

VARIABLES INSEPARABLE IN HIGHER EDUCATION: TEACHING AND RESEARCH

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Abstract

“Teaching vs. research” as a global false dichotomy will be the focus of this study. A modest but very universal evidence is revealing itself in world university rankings in every year. It is not deniable that university rankings are not well taken by intellectuals. They contempt the ranking criteria for being inappropriate and irrelevant for the social, moral, and academic values prevalent at universities. They severely criticize the exploitation of competitive, market driven potentials of universities. So many eminent scholars display their sense of humour by labelling these ranking ritual as “University Olympics” or as “horse race”. It is obvious that such a contest propagates the profitable positions of high rank universities. Fortunately, egalitarian values still reign supreme in higher education. However, equality does not necessitate justice. Justice requires discrimination when needed. It is impossible to ignore the existence of collegial hierarchy. The diversity is a reality among the universities in every country. Neither the students nor the researchers are all alike. Their uneven aptitudes and proficiencies result with ordered categories. These and many other facts compel the ranking culture to endure despite the opposing criticisms mentioned before. As a matter of fact, it is impossible to omit the inter-institutional differences. Instead of resisting the comparative information one can exploit it for the common concern or at least to reinforce the curiosity. Times Higher Education (THE) World University Ranking summarizes annual performances of prominent universities all around the world since 2012. Ranking criteria involves Teaching, Research, Citations International Outlook, and Industrial Income with differential weights. The purpose of this study is to display the correlations between the variables used as criteria to rank the world universities for 2018. It has been hypothesized that Pearson product moment correlations would have been significantly high and positive. Moreover, the correlation between Teaching and Research will be the highest one among all the other paired criteria in every different context.

Keywords: Higher education, teaching and research, university ranking.

1 INTRODUCTION

Fruits and rabbits were sufficient supplies for survival in the pre agricultural era. The limiting factor to produce enough food was the amount of fertile land in agrarian economies. Enormous majority of the population worked on farms but hunger was the most serious challenge. In the industrial economies, approximately ten percent of the population is employed in agriculture and they can produce lakes of milk and mountains of potatoes. It is the capital, not the land, happens to be the regulating factor as industry grows. It has been estimated that knowledge production and distribution account for almost one third of GNP in the leading countries [1]. Land, labour and capital are the conventional factors in the traditional economies. However this trio cannot account for the total growth.

1.1 Knowledge vs. Land, Labour, and Capital

Land, labour and capital can hardly replace each other. All of them loose their capability when split, and fall down when puffed up. Knowledge dwells in the human mind. The more offered it is, the more it can be utilized. Knowledge transforms low value inputs into valuable outputs. Information can enthusiastically be shared in education with a minor cost without major lost. Knowledge can be multiplied in reproduction and can be communicated from one source to many targets. All of the other conventional factors of production can be strengthened by knowledge to a great extent. Construction technology multiplies the amount of available land. Information and communication technology speeds up the accumulation and circulation of capital in the market. Machinery is the information replacement of labour. A robot is an assembly of information in disguise. Knowledge substitutes labour by extending and simulating its competencies.

1.1.1 Side-effects of Knowledge

The tribute to technological flood should not go beyond the healthy regard for applied knowledge. However admirable the profits of information are its injurious side-effects should also be thought. Climate change, nuclear bombs, weapons, air pollution, putrid soil, muddy water, food with excess hormones are also the destructions of information explosion. The battle against nature may end up with a grave defeat. The consolation is that it's still the wisdom distilled from knowledge could rebuild the fragments left from the abuse of information. The way it nourishes the land, the way it enriches the capital, the way it makes the labour expert it's still the information would hopefully harness itself. It could still be the scientific knowledge armoured with ethical and moral values to heal the injuries due to information.

1.1.2 Universities Nurture Science and Technology

Knowledge is mostly being manufactured at the universities. The university is the place for inquiry, invention and innovation. Teaching and Research are two important functions of any university. Above all intellectual value of higher education entails these paired functions. Curiosity is the auto-motivation of academicians. Research corresponds to the production and teaching matches the dissemination of information in a university as an agency of knowledge economy. Just another importance of teaching and research partnership is essential for universities to attract brighter students thru these assets. Teaching and research allow universities to be to be known globally in education [2]. The capability of a university for inquiry, invention, and innovation is determined by the brain power engaged on the campus. The strength and the reputation of a university is driven by bright students and academicians perseverant in learning and teaching [3]. There are so many false dichotomies (e.g. nature vs. nurture, process vs. product, curiosity vs. utility, theory vs. practice, unity vs. diversity etc.) in higher education as there are in other domains. When forced to make a choice between these bipolar options one most probably may disconcert the option in favour and tend to make the other unacceptable. Teaching and research are the reasons of having universities and being an academician in a university. No university can excel by expelling the teaching function. No matter how a professor pretend preferring research option over teaching they yearn for shining in the auditorium.

1.2 Comparative Evaluation of Universities

The main purpose this paper is to display an empirical evidence for the inseparable nature of research and teaching in higher education. In order to fulfil this purpose Times Higher Education World University Rankings (THE-WUR) 2018. There are other and perhaps better rankings: Academic Ranking of World Universities (ARWU), Leiden University, Quacquarelli Symonds (QS), Scimago, U-Multirank are the ones known by the author. New rankings appear quite often, and experts are improving the present ones. International Ranking Expert Group (IREG) evaluates and certifies these ranking systems [4]. Shortly there are rankings for the university ranking systems. Marginson lists eight criteria for evaluating the university rankings: These are materiality, objectivity, externality, comprehensiveness, particularity, ordinal proportionality, performance alignment and transparency [5]. The reasons for choosing THE-WUR in this study were so practical: timeliness, convenience and availability. Shanghai Academic Ranking of World Universities (ARWU) has been published in 2003. European Universities' Association responded to Global University Rankings. First of the eight main conclusions in this report ends as follows:

Since the emergence of global rankings, universities have been unable to avoid national and International comparisons, and this has caused changes in the way universities function [6].

1.2.1 Summary of Criticism against Rankings

Almost all of the intellectuals are against the "horse race" among the universities. They scorn the ranking criteria for being narrow and irrelevant with respect to the social and intellectual values of academia. "University Olympics" perpetuates the advantageous positions of leading universities. Universities are not as competitive as political parties to earn prestige at the expense of others. Egalitarian values still prevail in higher education. This is not to deny the existence of stratification of higher institutions. There are inter-institutional differences among the universities in every country. There are also differences among students and researchers. These unequal competencies ends up with hierarchical structure and challenge whether we like it or not. These are the main reasons why

the ranking culture sustains. It is impossible to avoid it but it is possible and desirable to obtain comparative information for the common concern may be just for curiosity.

1.2.2 False Dichotomies and Conjugate Qualities

The false dichotomy is not a dilemma that implies two different options. Conjugate qualities or entities are two polarities that may exist together in some proportions as to complement each other. Opposing them with each other and compelling a forced choice between the two is a case of false dichotomy. Research is the primary criterion of performance in academia. All academicians try to improve their ranks on the basis of research performance. Research gains the highest priority also in ranking the universities. Teaching is of secondary importance in collegial stance. However, universities are responsible to enable their students to reconstruct available knowledge; more than that to enable them to produce novel information. This is the binding force between research and teaching.

2 METHODOLOGY

In this study there is no special instrument used for data collection. Data published for the year 2018 is directly downloaded from the web-site of Times Education World University Ranking. THE collects evidence from the publications within the period of 2011-2017, and the citations they received from the Scopus database. These include books, book chapters, and conference proceedings. The units of analysis (i.e. subjects) are the world universities. They are placed along the rows. The particular values of criteria are placed along the columns across the universities. Essential descriptive statistics have been given to quantify the central tendency and the dispersion characteristics of observations. The readers can get access to the raw data analysed in this paper [7].

Correlational inferences are made between the variables. Correlation is a very useful statistical invention to show how two different variables go together. Pearson product moment correlation quantifies the magnitude as well as the direction of relationship between two interval level variables. Since there are some falsifying aspects of this handy tool it must be handled with care [8].

3 RESULTS

Table 1 displays the frequencies of (FRQ) universities with respect to their countries of origin.

Table 1. Frequencies of Universities across Countries.

Country	FRQ	Country	FRQ	Country	FRQ	Country	FRQ	Country	FRQ
United States	157	Spain	29	Egypt	9	Colombia	5	Algeria	1
United Kingdom	93	Russian Federation	27	Finland	9	Norway	5	Argentina	1
Japan	89	South Korea	27	Ireland	9	Romania	5	Bangladesh	1
China	63	Canada	26	Malaysia	9	Saudi Arabia	5	Belarus	1
Germany	44	Turkey	22	Portugal	9	Ukraine	5	Bulgaria	1
India	42	Iran	18	Austria	8	Indonesia	4	Costa Rica	1
Italy	39	Chile	13	Belgium	8	United Arab Emirates	4	Georgia	1
Australia	35	Czech Republic	13	New Zealand	8	Jordan	3	Ghana	1
Brazil	32	Netherlands	13	South Africa	8	Morocco	3	Kenya	1
France	31	Poland	12	Denmark	7	Slovakia	3	Kuwait	1
Taiwan	31	Mexico	11	Greece	7	Venezuela	3	Lebanon	1
		Sweden	11	Hungary	7	Croatia	2	Luxembourg	1
		Pakistan	10	Hong Kong	6	Cyprus	2	Macao	1
		Switzerland	10	Israel	6	Estonia	2	Nigeria	1
		Thailand	10			Iceland	2	Northern Cyprus	1
						Latvia	2	Oman	1
						Lithuania	2	Peru	1
						Singapore	2	Philippines	1
						Slovenia	2	Qatar	1
						Tunisia	2	Sri Lanka	1
								Uganda	1

Table 1 reveals the global inequality in higher education. There are 157 universities only from the USA. On the other hand there are more than 50 countries that cannot achieve this number when they come together. United Nations and World Bank reports data from 120 countries annually. Only 81 of all those countries appear on THE-2018 ranking. This simple figure is enough to delineate the

inequality in education on the globe. The inequality in higher education is not the beginning but an intermediate point of the eternal inequality on the earth.

3.1 Correlational Findings

Statistical correlation shows how well two different dimensions with respect to each other. Readers will remember that square of correlation coefficient (coefficient of determination) can be used as the amount of overlap between the variables correlated.

3.1.1 Correlations between Ranking Criteria within Universities

Table 2 displays the correlations between the Times Higher Education (THE) criteria utilized in ranking 1102 world universities in the year 2018.

Table 2. *Correlations between THE Ranking Criteria (2018).*

Criterion1	Criterion 2	Pearson Correlation
Teaching	Research	0,914
Research	Citation	0,653
Citation	Outlook	0,606
Teaching	Citation	0,590
Research	Outlook	0,485
Research	Income	0,474
Income	Research	0,474
Teaching	Income	0,395
Income	Teaching	0,395
Teaching	Outlook	0,353
Citation	Income	0,219
Income	Outlook	0,132

(N=1102; $p < 0.0001$)

3.1.2 Correlations between Ranking Criteria across the Countries

There are different number of universities from different countries as can be seen in Table 1. The relationship between the criteria is likely to delineate another pattern. To see if this is true country means of THE ranking criteria (average of all university scores in any criterion for a given country) were calculated and partial correlations are given on Table 3. The reason for using partial correlations is to control the concomitant effect of differential number of universities from different countries.

Table 3. *Partial Correlations between Ranking Criteria across Countries.
(Controlled for different number of universities in the countries)*

Criterion 1*	Criterion 2*	Partial Correlation
Teaching	Research	0,891
Research	Citation	0,756
Citation	Outlook	0,721
Research	Income	0,634
Research	Outlook	0,592
Teaching	Citation	0,556
Teaching	Income	0,531
Teaching	Outlook	0,457
Citation	Income	0,441
Income	Outlook	0,399

(N=81; $p < 0,001$)

*Country means of THE ranking criteria

Apparently there is no surprisingly different pattern of correlations between the criteria used in THE world university rankings.

3.1.3 Correlations between Ranking Criteria within Countries

A similar question to the one posed in 3.1.2 can be asked for particular countries. This question has been answered for three selected countries: USA, Turkey and Spain. USA is the country with the highest number of universities in the ranking list. Turkey is the author's homeland, Spain is the host country where this paper is expected to be presented.

Table 4. *Correlations between Ranking Criteria within Countries.*

Criterion 1	Criterion 1	USA	Significance	TURKEY	Significance	SPAIN	Significance
Teaching	Research	0,939	0,000	0,599	0,003	0,898	0,000
Teaching	Citation	0,662	0,000	0,464	0,029	0,679	0,000
Teaching	Income	0,470	0,000	0,357	0,103	0,271	0,155
Teaching	Outlook	0,634	0,000	0,471	0,027	0,594	0,001
Research	Citation	0,658	0,000	0,571	0,006	0,775	0,000
Research	Income	0,520	0,000	0,681	0,000	0,315	0,096
Research	Outlook	0,677	0,000	0,677	0,001	0,611	0,000
Citation	Income	0,367	0,000	0,317	0,150	0,336	0,075
Citation	Outlook	0,529	0,000	0,912	0,000	0,679	0,000
Income	Citation	0,367	0,000	0,313	0,156	0,467	0,011
		N=157		N=22		N=29	

Table 4 does not display entirely different configuration coefficients for these three countries. But there are some interesting differences between the countries. The highest correlation is between Teaching and Research in the USA and in Spain. However in Turkey the highest correlation appears between Citation and Outlook. This is not so astonishing if you know that there are some attractive incentives promised to the young academicians for their cited articles.

3.1.4 How Sustainable is the Correlation between Teaching and Research over Time?

In the section 3.1.3 it was shown that the correlation between Teaching and Research was not the highest among all the other pairs of criteria in Turkey. However in the previous studies conducted with the data of THE World University Rankings (2016 and 2017) the correlation between Teaching and Research was the highest for the Turkish universities as well (Baykal; 2016). Table 5 displays the variation of correlation between Teaching and Research over the years; 2016, 2017 and 2018 for N=752 universities who appeared on the ranking lists in all of those successive years.

Table 5. *Correlations between Teaching and Research (2016, 2017, 2018).*

Criterion-1	Criterion-2	Correlation*
Teaching-2017	Teaching-2018	0,989
Teaching-2017	Research-2018	0,985
Teaching-2016	Teaching-2017	0,979
Research-2016	Research-2017	0,976
Teaching-2016	Teaching-2018	0,971
Research-2016	Research-2018	0,968
Teaching-2017	Research-2018	0,916
Teaching-2016	Research-2016	0,912
Teaching-2017	Teaching-2018	0,912
Teaching-2017	Research-2017	0,909
Teaching-2017	Research-2018	0,907
Research-2016	Teaching-2017	0,906
Research-2016	Teaching-2018	0,905
Teaching-2016	Research-2017	0,899
Teaching-2016	Research-2018	0,891
N=752; p<0.001		*In descending order

3.1.5 Correlations between Teaching and Research within 11 Different Strata

Correlation is subject to abrupt fluctuations due to extreme scores, and it may yield inconsistent values due to hidden sub-samples within the whole sample. One can extract myriad of sub-samples within the 1102 universities. In order to see if there are “alien” sub-samples 1102 universities are sub-divided into almost equal 11 strata along their ordinal positions. The arithmetic means of ranking criteria have been compared by using one way ANOVA technique separately. The overall results are in the Table 6.

Table 6. Comparisons between the Means of Sub-Samples.

Scores Compared	df	F	Significance*
Teaching	10	320,3	0,000
Research	10	545,5	0,000
Citation	10	672,8	0,000
Income	10	22,3	0,000
Outlook	10	85,9	0,000
N=1102	*One way ANOVA		

Post-hoc analysis for Teaching yielded 7 homogeneous sub-groups. Table 7 displays these homogeneous sub-groups and their mean scores.

Table 7. Means of 11 Strata of THE 2018 Ranking: Teaching.

Stratum	N	Subset for alpha = 0.001*						
		1	2	3	4	5	6	7
11	103	18,4						
9	100	20,7	20,7					
10	100	20,7	20,7					
8	100		23,2	23,2				
7	100		23,9	23,9				
6	100			24,9				
5	100			26,6	26,6			
4	100				29,3			
3	100					33,8		
2	100						41,3	
1	99							61,9
*Post hoc analysis: Student-Newman-Keuls								

Post-hoc analysis for Research yielded 7 homogeneous sub-groups. Table 8 displays these homogeneous sub-groups and their mean scores.

Table 8. Means of 11 Strata of THE 2018 Ranking: Research.

Stratum	N	Subset for alpha = 0.001*						
		1	2	3	4	5	6	7
11	103	8,6						
9	100	11,2						
10	100	12,0						
8	100		15,6					
7	100		16,3					
6	100		19,5	19,5				
5	100			21,6				
4	100				25,5			
3	100					33,0		
2	100						42,7	
1	99							69,8
*Post hoc analysis: Student-Newman-Keuls								

As can be seen from Table 7 and Table 8 the bottom strata of 1102 universities are quite apart from the higher strata which are also not all alike with respect to mean scores of Teaching and Research. Table 9 shows how the correlations between Teaching-Research at different hierarchical levels of THE 2018 World University Ranking.

Table 9. *Correlations between Teaching-Research at Different Levels of THE 2018 Ranking*

THE 2018	Correlation	Significance	N
Stratum-01	0,901	0,000	99
Stratum-02	0,513	0,000	100
Stratum-03	0,610	0,000	100
Stratum-04	0,498	0,000	100
Stratum-05	0,502	0,000	100
Stratum-06	0,515	0,000	100
Stratum-07	0,444	0,000	100
Stratum-08	0,355	0,000	100
Stratum-09	-0,031	0,762	100
Stratum-10	0,103	0,306	100
Stratum-11	-0,031	0,757	103

It is important to flashback to Table 2 where the correlation between Teaching and Research was $r=0,914$ for $N=1102$ universities put together. Here it is clear that the correlation between Teaching and Research is very high and positive for the top 99 universities. Then it drops rapidly for the next 100 countries. Figure 1 illustrates how the correlation fluctuates at different layers of THE 2018 World University Ranking of 1102 participant universities.

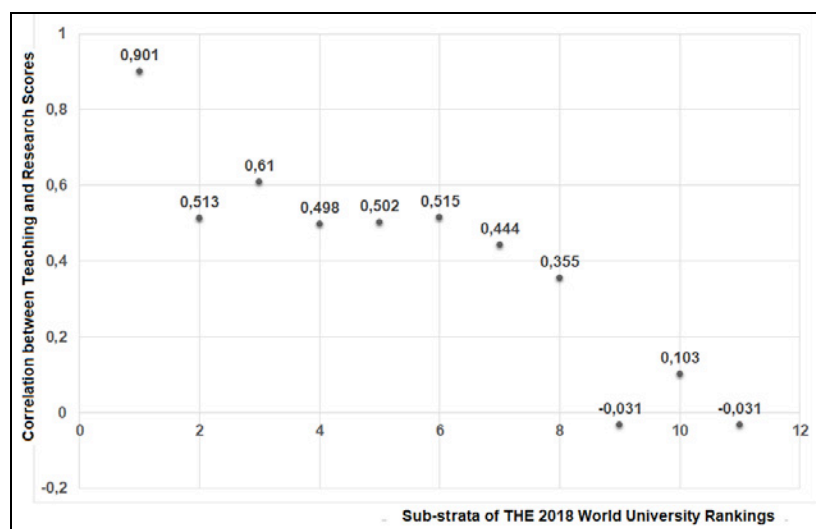


Figure 1. *Variation of the Correlation between Teaching and Research at Different Strata*

It is important to note that Teaching and Research are geared to each other at higher levels more strongly than that of at the ones at the lower strata.

4 CONCLUSIONS

This study is a challenge against the global false dichotomization between Teaching and Research in some circles. There is no hidden agenda, no pedantic advice behind the exploration of cross-country rankings. What is beyond the scope of this study is to extract information to enlighten the university administrators. There is no intention to highlight the features of high rank universities to suggest better practices for the others. International students will find neither overt nor covert cues about the merits of top universities.

In this study it had been hypothesized that the Pearson product moment correlations between the criteria used in THE 2018 World University Ranking would have been significantly high and positive. Moreover the correlation between Teaching and Research might be the highest one among all the other paired criteria in every different context.

These hypotheses have been confirmed by the variety of results displayed in Section 3 on this paper. There are however some exceptions on some instances. They have been indicated on occasions that they appeared all along the study.

This is not a sufficient but necessary evidence to assert that Teaching and Research do not alternate but reinforce each other in higher education. Inseparability of teaching and research cannot only be attributed to quantitative auto-correlation which can be attenuated by using partial-correlations. Therefore this simple index delineates the indivisible, inseparable qualitative bond between these conjugate qualities.

Teaching and Research have their own exclusive qualitative features, utilities, limitations in higher education. Quantitatively the comparative and correlational findings posed clearly that Teaching and Research are inseparable dimensions. They do not alternate but complement each other. They do not overlap each other, they are not redundant, but they do not oppose each other either.

The top 1102 universities is not a representative sample of all universities and colleges of the world. These institutions set the universal standards and become the role-model to all the others.

In the second section (Methodology) of this paper combined groups effect in correlational analysis took part as a warning to the readers. In section 3.1.5 there happened to be a real case within the span of this study. In order to elaborate the interpretations a few hypothetical examples will be given about the combined group effect.

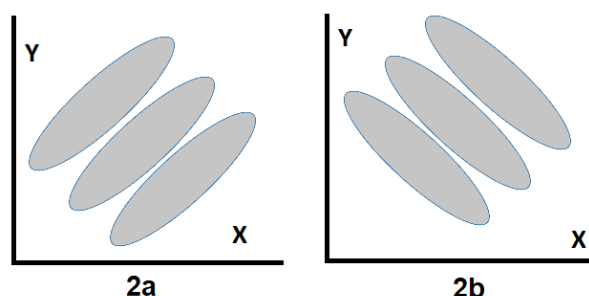


Figure 2. Sub-groups with significant correlations, non-significant resultant correlation

Figure 2 illustrates how sub-groups with positive (2a) or negative (2b) significantly high correlations may yield a non-significant correlation for the total sample.

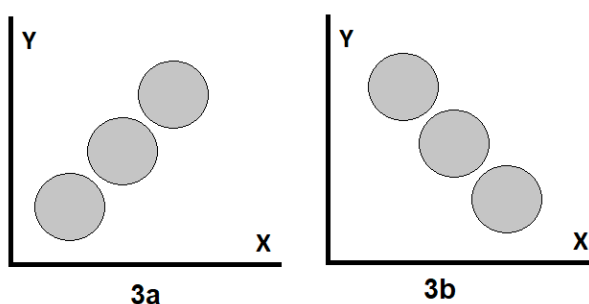


Figure 3. Sub-groups with significant correlations, non-significant resultant correlation

Figure 3 illustrates how sub-groups with non-significant correlations may yield a significantly high positive (3a) or significantly negative correlation (3b) for the total sample.

So many other examples can be generated to delineate how different sub-groups with correlations different in magnitude and in identical or opposite directions might yield resultant correlations between any two variables which are entirely different in magnitude and direction [9].

The findings of this paper will always be open to public criticism.

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