid the following fiscal year

** Longer duration from 2009–2011 most likely due to economic recession

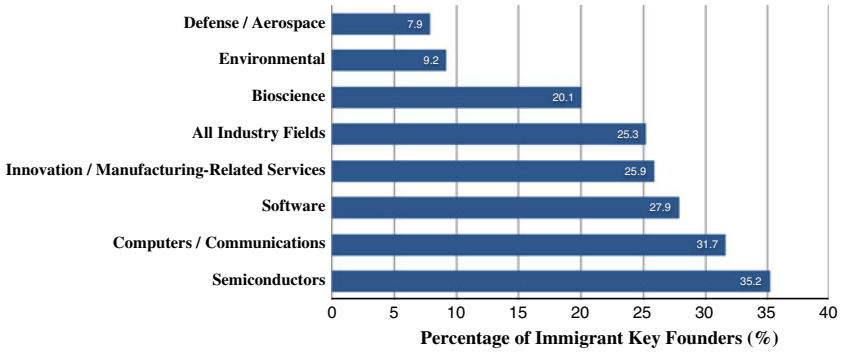

Fig. 1 Immigrant Breakdown of Immigrant Founded Companies. Note: Key Founder refers to President/Chief Executive Officer or the head of development/Chief Technology Officer. Source: Wadhwa et al. (2007b)

temporary visas (Finn 2007). This burdensome process is precisely why only 6 % of Indian, 10 % of Chinese, and 15 % of European students would like to stay permanently. Along with a sizable undecided population, this group is rapidly turning to alternative options. Vivek Wadhwa, the director of research at the Center for Entrepreneurship and Research Commercialization at Duke University, describes how other countries are attracting these students:

> If a tech start-up wants to launch in Chile, the government rolls out the red carpet. Entrepreneurs get $40,000 grants, free office space, and expedited visa clearance. There are no strings attached—provided the entrepreneur relocates to Chile and spends at least 6 months launching his or her idea. Australia, Britain, Canada, Germany, and Singapore all offer variations on this theme as part of aggressive efforts to recruit entrepreneurs. For its part, the Chinese government has pursued a particularly aggressive effort that includes awarding coveted city residency passes, free ownership of apartments, prestigious university posts, and outright cash grants to highly skilled returnees. Contrast this with Silicon Valley, where many foreign-born entrepreneurs spend a considerable amount of time, energy, and money worrying about their immigrant status and the whims of the Department of Homeland Security. (Wadhwa 2012)

Clearly, U.S. policies must not only welcome foreign talent, but also find ways to keep them in order to prevent a reverse brain drain. This includes: 1) loosening (or removing) H-1B visa cap restrictions for highly skilled workers; 2) supplying more grants, living residences, and research- or university-based positions; and 3) providing incentives, such as a fast-track residency program for both immigrants who graduate with an advanced degree in science and engineering and those who launch technology companies. Solutions as these would be similar to the DREAM Act, but for skilled—as opposed to undocumented—immigrants; yet implementation is predicated on the nation's ability to recognize its uniquely diverse demographic advantages. If it cannot, America would be committing what New York City mayor Michael Bloomberg has called a form of "national suicide."

The 2012 Pew Study: The Rise of the Asian-American Immigrant Demographic

Unsurprisingly, a significant portion of highly skilled immigrants comes from Asia. They are granted three-quarters of all H-1B visas, for instance, with China and India alone accounting for 64 %. Even so, such findings tell only a fraction of an emerging trend, according to the Pew Research Center's (2012) newest study, *The Rise of Asian Americans*. Asian Americans, the bulk of whom trace their roots to six countries—China, India, Japan, Korea, the Philippines, and Vietnam, are standing out as a select group, leading all other racial groups in population growth, income, and education in the United States.

Representing 6.2 % of the total U.S. population (as of 2011), the Asian population (including mixed race Asians) grew 46 % over the past decade and surpassed Hispanics as the fastest growing immigrant group in 2010. Although the Latino immigration rate has slowed significantly since the middle of last decade, those from Asia have continued to gain—quintupling from 1980 (3.6 million) to 2011 (18.2 million). Asian immigrants also accounted for 36 % (430,000) of *new* immigrants—those coming between 2007 and 2010—compared with 31 % who were Hispanic (370,000). Based on the most recent U.S. Census Bureau's (2008a, b) population projections, growth (or percentage change) for both groups will far outpace Blacks and whites by 2050; see Table 2. By then, it is estimated that Asians will number over 43 million and make up almost 10 % of the total U.S. population. The growth rate of whites will decline in comparison, going from 81 % of the population in 2010 to just about 77 % in 2050. If excluding mixed-race whites, they represented 64.7 % in 2010 and will steadily decline over the next four decades to 46.3 %. By 2050, whites in the U.S. will be the minority population.

The Asians' level of growth is compounded by certain economic advantages. For one, Asian immigrants have a much lower undocumented rate compared to Latinos (approximately 15 % vs. 45 %, respectively). Also, Asian immigrants are notably more likely than other groups to be admitted with employment visas (27 % received green cards based on employer sponsorship, compared with 8 % of other

Table 2 Projections & percent distribution of the U.S. population by race alone or in combination: 2010 to 2050 (in millions)

Race	2010	2020	2030	2040	2050	% Change 2010–2050
Asian	17.6 5.7 %	23.1 6.8 %	29.2 7.8 %	35.9 8.9 %	43.1 9.8 %	173 %
Hispanic	49.7 16.0 %	66.4 19.4 %	85.9 13.0 %	108.2 26.7 %	132.8 30.3 %	189 %
Black	42.2 13.6 %	47.7 14.0 %	53.5 14.3 %	59.5 14.7 %	65.7 15.0 %	110 %
White	251.4 81.0 %	272.8 79.9 %	294.9 79.0 %	316.7 78.1 %	339.4 77.3 %	95 %
Total	310.2 100 %**	341.4 100 %**	373.5 100 %**	405.7 100 %**	439.0 100 %**	–

In combination means in combination with one or more other races. **The sum of the race groups adds to more than 100 % (the total population) because individuals may report more than one race. Source: U.S. Census Bureau (Population Division 2008a, b)

immigrants). Most importantly, their median household income ($66,000) exceeds other groups, including whites ($54,000), even when adjusted for household size differences; see Fig. 2. Their median household wealth, or sum of assets, also eclipses the median U.S. population ($83,500 vs. $68,529), although they still lag far behind whites ($112,000). Despite out-performing whites in income, Asians have a lower net worth as a result of immigration restrictions prior to 1965 that hindered long-term asset accumulation. No doubt that gap will shrink significantly by 2050.

Such economic advantages are, in turn, due to the high overall level of education; almost half of Asians in the U.S. have at least a bachelor's degree compared with 28 % of the general population. Among *recent* Asian immigrant adults, the percent is even higher: practically two-thirds who immigrated between 2007 and 2010 were enrolled in college or graduate school, or held a college degree (see Fig. 3). Based on this trend, the education gap between Asians and other minorities will likely remain or widen unless current reforms are reimagined.

For now, *overrepresentation* is probably the most fitting description characterizing this ambitious demographic, especially within higher education. Asian Americans constitute 60 % of all foreign students in U.S. educational institutions. Within STEM fields, both foreign- and native-born Asian students disproportionately hold advanced U.S. degrees in 2010: A quarter of the 48,069 research doctorates granted at U.S. institutions; almost half of all engineering Ph.D.s, 38 % of math and computer science doctorates; one-third of physical sciences doctorates; one-quarter of life science Ph.D.s; and almost one in five social sciences doctorates. Predictably, two-thirds of the Intel Science high

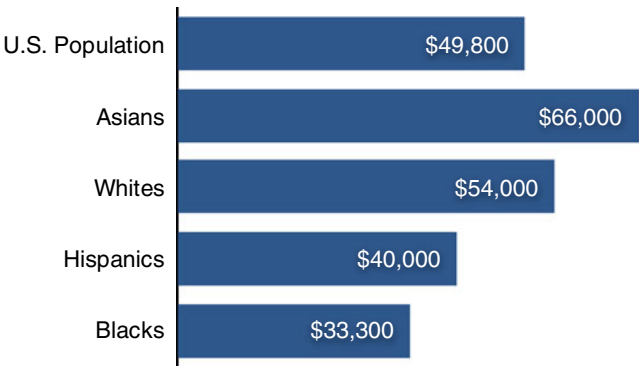

Fig. 2 Median Household Income, 2010. Note: Asians include mixed-race Asian population, regardless of Hispanic origin. Whites and Blacks include only non-Hispanics. Hispanics are of any race. Household income is based on householders ages 18 and older; race and ethnicity are based on those of household head. Source: Pew Research Center analysis of 2010 American Community Survey, Integrated Public Use Microdata Sample (IPUMS) files, Pew Research Center (2012)

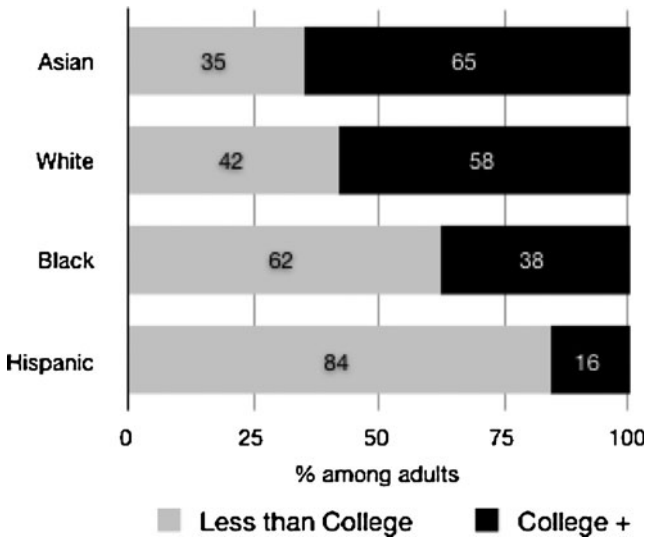

Fig. 3 Education Characteristics of Recent Immigrants, by Race and Ethnicity, 2010. Source: Pew Research Center analysis of 2010 American Community Survey, Integrated Public Use of Microdata Sample (IPUMS) files, Pew Research Center (2012)

school finalists in 2011 were of Asian heritage. Many finalists and winners of this talent search have subsequently won Nobel Prizes, MacArthur and Sloan research fellowships, or been elected to the National Academy of Sciences. They have been the key to keeping the United States competitive with China and India.

Undergirding their economic and educational edge is a distinctive culture that strongly values marriage, parenthood, hard work, and career success. The Pew survey reveals that Asians do in fact place the highest priorities on: 1) being a good parent (three-quarters of Asian-Americans vs. 50 % of the general public); and 2) marriage (54 % say that having a successful marriage is one of the most important things in life, compared with only 34 % of all American adults); see Fig. 4. As a result, they are more likely to be married (59 % vs. 51 % U.S. total), less likely to be an unmarried mother (16 % vs. 41 %), and their children are more likely than all American children to be raised in a household with two married parents (80 % vs. 63 %). Along with a larger than average household, this stability coincides with middle class values and creates a strong network of support for children's growth and learning.

Hard work and success also rate highly among Asian Americans: 93 % believed that "[Asian] Americans from my country of origin group are very hardworking," compared with only 57 % who thought that Americans are very hardworking. Perhaps no other book captured the stereotype of strict parenting more popularly than Yale law professor Amy Chua's (2011) *Battle Hymn of the Tiger Mother*, in which she unapologetically opined why "Chinese mothers are superior." In it, Chua extolled the virtues of authoritarian parenting where overriding children's preferences was crucial in getting them to practice harder and longer to become better at what they are doing. Asian parents are more demanding because they "assume strength, not fragility" in their child, unlike American parents who constantly agonize over their child's psyche, according to Chua. Results from the Pew survey appear to support her parenting model, with six-in-ten Asian Americans finding American parents put too little pressure on their children to succeed in school (only 9 % said the same about Asian-American parents). Interestingly, nearly four-in-ten Asian Americans also agree that Asian parents put too much pressure on their children.

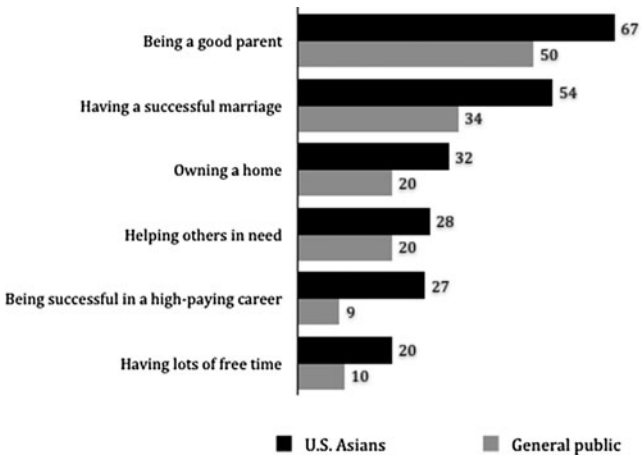

Fig. 4 Life Goals and Priorities: Asian Americans vs. General Public. Source: Pew Research Center (2012): Asian-American Survey. Q19 a-g. General public results from January 2010 survey by the Pew Research Center. The question wording varied slightly from one survey to the other

Asians' Academic Proficiency

Educators and policymakers are well aware of Asian's overall academic proficiency at the school level. Out of all ethnic groups, Asians had the highest percentage of students who were proficient (a score of 3 or 4) on state tests in 2008: 83 % of 4th and 8th graders were proficient in reading; whereas for math, 88 % in 4th Grade, 86 % in 8th grade, and 81 % in high school were deemed at least competent (Center for Education Policy, 2010); see Table 3. Only in high school reading did the same portion of whites score proficiently (78 %). Asians even outperformed whites in 29 out of 34 states in math state tests at the advanced level, representing a median of 46 % in the advanced category, compared with whites at 36 %. A significant gap between Asian/Whites and African American/Latinos exists across all levels, widening particularly in 8th grade and high school math. This plight has troubling implications for the 21st century economy if America's education model rests on a one-size-fits-all approach.

In addition, Asian students are overrepresented among the gifted and talented (G&T). Asians make up only 5 % of the total primary and secondary public school population

Table 3 Median percentages of students scoring proficient on state tests, by ethnicity, 2008

Subject/Grade	Asian American	African American	Latino	White
Reading				
Grade 4	83	58	64	81
Grade 8	83	58	58	81
High school	78	53	56	78
Math				
Grade 4	88	56	67	82
Grade 8	86	46	55	77
High School	81	45	50	71

Center on Education Policy (2010)

but comprise 9.4 % of the G&T population (Office of Civil Rights 2006). Representation can be measured by comparing the percent of students in programs for G&T relative to their proportion in the overall student population, with 1.0 a perfect proportionate representation. Asian students are overrepresented compared to white students in G&T programs (see Fig. 5), despite being outnumbered in total. It is possible that the percentage would be even higher if gifted and talented English language learners (i.e., limited in understanding English) were also included.

Asians' STEM Contributions

High growth, income, and education certainly suggest significant potential, but do not necessarily reveal impact. The Pew study showed that Asians earned a disproportionate number of degrees in science, technology, engineering and math as well as of H-1B visas, but actual economic and intellectual contributions are needed to prove the value of demographic characteristics as the basis for a reimagined education model. Within the engineering and technology fields, for example, Asians —especially Chinese and Indian—are a driving force behind *entrepreneurship* and *intellectual property* that directly impact America's GDP.

In terms of immigrant-founded businesses, the four largest immigrant groups came from India, the U.K., China, and Taiwan (Wadhwa et al. 2007b). However, Asian nations comprised half of the top ten nations whose immigrants founded engineering and technology (E&T) companies. In particular, Indians were key founders of 26 % of E&T start-ups from 1995 to 2005. In fact, they dominated the entrepreneurial arena among immigrant-founded businesses—more than those from the next four nationalities combined (see Fig. 6). Their growth, as illustrated in Silicon Valley, outpaced every other immigrant group over the past twenty years: Indian-led businesses in Silicon Valley more than doubled (from 7 % to 15.5 %) between 1995 and 2005, whereas Chinese-led tech companies declined from 17 % in 1998 (Saxenian 1999) to 12.8 % in 2005.

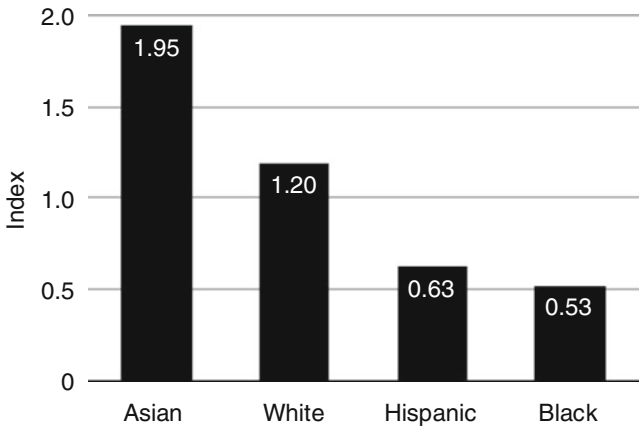

Fig. 5 Gifted Representation Index. Note: 1.0=perfect proportionate representation; >1.0=Overrepresentation; <1.0=Underrepresentation. Source: Office of the Civil Rights (2006)

Aside from founding engineering and technology companies, Asians also played a significant role in other STEM fields. Whereas Fig. 1 displayed the contributions of immigrants as a whole in each industry, Table 4 compares the influence between Asia and Europe.

Workers from Asia represent the largest portion in four out of the five immigrant-founded STEM industries listed above. Those from India, in particular, stand out significantly, founding more companies in the innovation/manufacturing-related services sector (24 %) than those from all of the European nations combined (19 %). Indian immigrants also dwarf those from other Asian nations, including Japan (7 %) and China (6 %). As a reference point, the next highest non-Asian nation was the U.K. (6 %).

The biosciences field was more evenly distributed. Indians, Germans, and Koreans each accounted for 10 % of immigrant-founded start-ups, and British, French, and Israeli immigrants each contributing 6 %. In total, those from Asia and Europe represented 32 % and 37 %, respectively.

Within both the computers/communications and the semiconductors industry, workers from China, Taiwan, and India were overrepresented. They accounted for over half of all immigrant start-ups in the former and 40 % in the latter. Overall, the percentage of Asian immigrant-founders in the computer industry (63 %) and semiconductors industry (55 %) was more than triple that of Europeans (20 % and 15 %, respectively).

Finally, in the software industry, Indians alone dominated immigrants from all other nations, founding 34 % of all new businesses. Their rate was almost four times the next highest group, the British (9 %). Asians overall founded twice as many start-ups as those from Europe (48 % vs. 24 %).

Intellectual property, in the form of patents, is another concrete measure of STEM innovation. Data from the U.S. Patent & Trademark Office (USPTO), which measures domestic patenting activity, revealed a steadily increasing rate among Asian residents over a thirty-year period (Foley and Kerr 2012). Chinese and Indian patenting activity, for example, accounted for merely 5.3 % from 1975 to 1982, but by the 2000 to 2004 period, their share increased three-fold to almost 17 %. In contrast, patenting among ethnic whites has declined over the same period. Those of white Americans, who own the lion's share of patents in the U.S., fell 16 % (from 81 % to 68 %). Innovators from Europe saw

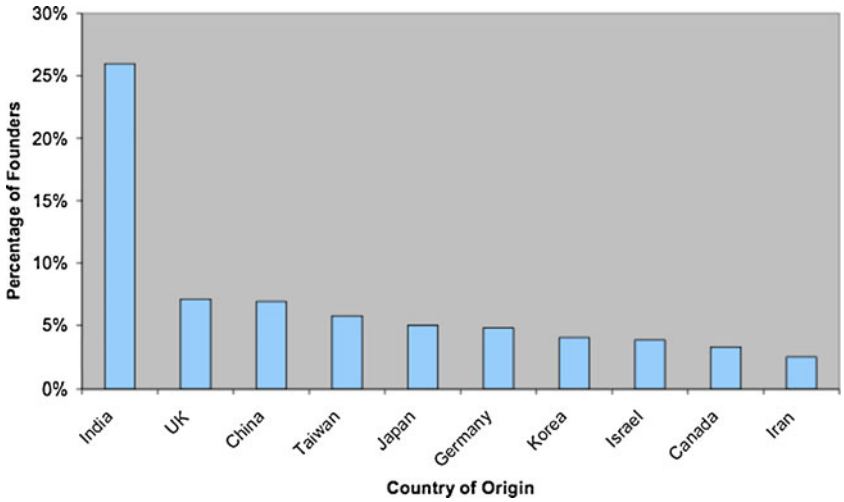

Fig. 6 Birthplace of Engineering and Technology Immigrant Founders. Source: Wadhwa et al. (2007b)

patenting activity fall even more sharply at 25 % (from 8.3 % to 6.2 %); see Fig. 7.

Though the number of patents filed through the USPTO is crucial to many corporations, international patenting rates filed through the World Intellectual Property Organization (WIPO) have become the standard measure of global relevance. Out of the 130,000 international patent cooperation treaty (PCT) applications filed in the U.S. in 2006, *almost one-third* was by either Chinese/Taiwanese (16.8 %) or Indian (13.7 %) inventors, followed by Canadians and British (Wadhwa et al. 2007b). The three-fold increase from 1998 (when Chinese and Indian immigrants combined had only 10.8 % of PCT applications) practically mirrors the growth recorded by the USPTO over three decades. However, their larger presence in the international stage of intellectual property suggests that Asians play a real and significant role in America's global economy. When combined with their entrepreneurial growth in STEM industries, the Asian emergence underscores the important role of demographics in education reform.

Table 4 Industry breakdown of immigrant-founded companies, by ethnic/geographic region

	Asia	Europe	Others*
Innovation/Manufacturing-Related Service	50 %	19 %	31 %
Biosciences	32	37	31
Computers/Communications	63	20	17
Semiconductors	55	15	20
Software	48	24	28

*Others include nationalities whose companies comprised 10 % or less: Middle East, Central/South America, Africa, Canada, and Australia

Wadhwa et al. (2007b)

The Call for Genuine Equity and Excellence Based on Differentiated Abilities

Acknowledging the rise of Asian immigrants or the impact of the smart fraction is in no way meant to suggest any inherent abilities that other groups lack; in fact, many immigrants from Southeast Asian countries face much of the same poverty and low achievement as American minorities. However, with all the data on the economic contribution of highly skilled immigrants and the intellectual class, it is nonetheless easy to dismiss these findings as elitist or even racist. In fact, it is merely acknowledging what parents, teachers, and others have long known to be true: that individuals have wide ranging abilities, inclinations, and interests, and that various factors—fairly or unfairly—contribute to these gaps.

Progressive thinkers are understandably reluctant, however, to promulgate any kind of differentiated development in light of historical oppression and man's

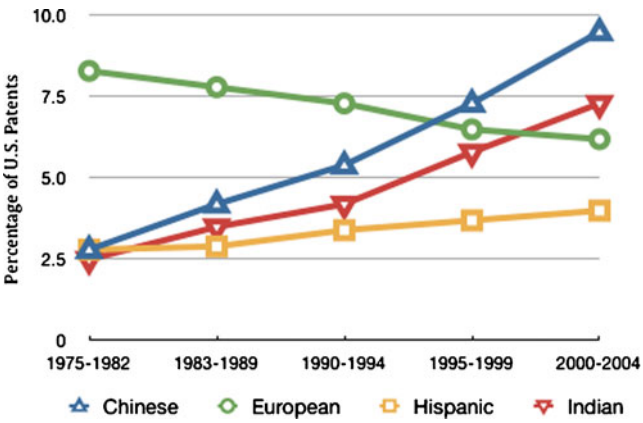

Fig. 7 Growth in U.S. Patenting, by Ethnicity. Note: This table presents the share of patents in which inventors are of particular ethnicities, reside in the U.S. at the time of patent application, and work for a publicly listed corporation. Source: Foley and Kerr (2012)

imperfect nature. As a result, modern policies become captive to the unwavering push for "equality" at the expense of bona fide excellence, as demonstrated by the declining proficiency standards in public school tests and in higher education. Marketers and politicians, in this way, have it easier; they aren't held to the same equity imperatives that educators are. Certain groups—like big donors—simply matter more to political candidates than others. For advertisers, addressing the different wants and needs of suburban moms or the millennial generation is fairly straightforward; yet with education, coming to grips with differences in mental abilities is far more difficult to accept.

Curiously, some interpretations about abilities and outcomes are widely embraced. Cognitive psychologist Howard Gardner's (1983) research, for example, suggests that people have differing abilities and should play to their strengths; yet, because they are couched in progressive terms like "multiple intelligences," his message is celebrated. Scientist Jared Diamond (1997) used geographic features—a country's latitude, its proximity to the sea, and its agricultural hospitality—to explain the political and economic preeminence of Eurasian countries like the U.K. or Japan, compared to Tanzania, for instance. His book became a popular bestseller. Social psychologist Richard Nisbett (2003) credited the intertwining of differing geographies with ecology, social structure, philosophy, and educational systems to explain profound cognitive differences between westerners and East Asians. On the whole, Nisbett's conclusions are widely accepted.

Regardless of America's wide discomfort to recognize differing abilities, inequality in the outcomes of schooling is a function of the natural inequality of talent among people (Ornstein 1977), due to the different mental patterns and thinking processes that are shaped by both genetics and environmental forces. Demographic patterns, as research has shown, illustrate and sometimes magnify these differences. They should thus be considered when reimagining a more equitable education paradigm. The answer is not to try to equalize math or verbal or artistic abilities as characterized by the "Education For All" initiative (UNESCO 2005); rather, the solution lies in differentiating the curriculum to meet different individual and group interests and abilities, as other industries have already recognized.

First, a reframed education paradigm should embrace the differentiated model that can optimize students' talents and interests in different areas. Developing one's athletic, cognitive, or artistic capabilities will not only lead to personal self-fulfillment, but also to significant contributions for society. For example, policies need to de-emphasize the current "STEM coursework for all" approach, which allocates limited resources to the vast majority of students who will never go into STEM jobs. Instead, the emphasis should be on promoting an "all STEM for some" approach—recruiting and developing STEM skills of only interested and capable students, including high-potential immigrants. Allocating resources to those with artistic or athletic talent has long been accepted, so why not for the cognitively gifted and talented?

Next, identification and development must start early. As much as 50 % of potential learning is developed by age four, another 25 % by age nine, and the remaining 25 % by age seventeen, according to Bloom (1964). This suggests that allocation of resources must be mainly focused in early childhood and primary grades. It also suggests that G&T students be homogeneously grouped, which some critics might question as elitist or discriminatory.

Third, there must be honest recognition that mathematical, verbal, and spatial skills are more prized in a knowledge-based economy. The problem is the "misbegotten, pernicious, wrong-headed idea that not going to college means you're a failure" (Murray 2008, p. 150). This does not mean that those with limited cognitive abilities cannot contribute, merely that the academic track may not be an appropriate or desirable use of one's time and resources. Instead, policymakers should expand niche secondary education services to meet employer demand.

For example, a knowledge-based economy also needs employees with basic and middle skills to implement the innovation strategies developed by scientists in a mutually enforcing way (Hanushek and Woessmann 2009; Autor et al. 2006). These positions have been called "middle-skill jobs"—those such as computer support, back office work in financial and healthcare companies, auto repair using computer diagnostic equipment—many of which requires more than a high school degree but not necessarily a traditional college degree. High school students who pursue the vocational track or 21st century career and technical education (CTE) programs like *SkillsUSA*, *YearUp*, and *ITT* will have the sought-after middle skills that have separate but complementary effects on economic growth.

The Road Ahead

The current school reform model, based on equality, is well intentioned and politically correct, but an antiquated solution for unleashing innovation since it ignores inherent demographic differences. In fact, Gardner (1995) suggests that: "Extreme egalitarianism…which ignores differences in native capacity and achievement, has not served democracy well. Carried far enough, it means…the end of striving for excellence which has produced mankind's greatest achievement." The implication is to develop capabilities at all levels, otherwise we will be left with mismatched skills that

result in what Uchitelle (2006) calls "disposable Americans," those caught in the cycle of unemployment and underemployment. However, developing the differing abilities of individuals, whether it is cognitive or physical, is the ultimate realization of Gardner's theme and the only ethical way to allow for true human dignity.

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