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Prof. Dr. Şule AYCAN - IOJPE Editor

Message from the Editor

I am very pleased to publish first issue in 2018. As an editor of International Online Journal of Primary Education (IOJPE), this issue is the success of there viewers, editorial board and the researchers. In this respect, I would like to thank to all reviewers, researchers and the editorial board. The articles should be original, unpublished, and not in consideration for publication elsewhere at the time of submission to International Online Journal of Primary Education (IOJPE), For any suggestions and comments on IOJPE, please do not hesitate to send mail.

Prof. Dr. Şule AYCAN
Editor

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MILLENNIUMDEVELOPMENTGOALS(MDGS)ANDQUALITY EDUCATION SITUATION IN PAKISTAN AT PRIMARY LEVEL

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The quality of education is a priority for every nation any educational institution or organization and their beneficiaries. This paper is concerned with methods and theories recently used in Quality Education research in Pakistan. It begins by looking at policies, practices and procedures implemented and their impact on quality of education in the light of MDGs. This study will explore the comparative difference of quality education against MDGs at primary level in Pakistan to identify the gaps and challenges in their policies, practices and procedures to suggest the possible measures for their quality improvement standards at proposed level.

In light of few international commitments has made by Pakistan to provide quality basic education to everyone as a basic right. As per the constitution of Pakistan, "The State shall provide free and compulsory education to all children of the age of five to sixteen years in such manner as may be determined by law" National Educational Assessment System (NEAS) reported shocking situation regarding the achievement of these obligations. The main focus of this article was to analyze the current situation of quality education in the light of MDGs and to understand what we can expect in near future regarding provision of quality primary education in Pakistan.

Situated on the western edge of South Asia, Pakistan has a population of about 184 million, with sex ratio of 105.6: 100. It is estimated that about 62% of the people are residing in rural and 38% in urban areas. GDP Per Capita Income is US$ 1,387 for 2014- 15.Pakistan is a developing country, gradually transforming from agriculture-based economy to an increasing share of industry and services sectors in the GDP. Country spends a major part of its budget to address challenges of national security and interest payments on its loans. This leaves a relatively smaller amount to be invested on infrastructure development to boost economic growth and enable social sectors to meet basic needs of the people like education, health, social services etc. Pakistan is confronted with a host of serious development issues.

The Gross Domestic Product (GDP) of Pakistan grew at a rate of 4.3% (FY 2014/15), but there are several challenges which are likely to restrict its future progress unless strict actions are implemented. Energy shortage is a major obstacle to raise production. Pakistan is a partner of on-going global war against terrorism. Resultantly, geo-political dynamics in the neighboring countries and on its borders have generated security and terrorism related threats for the local people, foreign investors, and development workers. This situation is restricting investment and emphasizing unemployment in the country. The deficit on trade balances is also adding to the fiscal pressures.

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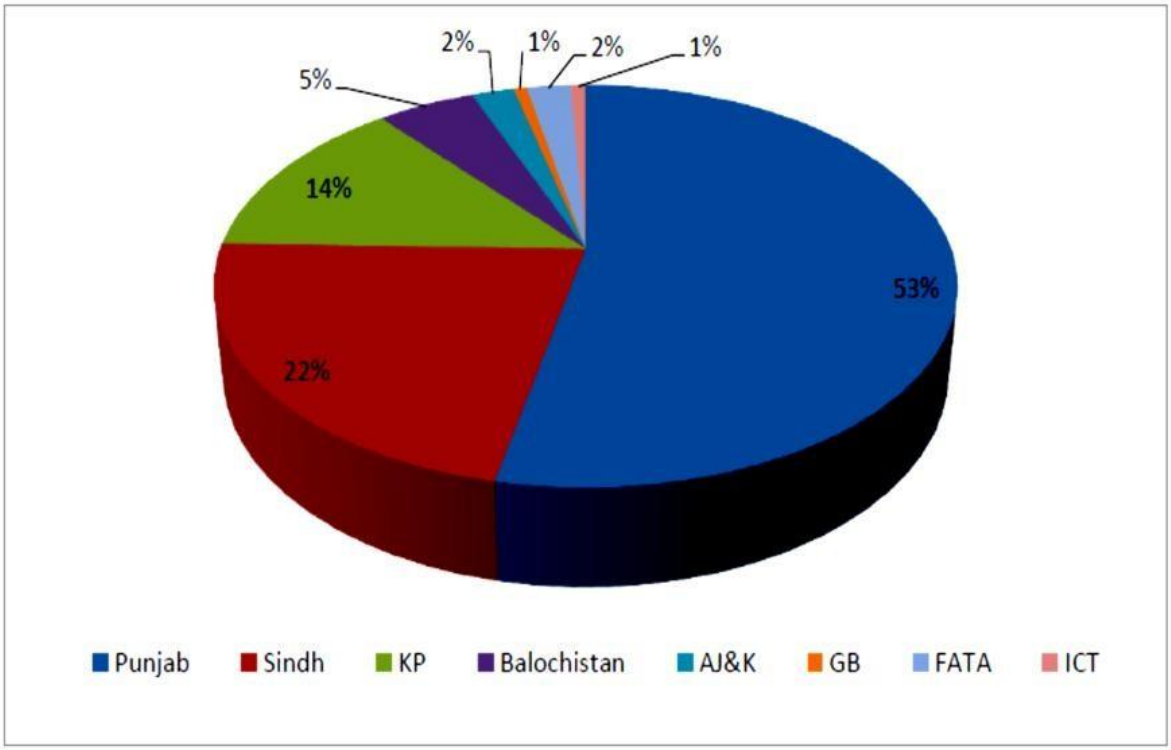
Table1: Area and population by Province/Region

Provinces / Regions	Area (km^2)	Population
Punjab	205,344	100,174,398
Sindh	140,914	44,079,720
KP	74,521	24,788,204
Balochistan	347,190	9,495,219
AJ&K	11,639	3,858,240
GB	72,520	1,253,223
FATA	27,220	4,409,800
ICT	906	1,401,375

Source: NIPS Projection 2013

Figure1: Distribution of population in Regions/Provinces shown in percentage (%)



In the past, Pakistan has not been spending enough in terms of basic social services to the people. Another hindering factor has been rapid population growth, which was 3.1% or more during 1990s, and is still above 2% per annum. Continuous fast increase in population has eaten up or diluted benefits of the investment on development. Illiteracy, rapid population growth and slow economic development have increased unemployment, stuck evolution of socio-political institutions and democratic norms in the society. Due to illiteracy and poverty, health indicators are also low in

Pakistan. One third children are born underweight and infant mortality rate is high.

Educational indicators of Pakistan are still miserably low, although steady progress has been noticed during last few decades. At present, about one third primary school age children are out of school, 42% population (age 10+) is illiterate. Wide discrepancies persist in education indicators pertaining to provinces/areas, location (urban vs. rural) and gender. At the national level, about two third women of age 15+ cannot read and write, and 35% girls remain out of school. Gender Parity Index in case of participation in primary education is 0.82. It is estimated that over 6.7 million children are out of school, and majority of them (62%) are girls.

Quality Education Importance:

Quality Education is a dominant instrument of socioeconomic and political change related to global, technological and democratic developments. So it is necessary to improve quality of education at different levels. Quality is one of the most important dimensions of an education system. There are probably as many different ideas about quality as there are schools. Quality is creating an environment where educators, parents, government officials, community representatives, and business leaders work together to provide students with the resources they need to meet current and future academic, business and changes. Strengthening the quality of education has become a global agenda at all educational levels and more so at the primary level. The quality of basic education is important not only for preparing individuals for the subsequent educational levels but to equip them with the requisite basic life skills and social norms too. Quality education also ensures increased access and equality and it is mainly due to these reasons that various international Forums and Declarations have pledged improvements in quality of education. It is important to mention that quality of education can be measured from three different viewpoints i.e. quality of inputs, quality of the process, and quality of output. Input reflects the resources committed by the government and society in general for the cause of providing education; these resources include infrastructure (including various physical facilities), teaching resources, curriculum and other support materials. Quality of the process reflects how good the delivery process is, and generally measures what goes on in the classroom as well as in the school in general. The quality of output reflects the conformance of the knowledge and skill levels of students to well established standards, e.g. exam systems and their results are a useful measure of output quality. Improving and sustaining quality of education is ultimate importance in any society round the world. By ensuring quality education the nations can be able to economic, social, mental, psychological and emotional growth of individuals on the right direction. The Universal Declaration of Human Rights (1948) also declared quality primary education as the basic right of all people. According to (Hoy, et al, 2000), many developed and developing countries have attained or near to the goal of (UPE) universal primary education. Now the focus has been turned to the quality of students' learning and it is quite justifiable not only for those countries which have attained quantitative targets, but it is also valid for those countries who are striving to achieve the target of EFA and MDGs like Pakistan. Quality of education requires standards set in order to develop assessment tools, compatibility of programs and propose someone as accountable for to meet the targets. Pakistan has made its commitments in all international forums of providing basic education with high quality and to make it accessible for all. Commitments of Pakistan with the international community are as under;

International Commitments

Pakistan was one of the 48 member states who voted in favor of the Universal Declaration of Human Rights on 10 December 1948. According to article 26 of this declaration, "Everyone has the right to education" and "Education shall be free, at least in the elementary and fundamental stages. Elementary education shall be compulsory". The convention on the Elimination of All Forms of

Discrimination against Women was adopted by the UN general assembly in 1974 but Pakistan acceded to the convention on March 1996. As a signatory to the Beijing Declaration and Platform for Action 1995, Pakistan is committed to promote "people-centered sustainable development through the provision of basic education, lifelong education, literacy and training for girls and women" (Article 27), and ensuring "equal access to and equal treatment of women and men in education" (Article 30).

Pakistan's Commitment to Education-For-All 2000

This is largely because of the sorry state of Pakistan's education system and the failure of successive governments to provide even basic education for all: according to the 2012 Global Monitoring Report, Pakistan continues to have the second-largest number of out- of-school children in the world. As a signatory of this declaration on Education for All (EFA), Pakistan agreed that every person should be able to benefit from educational opportunities designed to meet their basic learning needs, and called for an expanded vision of education, encompassing factors such as universalizing access to education and promoting equity including goal 2 "to achieve universal primary education" by 2015.

Dakar Framework for Action

Pakistan was among 164 countries who adopted the Dakar Framework for Action, Education for All: Meeting Our Collective Commitments at the World Education Forum. All 164 countries acknowledged education as a fundamental right for all people, regardless of gender or age, recognized the need to make comprehensive efforts to eliminate gender discrimination. The Dakar Framework is a collective commitment to achieve all EFA goals and one of these is "ensuring that by 2015 all children, particularly girls, children in difficult circumstances and those belonging to ethnic minorities, have access to and complete free and compulsory primary education of good quality. Unfortunately, Pakistan is among the countries which are not likely to achieve these goals by 2015.After Dakar, the country took a number of initiatives to accelerate the pace and progress towards achievement of EFA Goals, including abolition of school fees, provision of free textbooks to students and legislation to declare free and compulsory access of children to education as their constitutional right. Article 25-A has been inserted in the Constitution through landmark 18th Constitutional Amendment. Although, the country has lagged behind the targets of EFA, nonetheless, a momentum has been built and required legal and institutional mechanisms are being created to sustain and accelerate the pace of progress towards EFA Goals.)

The 2013 EFA Global Monitoring Report showed that progress towards many of the targets is slowing down and that most EFA goals are unlikely to be met in Pakistan. After good progress in the initial years after Dakar, the number of children out of school aged 5-9 years has risen to 6.7 million in 2013. It is clear that the target of universal primary education will be missed by a considerable margin by 2015.

The Millennium Declaration and Millennium Development Goals (MDGs)

Pakistan, including 192 members of United Nations countries has agreed to achieve the Millennium Development Goals developed/framed at the Millennium Summit in New York in 2000. All members States agreed to work towards achieving all the MDGs, including goal 2 "to achieve universal primary education" by 2015.

Constitution amendment # 18

Through a constitutional amendment # 18, free and compulsory education for the children aged 5 to 16 years has been declared a fundamental right. Article 25-A of the Constitutions provides that: "The

state shall provide free and compulsory education to all children of the age of five to sixteen years in such manner as may be determined by the law."

National Plan of Action (2001-2015)

To honor the international commitment made in signing the Education for All Dakar Framework for Action (April 2000), the Government of Pakistan developed the National Plan of Action (NPA) on Education for All 2001–2015. The objectives of the NPA are to ensure access to education for disadvantaged rural and urban population groups, particularly girls and women; to promote community participation and ownership of basic education programmes; and to improve the relevance and quality of basic education. The National Plan of Action 2013 estimates a total of 6.7 million primary-aged out of school children during 2013-16. Of these 5.06 million children are expected to be enrolled in the country. The total cost estimated to be RS. 189 billion.

National Education Policy (2009)

As per nature of the current situation of gender and rural- urban disparities regarding access of education, the New Education Policy aims to revitalize the education system. Policy also aims to enable Pakistan to fulfill all its international commitments regarding education on different forums and summits in general and EFA and MDGs in particular.

Education System in Pakistan

In Pakistan, education is now a provincial subject as a result of the 18th Constitutional Amendment legislated by the parliament during April 2010. The provincial/area governments enjoy greater autonomy in several social and economic sectors, including education. The Ministry of Education and Trainings and Standards in Higher Education (MET&SHE) at the federal level coordinates with international development partners and provides a platform to the provincial/area departments of education for exchange of information and creating synergy, synchronization and harmony. Public sector formal school system, which is largest service provider in Pakistan, consists of 12 academic years. It starts from Primary and ends at Intermediate level or Higher Secondary School Certificate (HSSC). Pre-primary classes (local name Katchi class, translation: Pre- Primary; premature or not ripe yet) can be found in schools, but this level is not recognized in terms of budgetary provision or examination. Private sector caters for educational needs of about one third enrolled children having diverse streams, some following public sector national curricula, while others opting for curricula of Cambridge International Examinations. The children of upper-middle classes, residing in urban localities, mostly attend high cost private schools, offering foreign curricula and international examination systems (O and A levels) and are staffed with qualified and trained teachers, well-equipped classrooms, all essential facilities of good quality, and imported teaching- learning materials.

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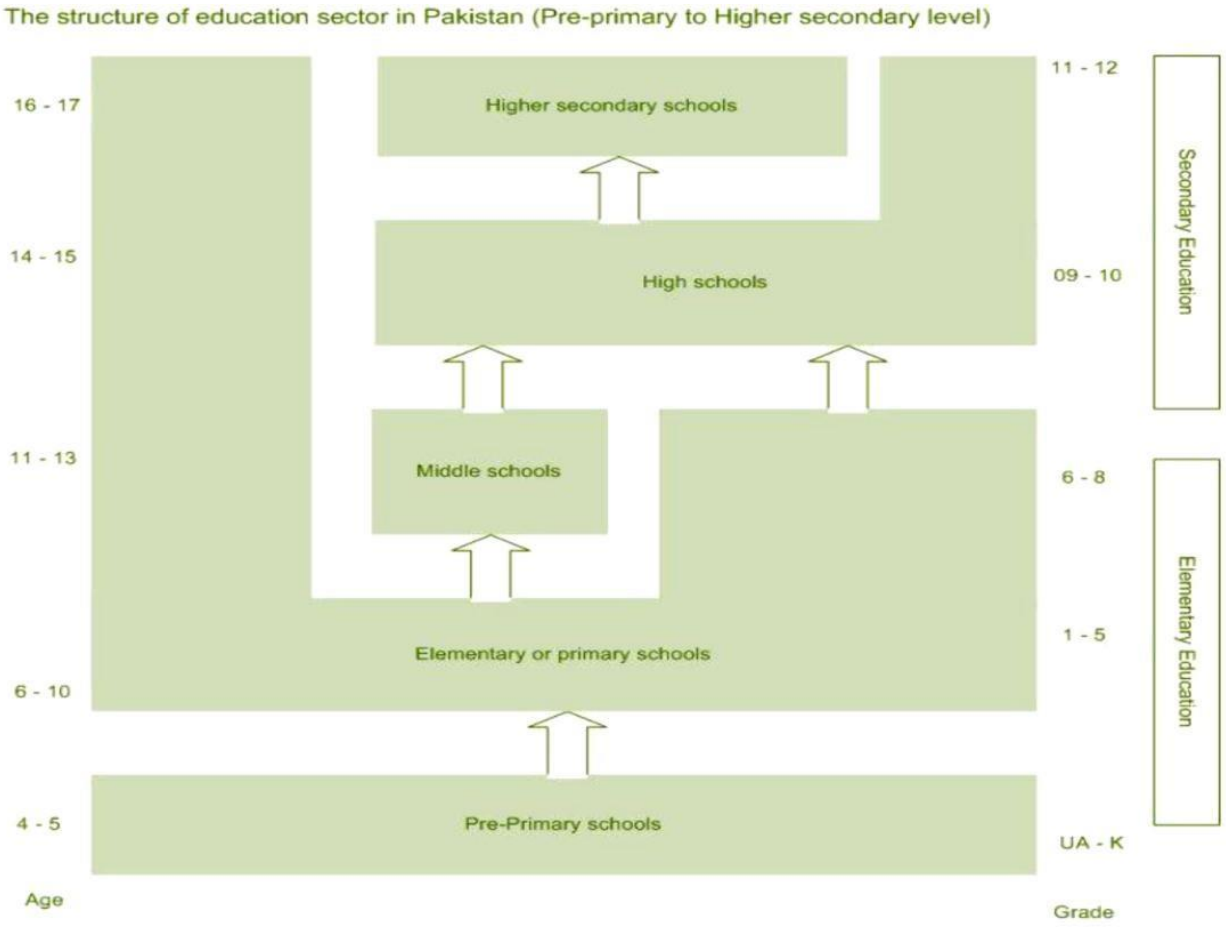
Figure2: Basic Structure of education in Pakistan



In addition to the public and private schools, there is another stream of 'Deeni Madrassas'(Religious Schools) offering free religious education with free boarding and lodging. These Madrassas are usually managed by local communities and are financed through charity and donations. These parallel systems of education in Pakistan have perpetuated inequalities and economic stratifications, and are root cause for behavioral divisions and social conflict in the society. Majority of the children, residing mainly in rural and semi-urban areas and belonging to the low income families, attend public schools which offer free education but are characterized by poor quality of education due to lack of physical facilities, shortage or absence of teachers, and non-availability of suitable learning materials.

Private Sector Contribution in Primary Education

Private Sector is playing an important role in the promotion of education in Pakistan. Private sector enrollment is increasing because of its overall better quality of education as compared to public sector. NEMIS (National Education Management Information System) data indicated that in 2012/13, there were 17,093 private primary schools in the country. In addition, there were 25,658 middle/lower secondary schools and 17,696 high schools in the private sector. At the primary level, overall 4.8 million (34%) children of 5- 9 years age group are enrolled in private sector schools. It is estimated that 34% of boys and 33% of girls are enrolled in private schools.

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EARLY CHILDHOOD EDUCATION (ECE)

In Pakistan, there are two types of pre-primary education: (i) poor quality "Katchi" classes in government primary schools, and (ii) good quality ECE usually in private sector commonly termed as Nursery, Kindergarten, and Montessori etc. Pre-Primary/Katchi class neither has a separate classroom nor a specific trained and qualified teacher. The children are usually those who accompany their older siblings to school and simply "sit around" in school premises. Mostly, one teacher, following multi-grade approach, teaches them and grades I & II simultaneously. This part-time or shared teacher daily assigns pupils of Katchi class some simple activity and over the year they learn simple alphabets and numbers only, and are not able to cover full national curriculum of ECE. Whereas, the more proper and good quality Early Childhood Education (ECE), with separate classroom, trained teacher and specific teaching and learning aids, is available mostly in urban private sector schools, where children from privileged families are enrolled. Although there are no separate preprimary/ECE budgetary allocations in public sector, however there is a clear national policy, standards, curriculum and teacher training packages for pre-primary/ECE. In public sector schools, pre-primary is a part of primary school and follows prescribed syllabus while private sector follows child-centered teaching methodology. The government has approved national curriculum which is implemented in selected schools, mostly supported by donors.There are wide variations across provinces in Gross Enrollment Rates (GER) of ECE/pre-primary, though gender differences do not appear pronounced (Table 2). Since 2000, for all Provinces and Areas

there have been steadily increases in the gross enrollment rates for a decade while all rates reflect a decline in 2012-13 due to an upward adjustment in population.

The national average for ECE/Pre-primary GER was 66% in 2012/13. While Punjab and Khyber Pakhtunkhwa (KP) demonstrate highest rates of gross enrollment in ECE/Pre- Primary, the pace of progress has been remarkably high in Sindh (Table 2).

Table 2: ECE / Pre-Primary: Gross Enrolment Rate from 2001-02 to 2012-13 by Province

Province	2001-02	2005-06	2009-10	2012-13
Balochistan	37.9%	71.3%	72.9%	63.9%
FATA	47.7%	59.5%	63.0%	57.2%
GB	33.6%	58.0%	60.6%	30.4%
ICT	13.5%	39.2%	45.0%	44.9%
KP	37.3%	72.9%	75.5%	88.2%
Punjab	31.6%	67.3%	80.2%	71.2%
Sindh	9.1%	36.4%	49.0%	48.9%
AJ&K	38.8%	55.4%	64.8%	54.8%
Pakistan	28.2%	60.4%	70.5%	66.4%

Source: NEMIS (2001-13) & NIPS Projections (2005-25) Govt. of Pakistan

Primary and Secondary Education

In Pakistan, there are 422 Pre-Primary Institutions and 145,491 formal primary, 42,920 middle level, High/Higher Sec./Inter Colleges 35,792 Degree Colleges are 1,086; 75% are public sector schools; 10% private sector schools and the remaining almost equally divided between non-formal basic

education schools and 'Deeni Madrassas'

Table 3: Education Statistics at every Level

Education Statistics 2013-14: An Overview

Levelccc	Institutions	Enrolment	Teachers
Pre-Primary	422	8,557,966	2428
Primary	145,491	17,869,859	405,652
Middle	42,920	6,295,471	364,839
High/ Higher Sec./Inter Colleges	35,792	3,543,321	624,800
Degree Colleges	1,086	674,451	25,964
BECS/NCHD	17,763	827,938	18,335
Technical & Vocational Institutes	3,323	308,613	16,377
Teacher Training Institutions	201	722,133	3,713
Universities	161	1,594,648	77,557
Deeni Madaris	13,405	1,836,143	58,633
Total	**260,564**	**42,230,543**	**1,598,298**

Source: National Education Management Information System (NEMIS) Database 2014 Govt. of Pakistan

On world community forum Pakistan is one of signatory regarding making its effort to achieve universal primary education (UPE) which is still a dream yet to come true. By utilizing less than 2 per cent of GDP, how it can achieve its targets in education sector. For the achievements of set targets it needs to raise the share of GDP for education and then assures transparent mechanism of implementation strategies to provide access and quality education for all. Increases in grass enrollment shows sincere efforts are being made and Pakistan has to multiply its efforts to achieve target of UPE.

Education Expenditure in Pakistan as % of GDP

During the past decade, Pakistan's education expenditure as percentage of GDP has varied between 1.5% and 2.1%

Table 4: Education Expenditure in Pakistan as % of GDP

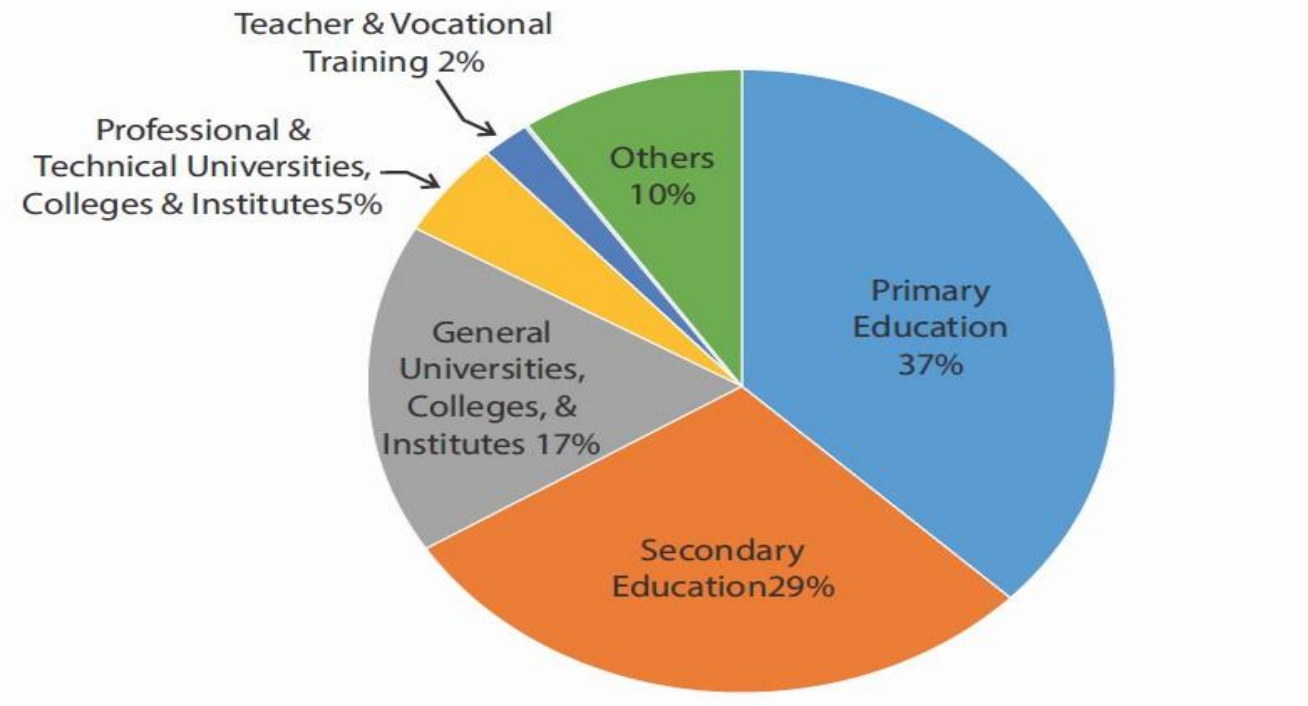
2001/02	2005/06	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13
1.5	1.9	1.8	1.9	1.7	1.8	1.9	2.1

Source: Ministry of Finance; Government of Pakistan (2001-13)

Distribution of National Education Expenditures by Sub-Sectors

On average at the national level, 89% of education expenditures comprise current expenses such as teachers' salaries (Figure 3). Only 11% comprises development expenditures, which is not sufficient to raise quality of education. Across provinces, too, an overwhelming proportion of total actual education expenditures are spent on current heads, mainly teachers' salaries, leaving a very small proportion for development expenditures. For 2012/13, except in KP where development expenditures are 22% of the total actual expenditures, these range between 5% (in Punjab), 6% (in Sindh); and 9% (in Baluchistan).

Figure 3: Distribution of National Education Expenditures by Sub-Sectors



Source: Office of the Controller General, Accounts (CGA). 2013, Govt. of Pakistan

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The National Plan of Action (NPA) to Accelerate Education-Related MDGs (2013-16)

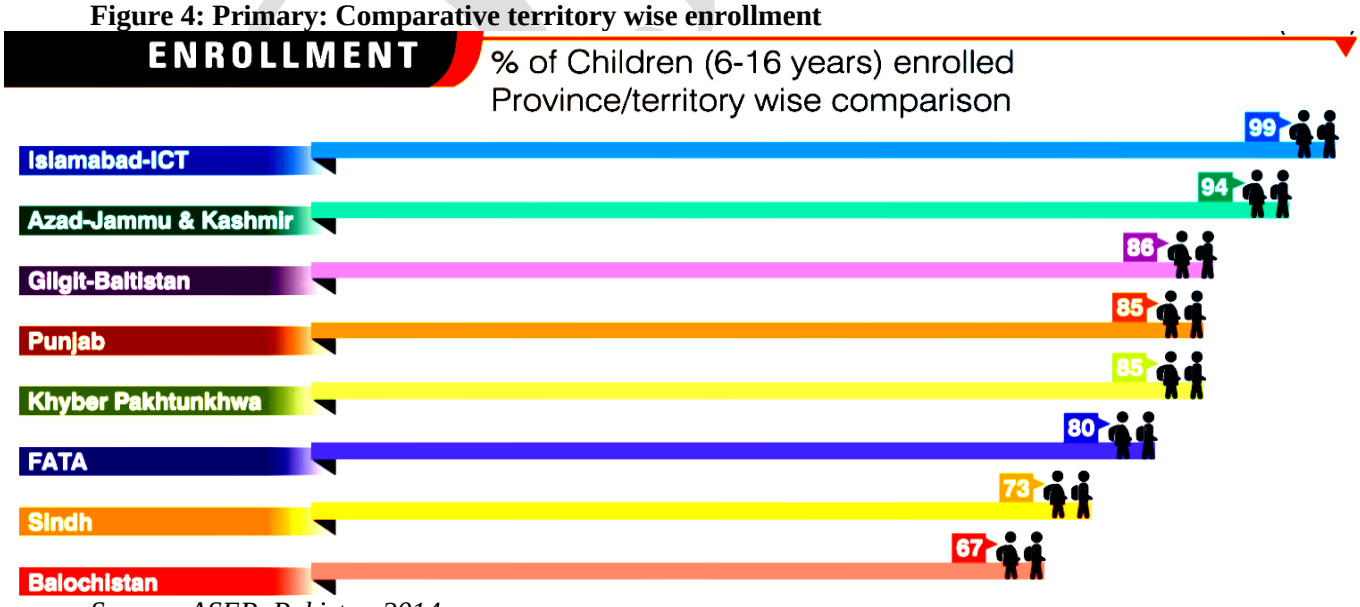
The National Plan of Action (NPA) is designed to accelerate progress towards education related goals and targets identified by MDG for 2015/16.The NPA to Accelerate Education Related MDGs is a consolidation of 8 Provincial and Area Plans, each specific to its local conditions, challenges and interventions. The National Plan envisages increasing the national net primary enrollment from 68% in 2011/12 to 91% by 2015/16. Given the stock of 6.7 million out-of-school primary-aged children, the Plan expects to enroll an additional
5.1 million (2.4 million boys and 2.7 million girls) by 2015/16.

GLOBAL PARTNERSHIP FOR EDUCATION 2015-18, REPLENISHMENT PLEDGING FRAMEWORK OF PAKISTAN

Education sector has faced myriad issues and challenges of access, equity and quality in the past. Current new political government has stoic resolve to enhance the allocation for education sector substantially in the next four years (FY 2014-15 to FY 2017-18). The political government in the election manifesto pledged to increase budgetary allocation from current 2% to 4% of the GDP by the year 2018. Right to education of every child of age 5-16 years is a constitutional obligation under Article 25-A. Immediately after taking over , the new government took stock of the situation and prepared a National Plan of Action to Accelerate education related MDGs and EFA targets.

All the governments, Federal and Provincial, through their manifesto are committed to people of Pakistan to gradually rise the spending on education to at least 4% of GDP by 2018. We pledge that Pakistan will increase the expenditure on education in public sector by an average of at least 1 percentage point per year from FY 2014-15 to FY 2017- 18.Government of Pakistan is fully committed to remove all types of disparities in the education service delivery in Pakistan as early as possible through making specific allocations for the education of disadvantaged and under-served groups especially girls, disabled and minorities.

Figure 4: Primary: Comparative territory wise enrollment



Source: ASER, Pakistan 2014

Situation Analysis

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Primary Enrollment Rates

Table 5: Primary: Gross Enrollment Rate from 2001-02 to 2012-13 by Province

Province	2001-02	2005-06	2009-10	2012-13
Balochistan	43.3%	50.1%	64.2%8	62.2%
FATA	64.6%	58.8%	3.3%15	79.3%
GB	45.3%	86.4%	3.3%*	119.5%*
ICT	134.3%	104.7%	92.6%	89.3%
KP	74.3%	82.7%	100.6%	104.1%
Punjab	75.9%	83.7%	86.4%	88.5%
Sindh	66.9%	79.5%	80.0%	76.4%
AJ&K	56.5%	74.4%	73.0%	67.8%
Pakistan	**71.2%**	**80.1%**	**85.9%**	**85.9%**

Source: NEMIS (2001-13) & NIPS Projections (2005-25) Govt. of Pakistan

Despite repeated policy commitments, primary education in Pakistan is lagging behind in achieving its target of universal primary education (UPE), 100% survival rates up to grade V, low/negligible dropout rates and good quality education. This is largely due to low budgetary allocations (2% of GDP) to education sector; shortage of schools especially for girls and also in remote and far flung areas; shortage and absenteeism of teachers; lack of trained teachers, especially female teachers; missing facilities such as water, toilets and boundary walls; weak supervision and mentoring; and a host of out-of-school factors such as conservative and tribal culture; insecurity and lawlessness; and poverty, compelling a large number of children to work rather than attend school.Since 2005-06, for all Provinces and Areas there have been steady increases in the gross enrollment rates for a decade while all rates reflect a decline in 2012-13 due to an upward adjustment in population. The overall gross primary enrollment rate in Pakistan is 86% (Table 5). ICT, KP and Punjab display higher than national average rate while Baluchistan, FATA, Sindh and AJ&K have lower than national average rate. It is encouraging to see that FATA and KP are showing progress despite years of uninterrupted conflict and militancy leading to aggression, insecurity and terrorism.

Table 6: Primary: Out of School Children 2012-13 by Province

Province	Male	Female	Total
Balochistan	267,066	296,147	563,214
FATA	44,323	149,768	194,091
GB	32,613	30,832	63,445
ICT	25,427	16,734	42,161
KP	58,163	424,250	482,413
Punjab	1,520,812	1,647,954	3,168,766
Sindh	881,06	1,096,208	1,977,272
AJ&K	3134,003	127,200	261,203
Pakistan	**2,963,471**	**3,789,094**	**6,752,565**

Source: NEMIS (2001-13) & NIPS Projections (2005-25), Govt of Pakistan

Table 7: Net Primary Enrollment Rate of age 5-9 years (2013-14)

	Baluchistan	KPK	Punj.	Sind	Glt.B	ICT	FATA	AJ&K	Pakistan
Boys (%)	56	92	73	69	82	68	81	58	73
Girls (%)	44	68	67	57	69	72	42	59	63
Both (%)	51	81	70	63	76	70	62	58	68

Source: National Education Management Information System (NEMIS) Database 2013-14, AEPAM, MET, Islamabad & Population Projection 2005-2025, NIPS, 2013

Primary School Survival Rates (2013-14) Grade 5

Also called Retention Rate, Survival Rate to Grade 5 is the proportion of a cohort of pupils who reached Grade 5 expressed as a percentage of pupils enrolled in the first grade of a given cycle in a given school year.A Survival Rate approaching 100 percent indicates a high level of retention and low dropout incidence. Survival Rate may vary from grade to grade, giving indications of grades with relatively more or less dropouts. The distinction between survival rate with and without repetition is necessary to compare the extent of wastage due to dropout and repetition.

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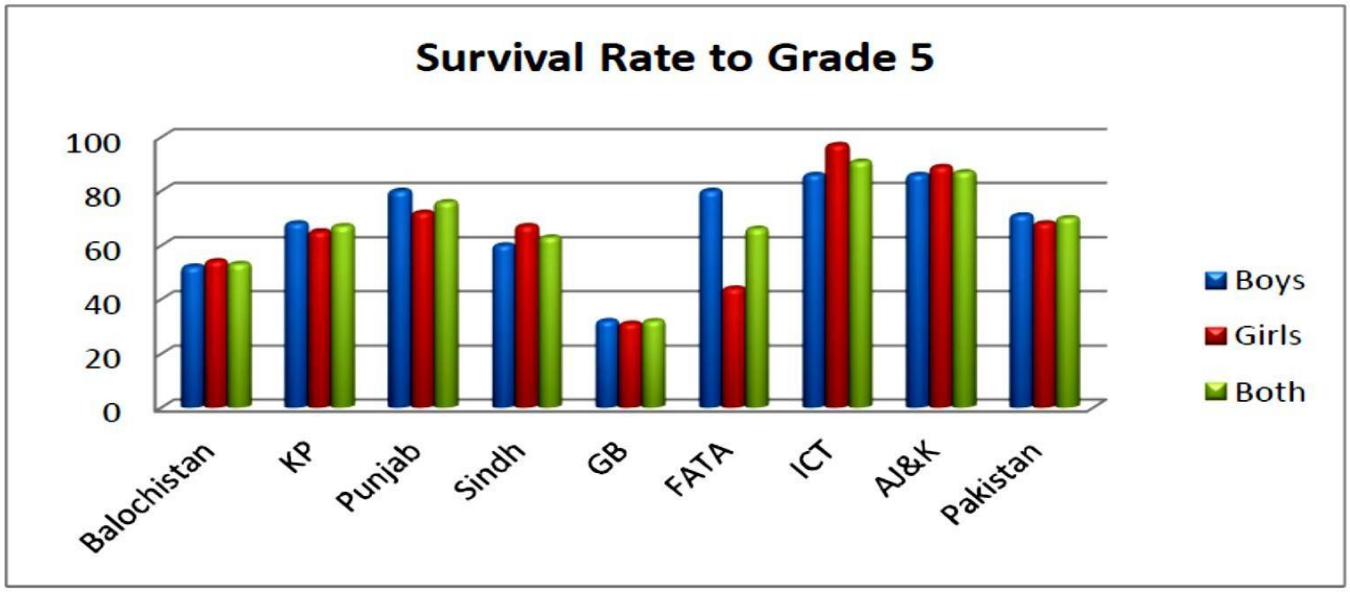
Table 8: Primary School Survival Rates Grade 5

	Balochistan	KPK	Punj.	Sind.	Glt.B	ICT	FATA	AJ&K	Pakistan
Boys (%)	52	68	80	60	32	86	80	86	71
Girls (%)	54	65	72	67	31	97	44	89	68
Both (%)	53	67	76	63	32	91	66	87	70

Source: 1.National Education Management Information System (NEMIS) Database 2013-14, AEPAM, MET, Islamabad 2. Calculated through UNESCO Reconstructed Cohort Model

Figure 5: Survival Rate to Grade V



Source: Annual Report of Education Statistics. National Education Management Information System (NEMIS) Database 2013-14, AEPAM, MET, Islamabad Government of Pakistan

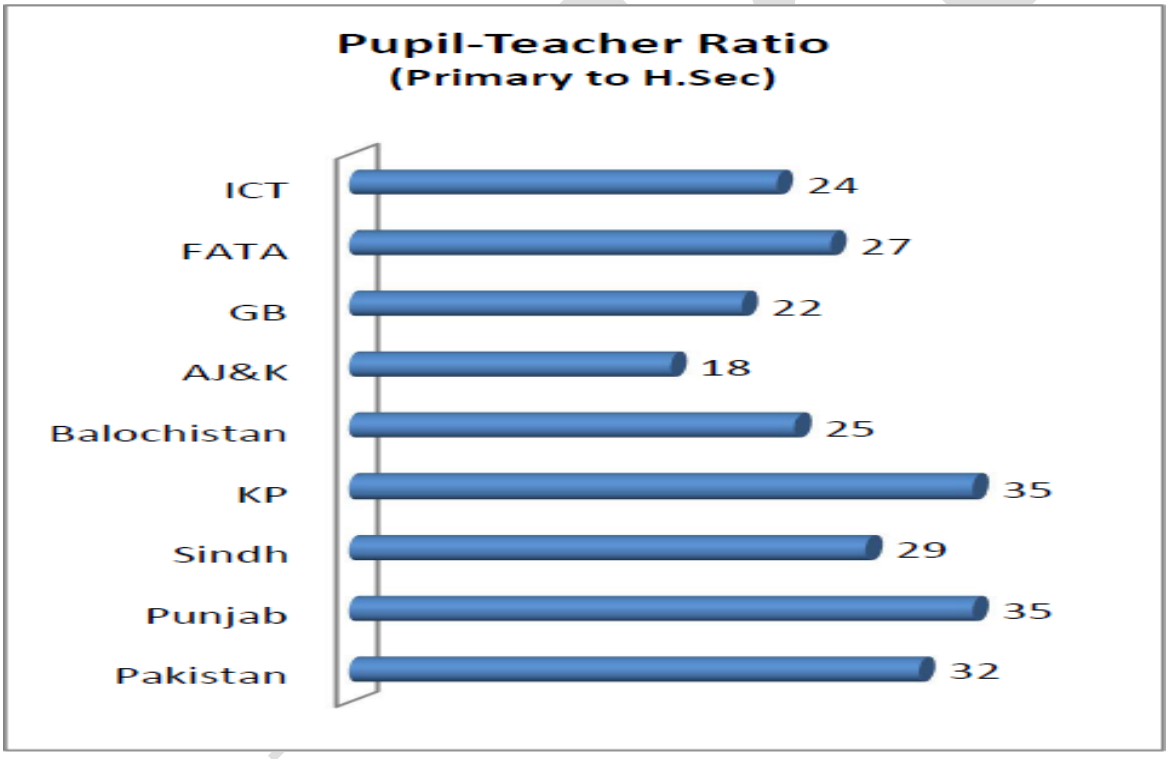
Pupil Teacher Ratio (PTR)

PTR is one of the most common indicators used in educational planning for improvement of quality education. A low number of pupils per teacher indicate pupils will have a better chance of contact with the teachers and hence a better teaching learning process. The PTR should normally be compared to established national norms on the number of pupils per teacher for each level or type of education. A high pupil-teacher ratio suggests that each teacher has to deal with a large number of pupils and that; conversely, pupils receive less attention from the teacher. The ratio of students to teaching staff is also an important indicator of the resource Level wise PTR in public sector of education is shown in Table 9 and Figure 6.

Table 9: Pupil-Teacher Ratio by Level

	Pri	Mid	High	H. Sec
Punjab	41	30	31	30
Sindh	30	23	25	38
KPK	43	16	26	27
Balochistan	33	18	21	29
AJK	23	18	14	13
GB	25	18	24	-
FATA	35	16	20	17
ICT	35	58	13	9
Pakistan	37	25	27	29

Figure 6: PTR (Pupil Teacher Ratio)



Source: Annual Report of Education Statistics. National Education Management Information System (NEMIS) Database 2013-14, AEPAM, MET, Islamabad Government of Pakistan

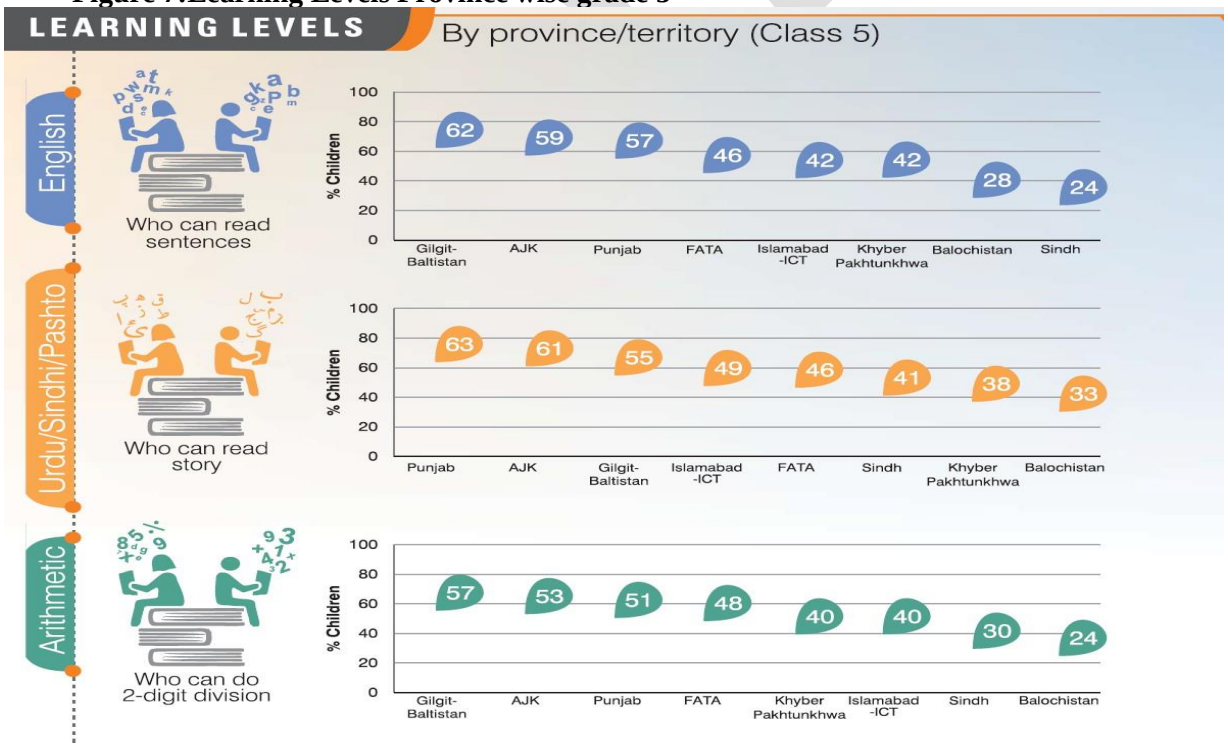
Table 10: Quality of Education in Pakistan at Primary Classes

Findings (Summary)

Territory	% Children										
	Access					Quality					
	(Age 3-5)	(Age 6-16)			Attending paid tuition (Govt.& Pvt. schools)	Class 3			Class 5		
	In Pre-school	Out-of-school (All)	Out-Of-school (Girls)	in private school		Who can read sentence (Urdu /Sindhi /Pashto)	Who can read word (English)	Who can do subtraction	Who can read story (Urdu /Sindhi /Pashto)	Who can read sentence (English)	Who can do division
Azad Jammu and Kashmir	50.1	6.1	3.3	38.1	12.2	54.2	67.8	50.4	61.4	58.5	52.9
Balochistan	27.6	33.0	16.8	14.1	2.9	32.4	31.7	25.3	32.8	27.6	24.3
Federally Administrated Tribal Areas	35.9	20.4	12.5	32.5	9.6	43.5	55.7	49.4	45.5	46.1	48.5
Gilgit-Baltistan	39.6	14.3	9.2	44.4	12.6	49.9	68.9	57.3	54.7	61.9	56.5
Islamabad - ICT	75.8	0.7	0.3	46.6	13.3	50.0	60.4	47.2	49.5	41.8	39.6
Khyber Pakhtunkhwa	38.2	15.2	10.0	28.0	10.7	35.5	51.8	41.0	37.5	41.6	40.0
Punjab	55.1	14.7	7.6	34.3	23.6	52.9	58.6	48.0	62.6	56.6	51.0
Sindh	36.7	27.2	13.9	15.1	8.8	36.8	27.9	29.6	41.0	23.6	30.5
National Rural	**39.2**	**21.0**	**11.4**	**27.0**	**12.2**	**41.4**	**47.0**	**39.1**	**46.4**	**42.3**	**40.4**

Source: ASER, Pakistan 2014

Figure 7:Learning Levels Province wise grade 5



Source: ASER, Pakistan 2014

Quality of education also depends on the physical environment and availability of facilities such as

water and sanitation in educational institutions. In this context, statistics on public sector schools show that availability of drinking water is positively related with the level of educational institution e.g. upper secondary schools, in relation to lower secondary and primary schools are best provided with drinking water facility e.g. 64% primary, 80% middle and 91% upper secondary schools have water available (Table 11).

Table 11: Drinking Water Facility 2012-13

Province	Primary	Lower Secondary	Upper Secondary
Balochistan	49.9%	55.3%	74.5%
FATA	34.1%	48.3%	59.5%
GB	34.7%	66.5%	91.9%
ICT	98.4%	100.0%	100.0%
KP	65.4%	73.5%	88.1%
Punjab	96.3%	99.5%	99.6%
Sindh	44.8%	56.0%	84.8%
AJ&K	26.6%	46.5%	62.5%
Pakistan	**64.2%**	**80.1%**	**90.6%**

Source NIMS 2012-13, Govt. of Pakistan

Data for sanitation facilities in public sector schools, too, show better availability by levels of educational institutions e.g., 66% primary, 85% middle and 91% upper secondary girls' schools have sanitation facilities while 54% primary, 76% middle and 85% upper secondary boys' schools have access to sanitation facilities.

Education is considered as the cheapest defense of a nation. But the down trodden condition of education in Pakistan bears an ample testimony of the fact that it is unable to defend its own sector. Though 62 years have been passed and 23 policies and action plans have been introduced yet the educational sector is waiting for an arrival of a savior. The current government invested comparatively well in education sector and that era saw a visible positive educational change in Pakistani society. Now days, the economic situation in Pakistan is under stress and education is the worse effected sector in Pakistan.

Table 12: Sanitation Facility 2012-13

Province	Primary		Lower Secondary		Upper Secondary	
	Male	Female	Male	Female	Male	Female
Balochistan	15.8%	34.3%	49.3%	67.7%	59.6%	77.1%
FATA	16.0%	51.7%	36.1%	67.1%	50.6%	76.4%
GB	26.9%	39.9%	62.0%	71.0%	87.5%	93.0%
ICT	98.0%	98.9%	95.8%	100.0%	100.0%	100.0%
KP	66.1%	91.7%	83.3%	92.9%	92.7%	97.6%
Punjab	67.3%	76.6%	88.7%	92.8%	90.2%	94.1%
Sindh	53.1%	48.7%	66.6%	66.7%	88.0%	91.2%
AJ&K	25.6%	27.9%	49.2%	51.6%	43.5%	54.8%
Pakistan	**53.5%**	**66.2%**	**75.5%**	**84.5%**	**84.7%**	**90.6%**

Source NIMS 2012-13, Govt. of Pakistan

Education Key Challenges in Pakistan

The key challenges to Pakistan's education are: (i) lack of access to education; and (ii) poor quality of education; (iii) equity; and (iv) governance. Other influencing factors include budgetary constraints and weak management, which indirectly accentuate the lack of access and poor quality; and a set of external factors such as poverty, adverse law and order situation; and devastation due to natural disasters especially devastating floods of 2010 and annihilating earthquake of 2005.These challenges are strongly interlinked with poor teaching quality, teacher absenteeism, truancy and/or lack of textbooks etc. As cumulative effect this generates lack of interest/motivation among students who dropout from school – adversely affecting every EFA goal and its corresponding targets.

Improving the quality of education is one of the key objectives of the National Plan of Action (2013) for education. For each strategy to be adopted for increasing enrollments, 15% of the total current and development costs have been additionally included for quality improvement measures. In this, the provinces and area governments will be free to select the most appropriate mix of investment e.g. in teachers' training, distribution of free textbooks, provision of missing school facilities such as water, toilets, electricity, better supervision or any other facility. Recently, minister of education announced a new Education policy for that next 10 years even the previous educational policy from 1998 to 2010 is still not expired. It is said in this policy that all the public schools will be raised up to the level of private schools because level of private schools considered good as public schools. Now a notice is issued to private schools to induct government course in 5th and 8th class and these classes will bound to take board exams.

Solutions for Educational System:

Estimating the value of education, the Government should take solid steps on this issue. Implementation instead of projecting policies should be focused on. Allocation of funds should be made easy from provinces to districts and then to educational institutes. On their end, provinces will need to make higher financial allocations to education, both formal and non-formal and literacy;

strengthen their capacities to design and implement education policy. Workshops must be arranged for teachers to enhance their professionalism, regular training of teachers, timely provision of textbooks, and effective monitoring and supervision is necessary for quality of education. Besides, undertaking more public-private partnerships, involvement of the community and participation of parents in school matters (through school management committees) should be encouraged. Lessons learned from public-private partnership experiences show that it produces better quality education at lower cost with improved management and greater coordination between parents and teachers. LSS (Learning Support Systems) *Explanation: "Create systems of learning support to enable students to achieve extraordinary learning results in classrooms, laboratories and beyond."* should be inducted in Pakistani schools to improve the hidden qualities of children. Technical education must be given to all the classes. Promotion of the primary education is the need of time must have to work on UPE. Teachers, professors and educationists should be consulted while devising any plan, syllabus or policy; and develop a strong field force of supervisors and monitors for tracking progress (or lack of it) in the education sector. International development partners can assist Pakistan in its efforts to meet the international commitments.

They can assist in:

1. Development of a well-organized consultative process among different stakeholders in education;
2. Establishment of a Consortium of Sponsors to Education in Pakistan;
3. Simplify the procedures required for approval of project/programme.

Given the fast approaching deadline of 2015 for meeting the internationally agreed goals and commitments, the international development partners should come forward and generously support educational development in Pakistan, strictly in line with national priorities. Investment in the education sector will help improve quality of life of the people through improved awareness and lead to the creation of a literate, tolerant, and development oriented society in Pakistan.

Model of Quality Control in Education

Adams (1993) included six elements of quality, i.e. reputation of the institution, resources and inputs, process, content, output and outcomes, and value added. Since the concept of quality control and quality management have come from industrial and management sciences, the models of quality control are essentially based on the same philosophy. The industrial models were later on applied and adapted to the educational settings. The educational planners have been defining the quality out-put and have been searching for educational quality correlates. The quality out-put is defined in terms of learning achievement in three domains, i.e. cognitive, affective and psychomotor. Other indicators of quality output are decreasing rates of dropout and increasing rates of stay-ins, number who complete the program cycle and, gender and social equality.

Lockheed and Verspoor (1991) in a study of developing countries have identified various input and process determinants of educational output. These include orderly school environment, academic emphasis in the form of clearly defined learning outcomes and standards, curriculum, particularly the "implemented curriculum" (textbooks, other learning materials), time for learning, and effective use of school time, qualified teachers and healthy children. The developed countries show the similar results with a varying level of quality inputs. For example literature on Educational Reforms in the United States describes that standards of education can be improved through redefining basic curricula, and setting performance standards required from students at the completion of the program (Paliakoff and Schwartizbeck, 2001). Farguson, as cited in Paliakoff and Schwartzbeck (2001), after his examination of student achievement in 900 Texas school districts concluded that the quality of

teachers is the most critical aspect of schooling and that it has a direct impact on student learning.

The study:
This study designed to achieve the following objectives;

1. To analyze the current situation of primary education in terms of enrollment.
2. To find out the quality of education regarding academic achievement in different school subjects at primary level through different documents and
3. To find out the differences of quality education in light of MDGs and
4. To devise a strategy of managing quality education at primary level in Pakistan.

Research questions:
Following research questions were constructed to guide the study;

1. What is the enrollment rate at primary level in Pakistan?
2. What is the completion / survival rate of primary education?
3. What is the academic achievement of the students at primary level?
4. How quality education can be controlled in order to achieve millennium development goals (MDGs), objectives of Education for All (EFA) and targets of Universal Primary Education (UPE).

RESEARCH METHODOLOGY:

Research design was mixed method. Qualitative objectives (Obj. # 1 & 2) and satisfactory answers of all four research questions were found through document analysis technique. Different national and international reports, online books, research articles and education policies were consulted. For quantitative part of the study a ASER Pakistan (Annual Status of Education Report) survey reports 2013/14 and NEMIS (National Education Management Information System) Database 2013-14, AEPAM, Government of Pakistan was used.

RESULTS OF QUALITATIVE ASPECT

Research question # 1: What is the enrollment rate at primary level in Pakistan?
On average, Pakistan's gross primary enrollment rate (GER) is 86%, with 92% for boys and 119% for girls. KP displays the second highest GER of 104%, followed by ICT (89%), Punjab (88%), FATA (88%) and Sindh (76%). In Pakistan, of all the primary-aged (5-9 years) children, 68% are enrolled in primary school (Table 7 on page 8). The highest net primary enrollment rate is in KP (81%) where 92% of all boys (aged 5-9 years) and 68% of all girls (aged 5-9 years) attend primary school. This is followed by Glt.B (76%); Punjab (70%); and ICT (70%). About two-thirds of children attend school in Sindh (63%) and FATA (62%) while only one-half children in Baluchistan (51%) are enrolled in primary schools. ICT is also the only area in the country where primary enrollment rate is higher for girls (72%) than boys (68%) while AJ&K has almost an equal enrollment rate (58%- 59%) for boys and girls.

Research question # 2: What is the completion rate or survival rate of primary education?
For Pakistan, estimated information reveals that of all the children entering primary school, 70% reach Grade 5 (Table 8 on page 08). For boys this rate (71%) is slightly above than that for girls (68%). Among the provinces and areas, the highest rate of survival is for ICT (91%) while Glt.B

(32%) is lowest. In Sindh, FATA and KP, almost two- thirds of the children reach grade 5 while in Baluchistan only one-half survive up to the final primary class.

Research question # 3: What is the academic achievement of the students at primary level?
According to ASER (2014), (Table 10 on page 9), analysis of reading ability in Urdu/Sindhi/Pashto shows that 49% of Class 5 students could not read Class 2 story compared to the 50% in 2013. 84% of Class 3 children and 30% of Class 1 children could not able to read letters in Urdu/Sindhi/Pashto as compared to 31% in 2013. 58% of Class 5 students could not able to read English sentences of level 2 compared to 57% of children in 2013. 86% of Class 3 children could not read class 2 level English sentences 38% children enrolled in class 1 cannot read capital letters as compared to 39% in 2013. 89% children enroll in class 3 could not do two digit division as compared to 88% in 2013. 30% of class 1 children could not do number recognition (1-9) as compared to 30% in 2013.

Research question # 4: How quality education can be controlled in order to achieve millennium development goals (MDGs), objectives of Education for All (EFA) and targets of Universal Primary Education (UPE)?

The following findings of quality inputs and quality processes were emerged from data gathered and analyzed by ASER survey 2014 and Pakistan EFA review report 2015.

- In 2014, 21% of the children (age 6-16) were reported to be out of school which has almost remained the same as compared to the previous year (21%).15% children have never been enrolled in school and 6% have dropped out of the school for various reasons.
- 46% of the boys as compared to the 39% of girls could read language sentences the other side 49% of the boys as compared to the 42% of girls could read at least English words. Similarly, 42% of boys as compared to 38% of girls were able to do at least subtraction.
- In communities parents 24% of mothers and 48% of fathers in the sampled households have completed at least primary education.
- In multi-grade teaching, 43% of surveyed Government schools and 25% of private schools had class two sitting with other classes where as 10% of Government and 17% of surveyed private schools had class 8 sitting with other classes.
- 15% children in surveyed Government schools and 10% of private schools were absent where as 12% teachers in Government schools and 7% in private surveyed schools were absent too.
- 33% teachers in surveyed Government schools have done graduation as compared to 39% teachers of private schools where as in term of professional qualifications 38% of Government teachers are professionally qualified as compared to 49% of private school teachers.
- 41%of Government schools have computer labs as compared to the 36%in private surveyed schools where as 49% of Government schools did not have toilets in

2014 as compared to 53% in 2013. Similarly, 25% surveyed private primary schools were missing toilets facility in 2014 as compared to 24% in 2013.

- 43% of Government primary schools did not have drinking water in 2014 as compared to 36% in 2013. Similarly, 21% of surveyed primary schools did not have drinking water facility in 2014 as compared to 17% in 2013.
- 39% of surveyed Government primary schools and 27% of private primary schools were without complete boundary walls as compared to 28% in 2013 and 68% Government Primary schools and 62% private primary schools were without playgrounds.

CONCLUSIONS AND RECOMMENDATIONS

The Constitution of Islamic Republic of Pakistan says,

"The state of Pakistan shall remove illiteracy and provide free and compulsory secondary education within minimum possible period." In Human Development Report, Pakistan is placed at 136th position for having just 49.9% educated populace. The primary completion rate in Pakistan, given by Data Center of UNESCO, is 33.8% in females and 47.18% in males, which shows that people in the 6th largest country of the world are unable to get the basic education. Following conclusions and recommendations need to be discussed below:

Firstly, the educational system of Pakistan is based on unequal lines which directly effects on quality of education and especially at primary level. Medium of education is different in both, public and private sectors at every level. This creates a sort of disparity among people, dividing them into two segments. One division is on the basis of English medium language while the other is Urdu medium language. There should be better to standardize the medium of education in all over the country to maintained quality education.

Secondly, regional disparity is also a major cause which also affects the quality education. The schools in Baluchistan (The Largest Province of Pakistan by Area) are not that much groomed as that of Punjab (The Largest Province of Pakistan By Population). In FATA, the literacy rate is deplorable constituting 29.5% in males and 3% in females. Here it should be equal treatment to all the provinces to improve educational system and quality.

Thirdly, the ratio of gender discrimination is a cause which is projecting the primary school ratio of boys & girls which is 10:4 respectively. For the last few years there has been an increase in the growth of private schools. That not only harms the quality of education but create a gap among haves and have not's. Here its need to work on gender harmony in order to achieve educational goals.

Fourthly, the allocation of funds for education is very low. It is only 1.5 to 2.0 percent of the total GDP. So, it's very low budget to fulfill the basic necessities of the education sector at every level which definitely affect the quality of education. It should be around 7% of the total GDP. Political government currently plans to increase budgetary allocation from current 2% to 4% of the GDP by the year 2018.

Fifthly, the teachers in government schools are not well trained. The education sector if fully influenced by the political parties so the teachers even not professionally equipped can get easy job in education sector without any tough criteria. They are not professionally trained teachers so they are unable to train a nation by delivering good quality education. However, professionally more trained people can educate the people to build a good nation.

Sixthly, irrelevant curriculum, non-availability of textbooks and shortages of other learning materials affect learning levels especially in primary level. Lack of regular supervision and monitoring has failed to check teacher absenteeism and misuse of resources. So, these problems should be tackling according to the proper needs to improve good quality.

Finally, Educational outcomes are one of the key areas influenced by family incomes which directly effects quality education. Children from low-income families often start school already behind their peers who come from more affluent families, as shown in measures of school readiness. The incidence, depth, duration and timing of poverty all influence a child's educational attainment, along with community characteristics and social networks. However, it represents that the effects of poverty can be reduced using sustainable interventions to enhance quality education.

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EFFECT OF FASTING ON THERMOREGULATION BALANCE AND AEROBIC ENDURANCE IN MIDDLE-DISTANCE RUNNERS

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Abstract
This study aims to evaluate the influence of fasting on the balance of thermoregulation and the aerobic endurance performance in middle distance runners. 13 male athletes (aged 21-33), specialists in middle distance, were evaluated 11 days before the fasting period, then the 25th day of the fast and finally the 119th day after the end of the fasting period. In order to make the study operational, we took axillary temperature measurements before the preparatory warm-up and, also, just after the end of each running event over a distance of 3000 meters. Statistical analysis shows that the fasting period generates significant changes in thermoregulation balance and, also, aerobic endurance performance of middle distance runners.
Key words: fasting, balance, thermoregulation, aerobic, endurance.

1- INTRODUCTION

Regular practice of high-intensity endurance exercises, without sufficient rehydration, negatively affects not only work capacity, and therefore athletic performance, but also fluid balance and central body temperature (Mazer, 2004). Scientific studies agree that dehydration is accompanied by a significant decline in physical ability and exposed to many complications, such as the appearance of cramps, musculo-tendinous lesions, stroke heat or even death, as is the case of the Minnesota Vikings American footballer Korey Stringer, victim of a heat stroke, which collapsed during an intense training in the heat, His central temperature was 40 ° C, 13 hours after this incident, he died (Wilmore, JH, et al., 2009).

During the sports effort, as body temperature increases, sweat losses rise to avoid hyperthermia. When the sports effort is intense and prolonged, sudation increases and the amount of water produced by the cells to prevent dehydration is insufficient. If in parallel, there is no compensation, at least partly losses due to evaporation, the performance will be affected. Indeed, according to Wilmore, J-H., Et al. (2006, pp.357-358), dehydration also affects the functioning of cardiovascular and thermoregulatory systems. A loss of water equivalent to 2% of the body weight leads to an increase in heart rate, an increase in body temperature and a decrease in running performance (1500m, 5000m and 10000m).

Maintaining fluid and electrolyte balance during exercise is, therefore, essential for performance. Moreover, the recommendations from the scientific work are unanimous as to the need for adequate hydration before, during and after the practice of physical and sports effort, to which it is advisable to add mineral elements in case of necessity (Paillard, 2010, Wilmore et al., 2006; Stéphane Cascua & Rousseau, 2005; Mazer, 2004; Pasquet, Hascoat, 2004; Basdekis, 2003).

In this context and, also, taking into account the fact that high-level Muslim athletes must pursue intensive sports training programs, during the fasting period that begins before sunrise and extends to sunset during the entire month of Ramadan, we want to ask the following question: Does fasting significantly affect the thermoregulation balance and the performance of middle-distance runners?

2- METHODS AND TOOLS

2-1- The subjects of study

The sample of our study is made up of 13 competitive male athletes, specialists in middle distance race, aged between 21 and 33 years old. They all live in the same sports center and, they are subject to the same training conditions.

2-2-Tests and Data Acquisitions.

- Endurance test: To evaluate the relative aerobic endurance capacity of the athletes, we used the running test over o distance of 3000 meters.

- Measurement of the axillary temperature: The axillary temperature is obtained using the medical mercury thermometer.

2-3- Protocol of the study

The race tests over a distance of 3000 meters are performed at the same time and under the same conditions: The first evaluation (EVAL-endur 1) is performed 11 days before the beginning of the month of fasting; the second evaluation (EVAL-endur 2) 25 days after the start of the fast and, the third evaluation (EVAL-endur 3) 119 days after the end of the fasting period.

The evaluation of the axillary temperature (Temp-test) is carried our just before the preparatory warm-up and, also, just after the end of each evaluation. The procedure is to keep the thermometer 120 seconds under the armpit.

2- 4- Statistical analysis.

Means and standard deviations were computed for all the different evaluations. A T-test for paired groups was used to evaluate the differences between the performances of the different evaluations. The level of significance was set at $p < 0.05$.

3-RESULTS

Table 1: Statistical Analysis of the Different Evaluations (EVAL-endur) Related to the Middle - distance test over a distance of 3000 meters.

Statistical Parameters	Evaluation		
	EVAL-endur 1	EVAL-endur 2	EVAL-endur 3
N	13	13	13
Means (seconds)	557,52	592,39	531,78
Standard deviation (SD)	30,36	53,19	26,80
t-test	(EVAL- endur 1 with EVAL-endur 2) (T-test = 5.16 significant at $p < (0.05)$ (EVAL- endur 2 with EVAL- endur3) (T-test = 7.01 significant at $p < (0.05)$		

Table 2: Means, Standard-deviation of different Axillary Temperature tests.

Statistical Parameters	Temperature tests.		
	Temp-test 1	Temp-test 2	Temp-test 3
N	13	13	13
Means (seconds)	37,21	37,58	37,22
Standard deviation (SD)	0,11	0,03	0,02
t-test	Temp-test 1 with Temp-test 2 (T-test = 3.59 significant at $p < 0.05$) Temp-test 2 with Temp-test 3 (T-test = 5.98 significant at $p < 0.05$) Temp-test 1 with Temp-test 3 (T student = 0.07 Not significant at $p < 0.05$)		

4-DISCUSSION

The study's aim is to evaluate the effect of fasting on thermoregulation balance and the aerobic endurance performance in middle distance runners. The statistical data (Table 1) shows, indeed, that the performances obtained during the fasting period (EVAL-endur 2 = 592.39) decreased significantly (- 0.331m / s) (t-test = 5.16 is significant at $p < 0.05$) compared to those obtained 11 days before the beginning of the month of fasting (EVAL-endur1 = 557,52). However, in the third evaluation (EVAL-endur 3 = 531.78), the athletes significantly improved their performances (+ 0.624 m / s) compared to those of the second evaluation (EVAL-endur 2) (t-Test = 7.01 is significant at $p < 0.05$).These results are in agreement with the explanations of Mazer (1995) and weineck (1997) who claim, that high-intensity aerobic exercise, without sufficient rehydration, negatively affects the athletic performance.

The statistical data (Table 2) show that the axillary temperature of middle-distance runners has increased significantly during the fasting period. Indeed, the differences between the averages of temperatures taken 11 days before the beginning of the month of fasting (Temp-test1 = 37,21) and, those obtained 25 days after the beginning of the period of fasting (Temp-test 2 = 37.58), are statistically significant (T-test = 3.59) at $p < 0.05$. The same observation is observed when comparing the average temperatures taken 119 days after the end of the fasting period (Temp-test 3 = 37,22) with those obtained 25 days after the start of the fasting period (Temp-test 2 = 37.58). On the other hand, we note that the comparison between the mean of Temp-test 3 (37,22) and that of Temp-test1 (37,21) is is not significant (T-test = 0,07) at $p < 0,05$.

The decrease in the performance level of the athletes, during the fasting state, could be explained by the effect of the interaction of several factors. Among them, the water balance and in parallel the preservation of the electrolyte balance (sodium, potassium, ...) which are of capital importance in the maintenance of an optimal functional level of the metabolic and enzymatic activity and, also, thermal regulation; on the other hand, excessive loss of water and electrolytes can be directly related to a series of psychological and physical phenomena that affect performance (Weineck, 1996, p.495). The results in Table 2 show, indeed, that the differences between temperatures taken 11 days before the beginning of the month of fasting (Temp-test1 = 37,21) and, those obtained 25 days after the beginning of the period of fasting (Temp-test 2 = 37.58), are statistically significant (T-test = 3.59) at $p < 0.05$. The same thing is observed when comparing the average temperatures taken 119 days after the end of the fasting period (Temp-test 3 = 37,22) with those obtained 25 days after the start of the fasting period (Temp-test 2 = 37.58). On the other hand, we note that the comparison between the results of Temp-test 3 (37,22) and those of Temp-test1 (37,21) is not significant (T-test = 0,07) at $p < 0,05$. This result is in agreement with the explanation of wilmore and Costill (2006) who confirm that excessive loss of water and electrolytes, especially in athletes, during thermal regulation, particularly through transpiration, is directly linked to a series of physical and psychological factors that negatively influence sports performance (Wilmore & Costill, 2006).

CONCLUSION

Determining the influence of fasting on thermoregulation balance and aerobic endurance performance in middle distance runners was the purpose of this study. Through the results obtained, we can confirm that fasting influences the capacity of aerobic endurance. Indeed, the statistical analysis of athletes' performance in the 3000-meter race test performed before, during and after the month of fasting confirms that diurnal food abstinence and, in particular, water deprivation, negatively influences aerobic endurance capacity. It was, also, observed a large amplitude of the axillary thermal gap during the fasting period which explains, to a certain extent, the decrease in the capacity and physical performance of the athletes in the race event.

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FITTS' LAW AS AN EDUCATION RESOURCE FOR HUMAN-COMPUTER INTERACTION IN COMPUTER SCIENCE CURRICULA

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Abstract
Fitts' Law is, more often than not, thought of as standard knowledge in the field of Human-Computer Interaction. However, in many occasions, interface components are being built by professionals with little or no knowledge of HCI principles (e.g., software menus are often being built by software developers with no designer input). How much appreciation of Fitts' Law exists among developers, and how does it affect our collaboration with them and the software they build and we use? To help answer this question, a survey among 65 designers and developers was conducted, as well as an analysis of the Computer Science undergraduate curricula from 94 internationally high-ranked universities. The contribution of this paper is twofold: firstly, treating Fitts' Law as an Open Educational Resource and, secondly, the analysis identified gaps that extend beyond HCI Education and fall in the sphere of Epistemology.

Keywords: Fitts' law; HCI; education; epistemology.

1. INTRODUCTION

We all know what Fitts' Law is. Or do we? The answer may depend on who "we" are, and on how we understand scientific laws. Fitts' Law is a *sine qua non* in HCI Education. However, many—if not most—practitioners in the field would not have undertaken traditional HCI Education: they would originate from either non-technical backgrounds such as (non-applied) psychology and design, or from engineering and computing. The interdisciplinarity of HCI practitioners has offered a great deal to the field, and many courses in the aforementioned fields offer elective HCI modules; however, it is not expected that a graduate of these courses would be necessarily aware of what HCI is. Working in groups where the majority of members have little or no awareness of HCI can hinder communication around a design problem—or a proposed solution thereof—, and can potentially lead to designing for poor user experiences.

Finding a balance between the desired interdisciplinarity of a group and a mismatch in understanding is no easy task. Difficulties are manifest in a large sub-field of HCI, which is software construction. The designer/developer workflow is a constant example of workplace friction, and a rich source of inspiration for imaginative start-ups that produce tools promising to ease the workflow. While an increasing number of organisations values design more than in the past and the number of start-ups with designer founders is reportedly increasing, the conceptual mismatch in the designer/developer workflow is still present.

In this paper, the aim is to consider Fitts' Law as an example of the designer/developer mismatch. Do designers and developers perceive Fitts' Law in different ways? If yes, is this a result of HCI Education? If not, what can be still said about the apparent conceptual mismatch?

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2. RELATED WORK

Fitts, after having worked for a number of years with the U.S. Air Force on the psychological aspects of aircraft displays (Fitts, 1947), generalised his work on controlling the amplitude of movement. His experimental work was seminal and has resulted in a series of laws (Fitts, 1992). The law describing how the response time of controlling a target is proportional to the distance from and the size of the target has been named the "Fitts' Law" and been considered as a law of paramount importance for the field of Human-Computer Interaction (Thimbleby, 2013).

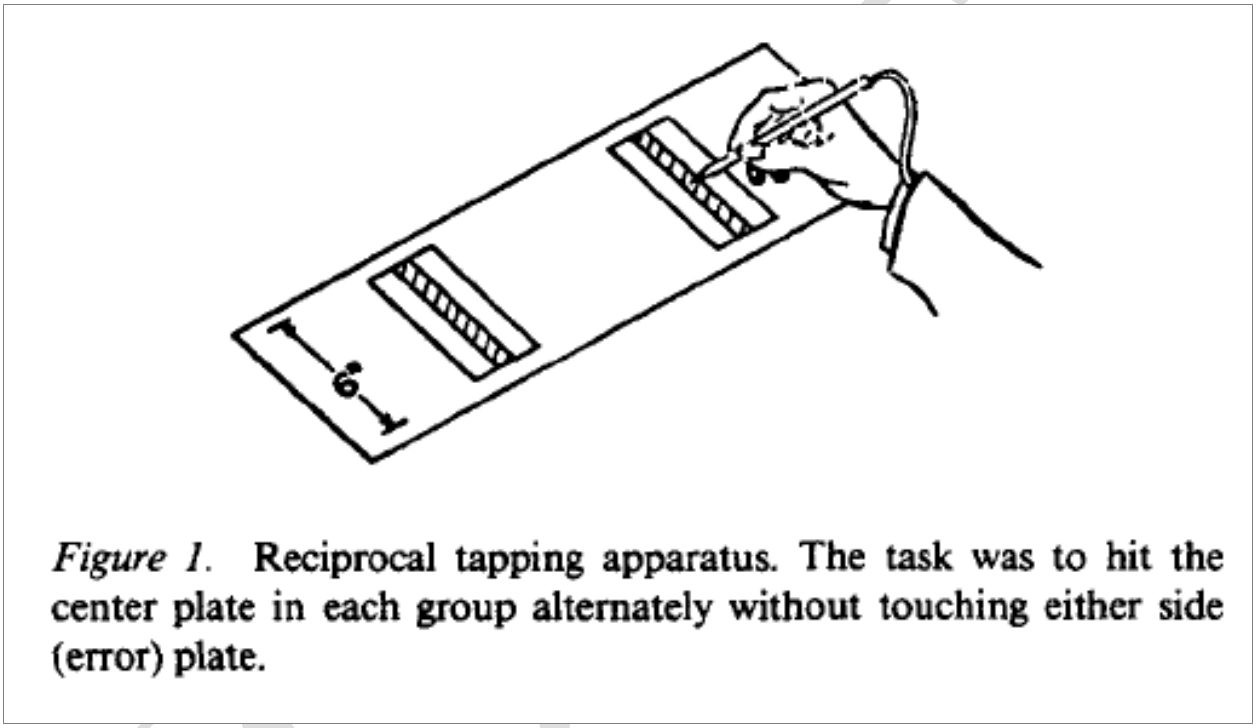

Figure 1. Reciprocal tapping apparatus. The task was to hit the center plate in each group alternately without touching either side (error) plate.

Figure 1. A figure from the original Fitts' experiment (Public Domain) (Fitts, 1992).

Fitts' Law has played a big role in HCI research, as it has been viewed through multiple lenses. It has been shown that the Law holds for tablets; for hand-gesture detection; for tracking certain eye movements; for touchpads; for (some) motion kinetics; or for screen-edge pointing (Appert, Chapuis, and Beaudouin-Lafon, 2008), (Brown, M. A., Stuerzlinger, & Mendonça Filho, 2014), (MacKenzie and Oniszczak, 1998), (Mandryk and Lough, 2011), (Surakka, Illi, and Isokoski, 2004). It has been shown not to hold for some radial menus (Friedlander, Schlueter, and Mantei, 1998). It has been viewed as a time/error tradeoff, as a research and design tool in HCI, or as a research tool for the perception of user performance (Guiard and Perrault, 2011), (MacKenzie, 1992), (Nicosia, Oulasvirta, and Kristensson, 2014). Others have focused on the specific variations of the formula that expresses Fitts' Law (Drewes, 2010). A multitude of academic research articles and blog-posts have been written about it.

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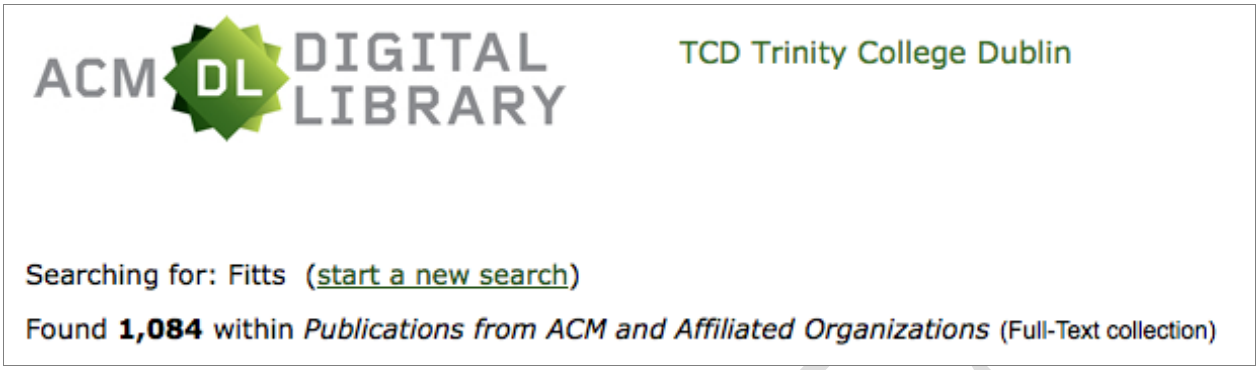

Figure 2. A search for "Fitts" in the ACM Digital Library is indicative of the popularity of Fitts' Law.

With regard to the field of Education, previous research has built upon traditional HCI for Education work to show that research projects around experimenting with laws such as Fitts' one are beneficial to CS undergraduate students (Pastel, 2005).

More broadly speaking, some previous work describes case studies where HCI has been integrated, in one way or another, in a CS curriculum (Chan, Wolfe, and Fang, 2002), (Cockburn and Bell, 1998), (Douglas, Tremaine, Leventhal, Wills, and Manaris, 2002), (Fischer, 2008), (Greenberg, 1996), (Moore and Lottridge, 2010), (Pastel, Brown, C., Woller-Carter, and Kumar, 2012), (Rusu, C., Rusu, V., Roncagliolo, and Rubio, 2007). The need for interdisciplinarity has been emphasised; specifically, the joint ACM/IEEE CS 2013 curriculum especially recognises the need to "provide students with the flexibility to work across many disciplines" and to cover various knowledge areas in introductory courses (it specifically includes HCI in both Tier 1 and Tier 2, which is great) (The Joint Task Force on Computing Curricula – Association for Computing Machinery / IEEE-Computer Society, 2013).

Thus, a study on the actual situation in CS curricula seems to be necessary; is the recommendation of the CS2013 curriculum to include HCI in Tier 1 Core modules actually being implemented? Such a study is presented below.

3. FITTS' LAW BEYOND HCI EDUCATION

A study on the inclusion of HCI in CS curricula should try to address the following two issues. Firstly, do HCI-related concepts appear in Tier 1 modules? Secondly, what are the implications of not including HCI in core CS?

3.1 HCI Education in CS Curricula

To investigate if HCI-related concepts appear in CS core modules the following approach was followed.

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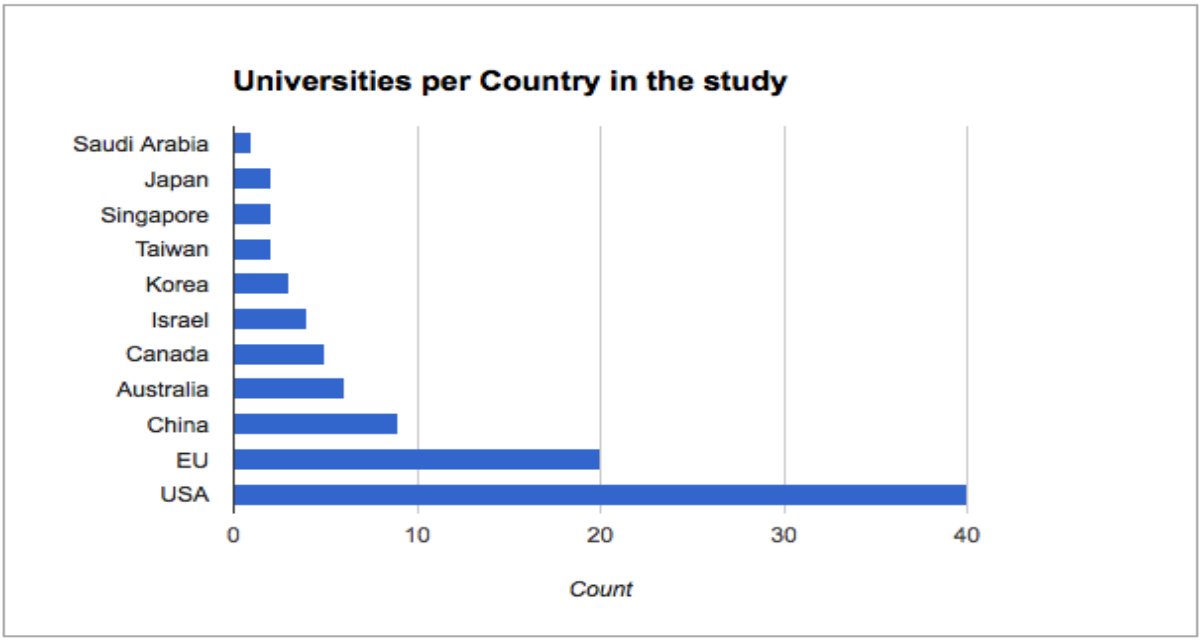
Firstly, a list of universities was compiled by triangulating the results of three prominent university-ranking providers [1]. The top 75 universities in CS from the 2014 Shanghai Academic Rankings, the top 50 universities from the 2014 QS University Rankings in CS and Information Systems, and the top 50 universities from the 2014-2015 Times Higher Education ranking in Engineering and Technology. This list yielded a list of 94 universities from 11 countries. For the sake of simplicity (no political connotations should be drawn from this), universities from the EU and Switzerland were filed under "EU" as they use the structures of the European Higher Education Authority (EHEA) and, similarly, universities from China and Hong Kong were filed under "China".

For these 94 universities, their CS curricula were located through their websites. One undergraduate Bachelor's or Major in CS program per university was chosen to be included in the study. Computer Engineering, Information Systems, Interaction Design, or Multimedia Design programs were excluded, as they are out of scope for this study.

Then, for each CS course the following information was collected. Firstly, if the course offers an introductory course to CS, in which various fields of computing are represented. Possible answers are {*yes*, *no*, *programming*}, where "yes" means that an Introduction to CS exists and covers various CS fields, "no" that such an introduction to CS does not exist, and "programming" that an introduction to problem solving exists, but is entirely focused on algorithmic thinking and using a programming language. Secondly, data were collected with regard to the course including HCI topics in the introductory CS modules, as an obligatory HCI module, as an elective module, or not at all.



[1] Disclosure: I participated in the 2014 QS World University Rankings Survey as a respondent.

Figure 3. A graph of the—skewed—distribution of the top ranked universities for CS per country. Triangulating rankings from three different providers composed the list.

Limitations in data gathering resulted in analysing 82 out of 94 programs. Some programs offered information only in the native language of the country where they are offered: machine translation helped successfully with some of these, but not all curricula pages could be located. Another limitation was the lack of detailed descriptions in some courses, which may have mentioned that they offer an introductory CS course, but its syllabus is not publically available. Finally, one website was not available due to technical failures during data collection.

All effort was put into gathering the latest information, namely for the 2014-2015 academic year. An apparent weakness of this method is that it may identify current patterns is curricula, but the direction towards these curricula will be developed is not clear. Thus, a university that currently considers moving to the CS2013 curriculum, and one that does not will appear the same, if their current offerings are the same. However, considerations to change the curriculum towards CS2013 are rarely announced in public, making such a data collection almost impossible.

The list of universities and the full data are available at: http://bit.ly/1JYF03A

The results of the data analysis are presented in the next section. Before that, the following sub-section describes the second part of the study around the implications of excluding HCI from core CS curricula.

3.2 Designers' and Developers' Perception of Fitts' Law

To define all implications of excluding HCI from Tier 1 CS courses in no easy task. For this reason, this study is limited in identifying a small, but important, subset of the HCI body of knowledge: its iconic Fitts' Law.

The rationale originates from a real case in Learnovate Centre around an educational software application. On an in-house re-design of a content-composition application for Windows 8.1 bearing Microsoft Surface devices, a discussion arose among our designers and developers around the design and implementation of the navigation menu. The original impression was that the native menu (see Figure 4) had to be implemented, but eventually a different mechanism was designed and implemented.

However, during the discussion around the native menu, various web searches revealed that many developers had a flawed perception about what Fitts' Law is. This flawed perception seemed to have affected the implementation of menus by the said developers.

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Figure 4. The navigation menu on the Microsoft Surface tablet device. This illustration uses a mockup of the Windows 8.1 operating system. gesture on the bezel of the device, that is a drag down from the bezel into the screen reveals the navigation menu. The low affordance of this menu, the small height of the device's top bezel, and the limited bezel width that is at reach each moment may hinder its use. Right-clicking when using a mouse reproduces the same behaviour.

Specifically, a perception that bad menu design somehow "violates" Fitts' Law seems to be particularly popular. The discussion about how a menu "violates" or "breaks" [*sic*] Fitts' Law is taking place in popular developer blogs and forums, and even in corporate developer forums (in start-ups and multi-nationals alike).

To validate the above, a survey related to Fitts' Law and menu design was designed and circulated to designers and developers.

The survey consisted of a short introduction to Fitts' Law, a question about whether the menu of Figure 4 "violates Fitts' Law" [*sic*], and questions about the occupation of the respondent, their gender, age, and ethnicity. The demographic questions were not asked to validate a pre-existing hypothesis, but rather to allow for better data analysis.

The survey was circulated to various user groups through email and social media (Twitter, and LinkedIn SIGCHI and IxDA Groups).

The next section presents the findings from the CS curriculum analysis and the survey.

4. FINDINGS

4.1 HCI in CS Core Curricula

Out of the 82 analysed CS undergraduate curricula, only 11 (~13%) follow the ACM/IEEE CS 2013 recommendation, and 4 (~5%) other universities offer alternative options that also incorporate HCI in core modules. The 11 universities that include HCI in their Tier 1 employ different methods, ranging from briefly mentioning HCI in their introductory CS courses, to offering obligatory HCI modules. Alternative HCI incorporations include designing UIs at projects, and there is also a singular case where a CS program offers modules from a Design Academy *in its core curriculum*—not as a "dual degree" option (the Hebrew University of Jerusalem offers a CS program with the Bezazel Academy of Art and Design). A list of these institutions is below in Table 1.

Table 1. The 11 top-ranked universities that include HCI as part of their core, Tier 1 CS undergraduate offering (numbered 1 to 11), as well as the 4 universities that offer alternative paths in their CS curriculum that may include some HCI in a core module (a to d).

University	Country	Has HCI in CS Core?
1. Massachusetts Institute of Technology	USA	Yes
2. Nanyang Technological University	Singapore	Yes
3. The Hong Kong University of Science and Technology	Hong Kong (China)	Yes
4. University College London	EU	Yes
5. University of Washington	USA	Yes
6. University of Copenhagen	EU	Yes
7. University of Tokyo	Japan	Yes
8. Australian National University	Australia	Yes
9. University of Queensland	Australia	Yes
10. Yale University	USA	Yes
11. Rice University	USA	Yes, but focuses on Game Design
a. Georgia Institute of Technology	USA	Students can take HCI while on CS 'Thread'
b. Columbia University	USA	Potentially in projects
c. The Ohio State University	USA	Potentially in projects
d. The Hebrew University of Jerusalem	Israel	In CS program with Bezazel Academy of Art and Design

The majority of curricula, that is 42 (~51%) of them, offer HCI as an elective module, and do not mention HCI in their core. However, in all 42 curricula of this kind, it remains unclear why the student is expected to elect HCI as a module: the field is not introduced at any point, and it is unclear what mechanisms are in place to motivate students elect HCI. Thus, students may choose to attend the elective HCI module for

pedestrian, rather than academic reasons (e.g., a lecturer of their liking, easier access to previous exams' solutions, or similar).

Other institutions, more specifically 24 universities (~29%), do not include HCI at all in their CS courses, neither mentioned in an "introduction to CS" course nor as an elective course. Moreover, an institution has an HCI course in their course, but it is not offered in 2014-2015 (see Figure 5).

A geographical analysis of the results did not identify specifically interesting patterns. In general, in the USA, Australia, and Europe a variety of offerings has been adopted, while Canadian, Chinese, Korean, and Taiwanese institutions tended to follow one model (offering elective HCI courses, or no HCI at all). However, this difference may have been influenced by the larger sample size for some countries than for others, and should not be considered definite.

In conclusion, approximately 82% of the top-ranked universities do not actively motivate future computer scientists to further explore HCI, and 29% do not even offer basic knowledge about what HCI is. Only 18% of the institutions facilitate an informed choice with regard to studying HCI.

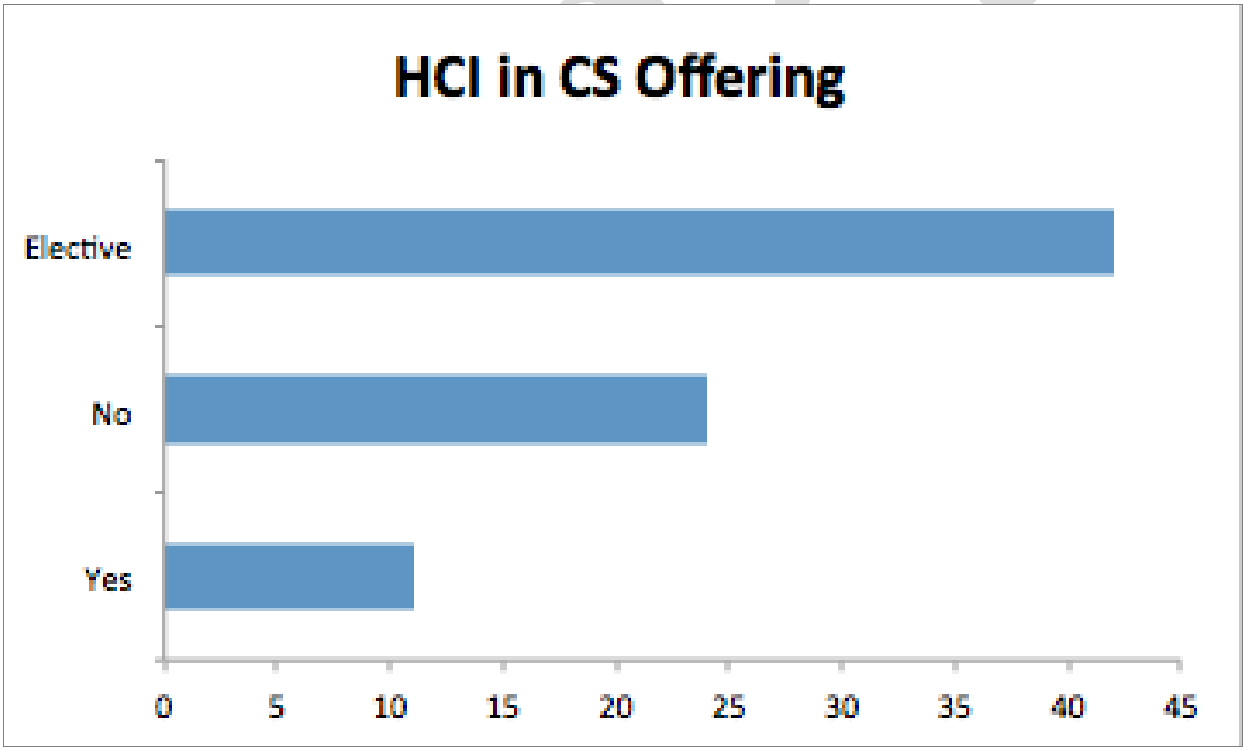

Figure 5. The majority of top-ranked universities do not mention HCI as a field in their core CS undergraduate curriculum.

4.2 Fitts' Law Developers' Perception Survey

Out of the 65 respondents of the survey, 19 (~29%) replied that the menu of Figure 4 "violates" Fitts' Law, and 31 (~47) replied that it does not. 15 respondents (~23%) typed in a response in the "Other" field,

of whom only 5 (~8%) respondents questioned the notion of what it means to violate Fitts' Law altogether (Table 2).

Table 2. Demographics for the 5 respondents who questioned the notion of "violating" Fitts' Law altogether.

Respondent	Job Function	Gender	Age	Ethnicity/ies
#16	Designer	Male	45-54	White
#28	Developer	Male	35-44	Prefer not to answer
#57	Researcher	Female	25-34	White
#60	Designer	Male	25-34	Hispanic
#64	Designer	Female	35-44	White

Respondent #64 summarised nicely that: "*I do not know how Fitt's law can be violated if it is a function that returns time*."

Table 3. Number of responses and percentages per group for the survey question based on Figure 4: "In your opinion, does this drag-from-bezel menu violate Fitts' Law?".

Developers		
Answer	**Responses**	**Percentage**
Yes	8	44.45%
No	7	38.89%
Other	3	16.67%
Designers		
Answer	**Responses**	**Percentage**
Yes	4	18.19%
No	12	54.54%
Other	6	27.27%

Respondent #28, the only developer who questioned the "violation" notion, gave a practical example to explain his rationale: "Say Zig's law is, a person who chooses a center seat in a theater walks further than a person who chooses an aisle seat. One person chose an aisle seat. Is Zig's law violated? Absolutely not, a person who chooses a center seat walks further than a person who chooses an aisle seat. The law does not apply to what decisions can or cannot made, it applies to the consequences of those decisions. The particular design decision made by Microsoft does not change the fact that design decisions have consequences, and all Fitt's law states is that design decisions have consequences." The other 3 respondents in Table 2 had a similar line of thought.

Other respondents who typed in the "other" field but didn't question the "violation", perceived Fitts' Law in different ways. A (male, designer, white, 35-44) respondent (falsely) replied that Fitts' Law is only relevant in drag-and-drop operations, and not when reaching a target: "Fits' Kaw is about the target (in this case, where you drop the item) and not about the start location" [*sic*]. A (male, white, 35-44) developer replied that: "because it is an established pattern on mobile i.e. to drag a menu or utility tray from the 'bezel', it works."

In general, developers were more likely to say that the menu "violates" Fitts' Law than designers (Table 3). Moreover, developers were less likely to choose the "other" option and type in their own answer.

With regard to other demographics, there were 12 male and 3 female developer respondents, and 13 male and 8 female designers. Both designers and developers were predominantly white, 11 developers (~69%) and 17 designers (~77%). Designers were slightly older than developers. Moreover, it is worth noting that female respondents were more diverse ethnically, and with regard to age, and predominantly designers (60% designers, 25% researchers, 15% developers). Considering ethnicity, 2 out of 20 non-white respondents (8 Asian/Pacific, 2 Black/African American, 7 Hispanic, 3 preferred not to answer) identified the issue with "violating" the law, while 3 out of 44 white respondents did (10% and 7%, respectively).

5. CONCLUSIONS

In conclusion, when presented with a concrete menu design problem at hand, most designers and developers who participated in the survey (~87%) did not question the premises presented to them. Moreover, only 8% achieved to re-frame the problem in a way that makes sense from an HCI point of view.

At first glance, this seems to be a very limited result about a specific law and how it applies to a particular menu. However, it reveals underpinning misconceptions about what a scientific law is and how it can be violated (e.g., a boat floating on water does not violate the law of gravity).

In addition, 82% of top-ranked universities have not yet adopted the recommendations of (The Joint Task Force on Computing Curricula ACM / IEEE-CS, 2013) to include HCI in their core CS undergraduate curriculum.

The effectively active *epistemological misconceptions about scientific laws* and the lack of computer scientist exposure to HCI may hinder the communication and inhibit the understanding between HCI practitioners or researchers and computer scientists, i.e., the very people who, most of the time, implement the solutions we design.

In the current times when a typical enterprise consists of 15 people (Bureau, U.S. and Statistics, L. 2012), an 8% of people able to re-frame a problem in a scientifically appropriate way would mean approximately 1 person per organisation. Given how group dynamics work, a single person may find it impossible to re-frame a related problem when necessary.

Of course, other factors may also exist, and further research should consider design curricula, life-long learning, and any related non-education factors. Ultimately, this paper is not an attempt to list an exhaustive list of factors, but rather to begin a dialogue which will link HCI Education to actual CS curriculum design.

6. ACKNOWLEDGMENTS

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