Evaluating the Impact of Teachers' Remuneration on the Performance of Students: Evidence from PISA

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Abstract: *Students' Learning Outcomes (SLOs) do not only depend upon the teacher's knowledge and teaching skills but there are many other contributing factors that affect the overall performance of students. In this paper we argued that teacher's salary/ remuneration is an important factor and it has an effect on students' performance because this variable can captures many other aspects as well; job satisfaction, motivation, desirability of profession, job preferences, and continuation of teaching career. In this research, the impact of teacher wages on students' achievement has been assessed by studying wages related sub-factors; starting salary, salary after fifteen year of experience, salary per hour of net teaching time and salary ratio to GDP per capita. For this purpose teachers' remuneration data and PISA 2000, 2003 and 2006 survey data of students' scores of fifteen year old pupil enrolled in lower secondary school in OECD member countries were used. The remuneration/ wages related independent variable/s was regressed on the dependent variable students mean country score. The results showed that there is a positive impact of teacher remuneration on students' performance.*

Keywords: Remuneration, teacher, students, achievements, PISA

1. Introduction

Does teacher's characteristics, qualities, profile and portfolio influence and affect achievements of students? This is one of the most debated questions in the circles of educators and researchers. Its gravity has further increased due to the recent trend and culture of *international or external assessment*; like PISA, PIRLS, PCAP, TIMSS[1] etc. Thus societies and social scientists both are more interested in schools than ever. As the present world is shifting rapidly towards *knowledge based economy* so for every country skilled human capital with a solid base of modern knowledge is very necessary. Today skilled human capital with a solid base of knowledge is essential to succeed in the world of technology. This *refined human capital* can only be possible by developing and sustaining education system according to social demands. For this reason, education of the young generation has become a priority in every society. Today stake holders watch keenly the performance of schools where the new generation is being educated. Here a question arises, Are these schools successfully grooming, developing, moulding, shaping and refining young generation for tomorrow? To answer this query students' and teachers' performance is monitored and evaluated by the concerned authorities and organizations.

From a practical perspective, understanding the effects of teacher profile on student performance and achievements can be helpful for administrator, educators and teachers in assuring quality. Equally it can help education researchers in exploring the teacher role in the learning process. Similarly it can help policy-makers in taking good decisions for the betterment of students as well as teachers. Consequently teacher characteristics have taken further weight and new dimensions. Substantial research has already been conducted to dig out the truth.

There are numerous social, psychological and environmental factors that affect, directly or indirectly, students' performance. These factors are so complex that it is very difficult for a researcher to assess exactly the impact of any one factor separately as all these factors are overlapped, intert-linked and multi-layered. Some factors are student related, some teacher related, some institution while some factors are policy related. Each and every factor has its own importance and one cannot totally discard or set aside any of them.

Research showed that learning is affected by multiple factors that can be personal, institutional or social; students' intelligence, skills, potential, learning styles, level of motivation and behaviour; family resources, family attitudes and support; peer group skills, attitudes and behaviour; social trends, nature and level of social interaction of student with the society, use of media; school structure, organisation, resources and climate; curriculum composition and content; and teacher profile, teacher characteristics, teacher skills, knowledge, attitudes and practices. These all

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[1] Programme for International Student Assessment (PISA)
Progress international Reading Literacy Study (PIRLS)
Pan-Canadian Assessment Program (PCAP)
Trends in International Mathematics and Sciences Study (TIMSS)

factors and many others have cumulative effects on the student achievements, performance, attitude, aptitude, behaviour, reactions and responses. Due to the complex nature of learning process, researchers have been compelled to use data sets and methodologies that provide "*focused or pointed measures*" so as to reduce the "NOISE". Here the term noise means variation in the results caused by other factors that are not understudy. In this way individual affects of any particular factor can be studied and estimated with minimum chance of error.

Teacher's importance is widely accepted because of his/her impact on student learning.[2] The research indicates that improved teacher characteristics are most likely to produce substantial gains in students' performance.[3] There are a wide range of teacher related variables; for example Gender ,Age, Race, Wage, Personality, Behaviour, Attitude, Education, Training, Experience, Job satisfaction, motivation, morale, ability and skill etc. This study examines estimates and evaluates the impact of teacher wages on students' performance using PISA[4] data. Wages is a *"key variable"*, here key variable means a variable that has an intrinsic ability to speak and explain the other variables also. Because teacher wage captures different aspects also: job satisfaction, desirability of profession, preferences, retention, continuation of teaching career and moral of a teacher etc. It is rational that teacher performance cannot be separated from students' performance; achievement during and after schoolings. Despite of this, there are many other important aspects of teacher qualities that cannot be capture by indicators merely.

Teacher is a *"Linking-Line"* between student and knowledge. In order to study this linkage, both extensive and intensive research work has been done on the impacts of teacher characteristics and students' achievement. These scientific investigations unearthed diversed findings: some studies reported a strong impact of teacher characteristics and teacher related indicators on students' total achievement;

- teacher pre- service training (Kim Creasy 2005)
- the impact of teacher qualification and student performance (Ferguson, 1991)
- Impact of teacher training on the achievement (In-service Training and Teacher Professional Development, OECD 1998, page 17)
- significant effect of teacher wages on student score (M. Sprietsma and F. Waltenberg, 2005)
- teacher specialization in particular subject a powerful predictor of student achievement (Linda Darling-Hammond 1999)
- role of teacher characteristics; education, experience and compensation (Darling-Hammond 2000; Darling-Hammond et al. 2001)
- attractive salaries of teachers and better student performance (Eric Hanushek 2000)
- individual characteristics and school autonomy (R. Robin and Sprietsma, Teachers Matter OECD, 2005)

- importance of motivation, qualification and in-service training (Key Topics in Education in Europe Volume 3, REPORT I- Eurydice, 2002. pp 25)
- teacher quality and fixed effects (Darling-Hammond and Youngs 2002)=
- Wayne and Youngs 2003; J.E Rockoff 2004)
- Teacher and peer effects (C. Jepsen 2004).

So improving teacher quality is major concern among educators, master trainers, administrators and policy makers. Results of many past studies on this subject highlight that teachers can impact student achievement, (Darling-Hammond and Youngs 2002), and that, there are identifiable characteristics of teachers which are predictive of their success in the classroom (Darling-Hammond and Youngs 2002; Wayne 2002; Wayne and Youngs 2003).

Those countries which adopt a salary structure in which "increase in salary incentives" available to teachers at different points in their careers have positive outcomes. Deferred compensation schemes help to attract, retain and motivate high-quality teachers. (Statutory salaries refer to scheduled salaries according to official pay scales.) Although attractive salaries are clearly important in improving teaching's appeal, the analysis suggests that policy needs to address more than pay.[5] Competitive salaries, good working conditions, job satisfaction and opportunities for development will increase the appeal and attraction of teaching profession for new entrants and existing staff alike.[6]

Good salaries, suitable working conditions and necessary elements of job satisfaction can be helpful in attracting competent future teachers. There is substantial evidence that teachers' relative earnings have an important influence on career decisions – for outsiders: whether to join the profession while for insiders: whether to stay. It is general rule of teacher labour market: the stronger are the employment prospects outside teaching the fewer qualified people will stay long-term in teaching. In particular, those people with skills who are likely to command the best job prospects elsewhere are less likely to remain in teaching for very long.[7]

While there exists research work that reveals "weak or no relationship" between teacher related factors and student achievement, Jencks et al. (1972) found that teacher factors have little or no effect on student achievement. Similarly Jacob Lefgren (2002) reported no impact of teacher training on student achievement. Hanushek (1986; 1997; 2002) proved that achievement is independent of school resources [ref: M. Sprietsma and F. Waltenberg 2005]. Dewey et al., (2000) argued that wages do not affect students' scores.

To explain this diversity of the findings, Jacob and Lefgren (2002), have rightly argued *"different programs in different settings have different effects, it is useful to examine some of*

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[2] C. Jepsen (2004)
[3] Laura Goe, Leslie Stickler (2008)
[4] See Annex A
[5] **Teachers Matter** ATTRACTING, DEVELOPING AND RETAINING EFFECTIVE TEACHERS   OECD 2005   page 169
[6] **Teachers Matter** ATTRACTING, DEVELOPING AND RETAINING EFFECTIVE TEACHERS   OECD 2005   page 170
[7] **Teachers Matter** ATTRACTING, DEVELOPING AND RETAINING EFFECTIVE TEACHERS   OECD 2005   page 180

the possible explanations for the discrepancies in order to understand how the results from each study might be generalized." By looking at only one aspect of the findings of previous studies one should not take "final judgement" that teacher qualities and characteristics are weightless in educational research. The students' performance should not be sole component or indicator used in the assessing teacher performance because teaching in more than test scores.[8] J.E Rockoff (2003) writes "It is clear that much research is still needed on teachers." From this it is obvious that a great deal of research is still needed to dig out the truth regarding the effectiveness of teacher and teacher characteristics.

Teachers' compensations are important to maintain the quality of teaching and to ensure and retain sufficient number of skilled teachers in school. As compensations and job conditions can affect both the demand for and supply of teachers. In addition, salaries and working conditions can be helpful in attracting, developing and retaining skilled and effective teachers. In competitive labour markets, the rate of salaries paid to different types of teachers reflects the supply and demand for those teachers. A career structure, promotions and increments, with age and experience-earnings can provide salary incentives that attract high quality teachers and increase job satisfaction and possibly performance. This research contributes to the existent pool of research by focusing the goal of examining the impact of teacher wages on student performance.

In this study student related variables were; *mean country scores in PISA 2000, 2003 and 2006*. While teacher related variable was statutory salary. Effect of Explanatory variable *Lower Secondary School Teachers' salary* was seen on the Explained variable *Students mean country score*. To get more precise information regarding the impact of teacher compensation, apart from the teachers' starting statutory salary and teachers' salary after 15 years of the experience, the salary per hour of net teaching time and teachers' statutory salary per teaching hour was also used in the calculation separately. As in all three previous PISA studies no data on teacher wages/ salaries had been collected, so it was necessary to go for other sources to find the required data. The data on teacher wages were collected from the Organization for Economic Cooperation and Development (OECD).

2. Teachers' Minimum salary and salary after 15 years of experience

The starting and mid-career (after 15 years of experience) statutory salary data of secondary school teachers was used as an explanatory variable. Study of the initial salary could help to find the answer of the question that how far good starting salaries are helpful in attracting good teachers? In the same way mid- career salary explains retention, motivation and job satisfaction.

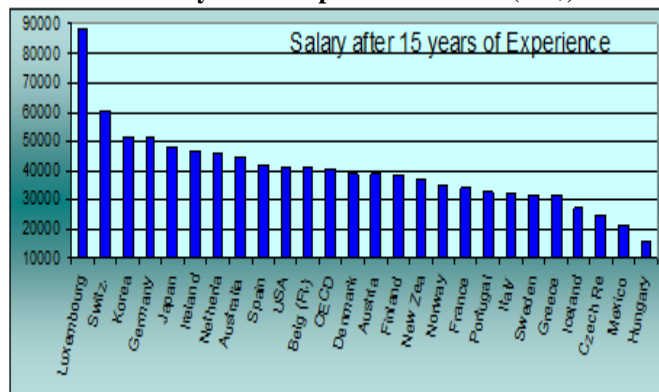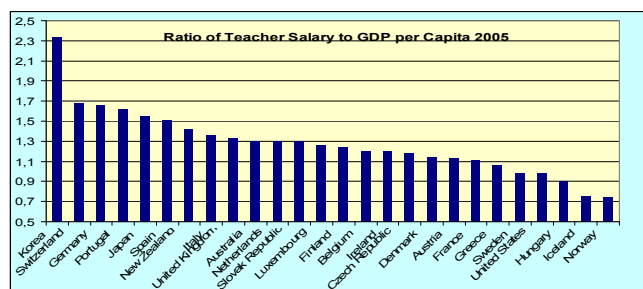**Salaries after 15 years of experience in 2005 (US$)**

Table based on the data from OECD 2005

3. Teachers' Statutory salaries relative to GDP per capita

All over the world countries invest in education relative to their total budget according to their pre-set priorities. Comparing statutory salaries to GDP per capita is thus another way of assessing the relative value of teachers' salaries; it eliminates the wealth factor of countries. This comparison with GDP per capita provides some basis for standardized comparisons among countries.
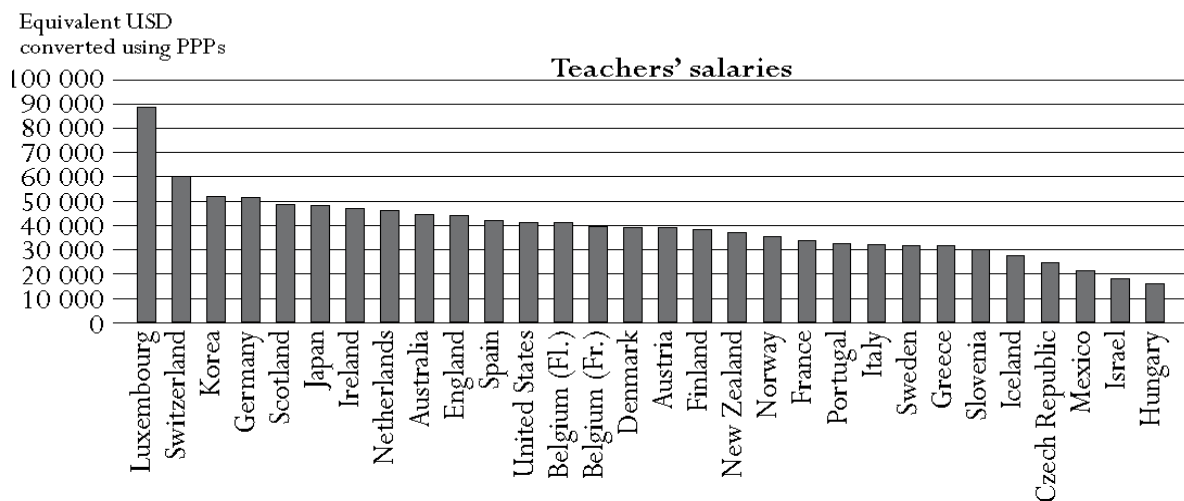

Source: Table based on the data from OECD 2005

4. Lower Secondary School Teachers Statutory salaries per hour of net teaching time

An alternative measure of salaries and the cost of teaching time is the statutory salary for a fulltime classroom teacher relative to the number of hours per year that a teacher is required to spend in teaching students.[9] Although this measure does not adjust salaries for the amount of time that teachers spend in various teaching-related activities, it can however provide a rough estimate of the cost of the actual time teachers spend in the classroom. The average statutory salary per teaching hour after 15 years of experience is USD 59 in lower secondary schools. Salaries are relatively high in Denmark, Germany, Japan, Korea and Luxembourg (USD 60 or more).[10]

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[8] Marco A. Muñoz & Florence C. Chang 2008 20:147–164 161

[9] see Education at glance, Indicator D4
[10] OECD

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Salaries of teachers with at least 15 years experience at the lower secondary level range from less than USD 16 000 in Hungary to USD 51 000 or more in Germany, Korea and Switzerland, and exceed USD 88 000 in Luxembourg.

Source OECD

Even in OECD countries where statutory salaries are the same in primary and secondary education, salaries per teaching hour are usually higher in upper secondary education than in primary education, since in most countries, secondary teachers are required to teach fewer hours than primary teachers.

5. Building of model

Students' performance in PISA was a cumulative output of multiple factors that affected their results. The model for this study is based upon teacher related single factor only, which might be determinants of students' achievements. The model estimates an education production function for scores that 15-year-old students obtained in PISA tests. Mathematically model of this study can be described as *student score in PISA is a function of teachers' wages considering all other factors constant.* We can write our model as;

$$S_y = f (Twy)$$

Where **S** refers to student achievement, **T**w refers to teacher wages and "y" refers to year 2000, 2003 and 2006. In this model "error term" is assumed as if it is zero. So our Ordinary Least Square (OLS) regression model is as follow:

$$S_{yi} = \beta_1 + \beta_2 Twyi + \varepsilon_i$$

Where, S_{yi} is Students' PISA Score in "y" year for country "i", Tw stands for teachers' wages and "ε" is error term for ith country while β_1 and β_2 are the parameters; intercept and slope respectively.

6. Results and Discussion

In fact this study was in continuation with previous studies conducted by many researchers in the world with an objective to assess and examine the impact of teacher characteristics on students' achievement. To have a much broader picture this study utilized extensive and data on students PISA scores have been used, so as to see the impact of teacher characteristics on the students' performance.

Affect of Explanatory variable "Teachers' salary" was seen on the Explained variable "Students mean country score" (as described in the research model). To get more precise information of the impact of teacher wages on student score, different datasets on teacher salary has been used; each has measured in different fashions.
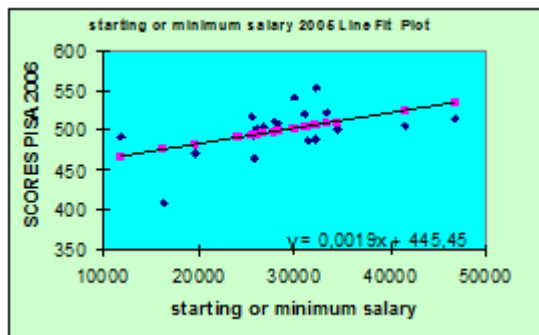
- Teachers' Starting statutory salary
- Salary after 15 years of the experience
- Teachers' Statutory salaries relative to GDP per capita
- Salary per hour of net teaching time

This multi-facet data gave an opportunity to construct different models, to estimate the impacts

6.1 Model 1: Teachers' Starting Salary

Teachers' statutory minimum or starting salary data was used in model 1. The linear regression analysis produced results as: R Squared (R^2) value of 0.25 gives an indication that 25% variation in dependent variable (students score) is explained by teacher minimum salary.

The p-value, for the Null hypothesis on minimum salary was found 0,01 at 5% level of significance. There is only 1% chance for the acceptance of the NULL Hypothesis (**H°**) which is smaller than 5% of level of significance. Therefore we have statistically significant evidence for rejecting the **H°** and accepting the Alternative Hypothesis (**H₁**). Results show a statistically significant relationship between teachers' minimum salary and the students' performance.

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In other words one can say that there is 99% chance that starting salary explains 25% variation in the students' scores in PISA. In Switzerland, Germany, Denmark, Netherlands, Finland, United States, Norway, Australia, Korea and United Kingdom teachers' starting salaries are higher, it ranges between 30000 US$ to 47000 US$, which is higher as compared to other OECD member countries. Similarly in comparison with rest of the OECD member countries, in the above mentioned countries students achieved higher scores in PISA 2006, it ranges from 502 to 553. On the contrary in Mexico and Hungary teachers' starting salaries are lowest among OECD member countries that ranges from 12000 US$ to 16500 US$ only. Likewise in Mexico and Hungary students' mean scores in PISA 2006 were also lower as compared to many other member countries.

6.2 Model 2: Teachers' salary after 15 years of experience

The explanatory variable of "Salary after 15 years of experience" produced following results in the model. R Squared (R^2) value of 0,29 gives an indication that 29% of variation in the students scores is explained by teacher salary after 15 years of experience.

The p-value, for the Null hypothesis on minimum salary was found 0,008 at 5% of level of significance. The small p-value shows that there is less than 1% acceptance chance of the NULL Hypothesis. Therefore we have statistically significant evidence of rejecting the **H°** and accepting the Alternative Hypothesis (**H$_1$**). We can deduce that there is a statistically significant relationship between teachers' salary after 15 years of experience and the students' achievements in PISA.
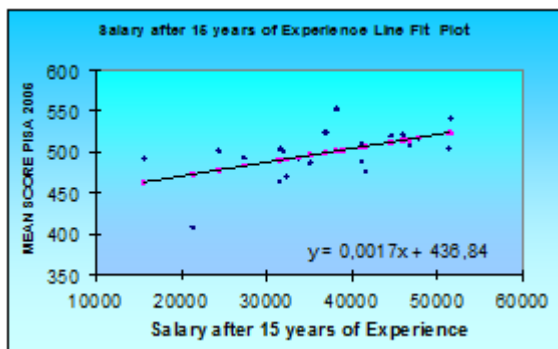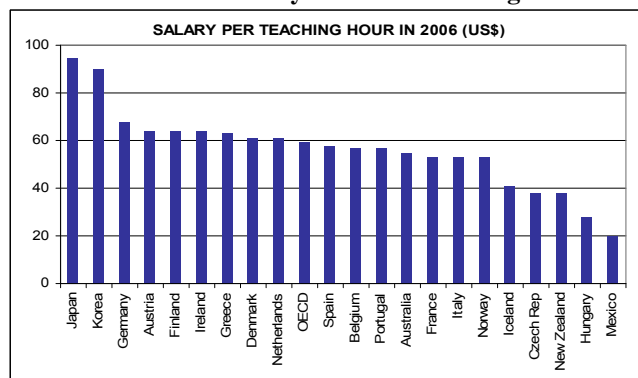

Table () gives the comparative data of teachers salaries after 15 years of Experience in 2005 and table () presents PISA 2006. Switzerland, Korea, Germany, Japan, Ireland, Netherlands, Australia, Spain, Belgium Denmark, Austria, Finland, New Zealand and Norway give comparatively

higher salaries, rages from 35000 US$ to 60000 US$, all these countries have PISA 2006 score above 500 except that of Norway and Spain which has 487 and 476 respectively.
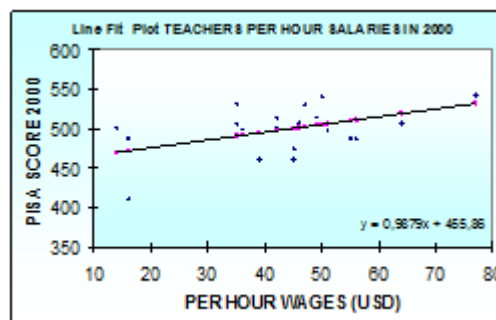
6.3 Model 3: Teachers Salaries per Hour of net teaching time

Per hour wages of net teaching time is another way to estimate the impact of teacher wages on the performance of the students. It is more effective way to have an estimate of teachers' compensation with respect to work load or net teaching time. Because per month or annual salary does not speak or explain net time spent by teacher in the class. As in different countries teaching time is homogeneously distributed; in USA and Mexico net teaching hour for lower secondary school teacher are 1047 hours and 1080 hours, while in Finland, Japan and Korea it is less than 600 hours per year. In other words in some countries teachers are more loaded as compared to their profession comrade, since comparative wages in per hour is the best way to have appropriate information of teachers' wages.

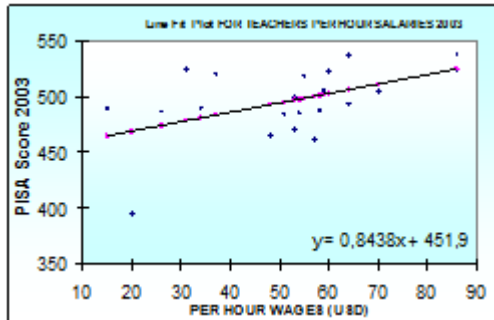**Teacher Per-hour salary to the net teaching time 2006**

In order to have more detailed picture of the impact of "teacher compensation on students score" researcher analysed in three segments with three different data sets. (Thanks to detailed PISA surveys which enabled to have such analyses) For this purpose Per Hour wages in 2000 and PISA scores 2000, per hour wages in 2003 and Students' PISA Scores in 2003 and in the same way Per hour wages in 2005 and Students' PISA Scores in 2006 were used in the model. The three results were as;

Per Hour wages in 2000 and Students' PISA scores in 2000 gave the R Squared (R^2) value of 0,28 gives an indication that 28% of variation in the students' scores is explained by teacher per hour salary in 2000. The p-value at 5% level of significance, for the Null hypothesis on per hour wages was found 0,013. This small p-value shows that there is only

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1,3% chance for the acceptance of the NULL Hypothesis. Therefore we have statistically significant evidence of rejecting the $H°$ and accepting the Alternative Hypothesis (H_1). We can assume that there is a statistically significant relationship between teachers' per hour salary and the students' achievements in PISA. In the other words we can say that those countries where salaries per hour of net teaching time are higher there is possibility of better students' performance at school.
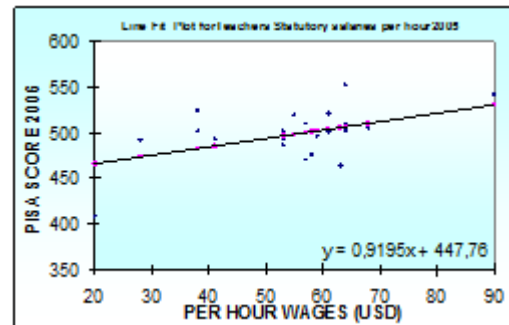

Having used 2003 Per Hour of net teaching time data and Students PISA scores in 2003 for OECD member countries, we have the results as; the R Squared (R^2) value of 0,25 gives an indication that 25% of variation in the students' scores is explained by teacher per hour salary in 2003. The p-value at 5% level of significance, for the Null hypothesis on per hour wages was found 0,012. This small p-value shows that there is only 1.2% chance for the acceptance of the NULL Hypothesis.

Therefore we have statistically significant evidence of rejecting the $H°$ and accepting the Alternative Hypothesis (H_1). We can believe that there is a statistically significant relationship between teachers' per hour salary and the students' achievements in PISA. In the other words we can say that those countries where salaries per hour of net teaching time are higher there is possibility of better students' performance at school.

By using 2005 Teachers Salaries per Hour of net teaching time data and Students PISA scores in 2006 for OECD member countries we have the more or less similar results as we had for 2000 and 2003. The R Squared (R^2) value of 0,28 gives an indication that 28% of variation in the students'
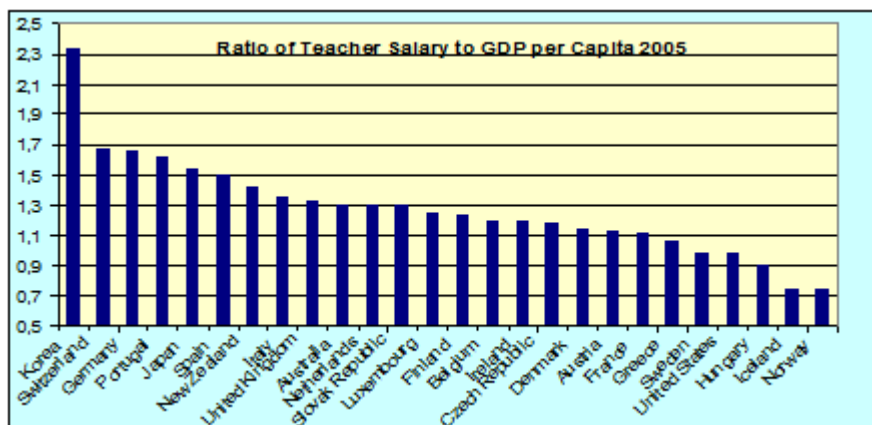
scores is explained by teacher per hour salary in 2003. The p-value at 5% level of significance, for the Null hypothesis on per hour wages was found 0,009. This small p-value shows that there is less than 1% chance for the acceptance of the NULL Hypothesis. Therefore we have statistically significant evidence of rejecting the NULL Hypothesis $H°$ and accepting the Alternative Hypothesis (H_1).

We can believe that there is a statistically significant relationship between teachers' per hour salary in 2005 and the students' achievements in PISA 2006. In the other words we can say that those countries where salaries per hour of net teaching time are higher, there is higher probability of better students' performance at school. In Japan, Korea, Switzerland, Germany, Austria, Finland, Ireland and Netherlands are the countries where teachers receive higher per hour wages and likewise these countries also scored higher in all three PISA tests. On the contrary in Poland, Mexico and Hungary TEACHERS' SALARY STATUTORY PER TEACHING HOUR IN US$ is the lowest in OECD member countries as well as in these countries students' performance in PISA TESTS also remained lower.

6.4 Model 4: Teachers' statutory salaries relative to GDP per capita

Though considering teachers starting, mid career (after fifteen years) and per teaching hour salaries gives some practical information but comparing statutory salaries to GDP per capita gives real picture of the teachers' wages in that countries because between countries variation is very large on per capita income scale.

Taking this between countries variation in to account the simple comparison of salaries become meaningless and illogical. So with an intention to have more precise and real

picture of the impact of teachers' compensations ratio of teachers' salary to GDP per capita is the best indicator of wages. Even if it does not give comparative information

regarding other professions but it tells about the relative value of teacher's compensation in that country. [11]

To facilitate more comprehensive information researcher used the ratio of teacher salary to per capita GDP and country scores in PISA 2006 in the model. The results of this analysis were; The ratio of teacher salary to per capita GDP in 2006 and mean PISA scores in 2006 gave the R Squared (R^2) value of 0,15 gives an indication that 15% of variation in the students' scores is explained by teacher wages in 2006. For the Null hypothesis on teacher wages the p-value at 5% level of significance was found 0,048 This small p-value shows that there are only 4,8% chances for the acceptance of the NULL Hypothesis. As this value is less than 5% of we can confidently reject the $H°$ and accept the Alternative Hypothesis (H_1) that teacher wages have significance in the student achievement.

Modern research has successfully studied the impact of various *teacher related factors* on students' learning and achievements. This research examined, evaluated and assessed the impact of teacher wages on the students' achievements utilizing extensive PISA surveys data and teacher salary data from OECD. Through this investigative study an attempt had been made to answer the question; *does teachers' salary matter*?

The available evidence to address this question was in some places somewhat limited. It is true that the results of studies on teachers are difficult to interpret due to the difficulty in controlling confounding factors and complex nature of the teaching and learning process. Nevertheless the conclusions of this study are as follows. In fact there cannot be a single explanation for students' achievements, as there is a web of interrelated factors which have cumulative effects on students' performance. Such may be related to the teachers, students, peers, school, society and culture. Furthermore student achievement score is not the only criteria to evaluate a teacher. Teachers' qualities and characteristics have weight and credence in the transmittance and dissemination of knowledge because students' learning and achievements is heavily teacher dependent.

7. Conclusions

This study found that teacher's salary/ remuneration has a positive effect on students' performance but the size of impact is not very large. In fact good salaries are helpful in attracting competent person towards the teaching profession and increase in the remunerations with age and experience is very helpful in retaining quality teaching staff. But in the

light of results we can say that there are many other tangible and intangible factors that might have an effect on the students' performance. Likewise teachers' motivation, job satisfaction, desirability of profession, job preferences, and continuation of teaching career might be influenced by other covert and overt dynamics. These results also attested that "money is not everything" and it is not only the *money* that makes mare go in the process of teaching and learning. Although the findings of this study highlight the significance and importance of teacher wages but it has also pointed out that further work is still required to find out the detailed impact of teacher's characteristics on students' performance by using micro level data.

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