

CHARACTERIZATION OF IBERO-AMERICAN UNIVERSITIES IN TOP500 OF ACADEMIC RANKING OF WORLD UNIVERSITIES 2019- 2020

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Abstract

Criteria and indicators to classify universities in Academic Ranking of World Universities (ARWU) annually produces a list of the top 1,000 University Education Institutions of the world according to four criteria and six indicators: Alumni, Award, HiCi, N&S, PUB and PCP, evaluating university performance in terms of quality of de academic and research activities. This paper aims to perform a comparative study, through a descriptive analysis, of Ibero-American universities in Top500 of ARWU 2019 and ARWU 2020, to relate and compare their indicators, and to determine the gap with better placed universities and, also, highlights which have best indicator results according to rank criteria. 25 Ibero-American universities highlight as results in Top500: thirteen are Spanish, six Brazilian, three Portuguese, one Mexican, one Argentine and one Chilean, which do not change in WRs 101-150, 151-200 and 201-300. In Quality of Faculty criterion, with a weight of 40%, UBA (AR) is positioned in WR 201-300, in both years, with highest values of SAW, and UB (ES) positioned in WR 151-200, in both years, with highest values of SHiCi. In Research Output criterion, also with a weight of 40%, UPF (ES) positioned in WR 301-400, with highest values of SN&S in both years, and USP (BR) is the best Ibero-American university positioned in WR 101-150 and presents the highest PUB value.

Keywords: University, Academic Ranking of World Universities, Ibero-American universities, indicators, ARWU2019, ARWU2020, Shanghai Ranking

1. INTRODUCTION

Academic Ranking of World Universities (ARWU), also known as Shanghai Ranking, created by Center for World-Class Universities (CWCU) of Graduate School of Education of Shanghai Jiao Tong University (SJTU), China [1] [2], considers every university that has any Nobel Laureates (Alumni and Award), Fields Medalists (Alumni and Award), Highly Cited Researchers (HiCi), papers published in Nature or Science (N&S), or papers indexed in Science Citation Index-Expanded and Social Science Citation Index (PUB) [3] [4], which is classified in a World Rank (WR), result of a Total Score value (TS) relating four criteria: Quality of Education, Quality of Faculty, Research Output and Per Capita Performance [3] [4].

ARWU is a ranking oriented to measure the academic performance in research, and most especially, for cutting-edge research [5]. The difference between it and other university rankings, such as SIR IBER [6] [7], is fact that it has held steady, since 2003, its criteria, indicators (Alumni, Award, HiCi, N&S, PUB y PCP), and the weightings of the same [3] [4]. The number of universities classified has varied, from over 1,000 in 2003, more than 1,200 in 2014, more than 1,300 in 2017, more than 1,500 in 2018, more than 1,800 in 2019 to over 2,000 in 2020 [4]. Also the quantity of best published universities has changed: In 2003, were 500 to 1.000 in 2020. Another thing that had

changed is the information to three indicators: To HiCi, the information source was: isihighlycited.com (2003 - 2011) , highlycited.com/ (2012 - 2017) and clarivate.com/hcr/ (2018 - 2020), while for N&S and PUB indicators the information source had changed in this way: webofknowledge.com/ (2003 - 2016) and webofscience.com/ (2017- 2020) [2] [3] [4].

This paper aims to perform a comparative study, through a descriptive analysis, of Ibero-American universities in Top500 of Academic Ranking of World Universities (ARWU) 2019 [2] and 2020 [8], to relate and compare their indicators, and to determine the gap with better placed universities and, also, highlights which have best indicator results according to ARWU criteria. This report first presents information about ranking criteria and indicators, then, results of criteria and indicators of the best Ibero-American universities are showed, along with their gaps with better placed universities, referred to: 1) Quality of Education (Alumni of an institution winning Nobel Prizes and fields Medals (Alumni), 2) Quality of Faculty (Staff of an institution winning Nobel Prizes and fields Medals (Award) and Highly Cited Researchers (HiCi), 3) Research Output: Papers published in Nature and Science (N&S), and Papers indexed in Science Citation Index-Expanded and Social Science Citation Index (PUB) and, finally, 4) Per capita Performance: Per capita academic performance of an institution (PCP).

NOMENCLATURE

ARWU	Academic Ranking of World Universities
SJTU	Shanghai Jiao Tong University
SA	Score on Alumni
SAw	Score on Award
SHiCi	Score on HiCi
SN&S	Score on N&S
SPUB	Score on PUB
SPCP	Score on PCP
TS	Total Score
WR	World Rank

2. ACADEMIC RANKING OF WORLD UNIVERSITIES (ARWU) 2019 AND 2020 EDITIONS

Since 2009, Academic Ranking of World Universities (ARWU) and Global Ranking of Academic Subjects (GRAS) are published every year by ShanghaiRanking Consultancy [1] to evaluate the global positioning of the best University Education Institutions from China, in their beginnings, while at present, classify universities of the world which meet the requirements of the indicators [2] [5] [9]. This university classification allows performing an organization of universities to measure the university performance according to indicators, which reflect the quality of scientific production and dissemination of research and innovation papers [10] [11] [12] [13] [14].

Universities are classified in ARWU through indicator that respond to four criteria: Quality of Education, Quality of Faculty, Research Output and Per Capita Performance, which have a weight of 10%, 40%, 40% and 10%, respectively [2] [3] [4]. In 2019 edition, more than 1,800 universities are classified [2] and in 2020 edition, published on August 15th of this year, more than 2,000 institutions [4]. However, the list of the top 1,000 universities is edited on the website. The position of each one is indicated by a World Rank value (WR). Total Score (TS) is published only for universities in Top100 as university performance product of the relation between six indicators [4] [8]:

- To Quality of Education criterion, the indicator is referred to alumni of an institution winning Nobel Prizes and Fields Medals (Alumni - 10%).
- To Quality of Faculty criterion are two indicators: staff of an institution winning Nobel Prizes and Fields Medals (Award - 20 %) and highly cited researchers selected by Clarivate Analytics (HiCi - 20 %).
- Research Output criterion also has two indicators: Papers (articles) published in journals of Nature and Science (N&S - 20%) and papers (articles) indexed in Science Citation Index - Expanded Social Sciences Citation Index (PUB - 20%).
- Per Capita Performance criterion considers one indicator: per capita academic performance of a university (PCP - 10%).

The maximum value of each indicator is one hundred (100), corresponding to that obtained by the best university. The indicator is calculated as a percentage proportionate to this maximum value (100) to other universities [4] [8] [9].

In both editions, 2019 and 2020, Harvard University (HARVARD) occupies WR1. In 2019, Ohio State University - Columbus (OSU) from US is located in WR 100 with a TS of 26 and, in 2020, in the same place, Fudan University (FUDAN) from CN is positioned with a TS of 255 [2] [8]. There are not Ibero-American universities positioned in in Top 100. From the position WR 101, universities are arranged in alphabetical order, with intervals of WR: 101-150, 151-200, 201-300, 301-400, 401-500, and so on, until 901- 1000 [2] [8].

3. CHARACTERIZATION OF IBERO-AMERICAN UNIVERSITIES IN TOP 500 OF ACADEMIC RANKING OF WORLD UNIVERSITIES (ARWU) 2019 - 2020

Below is showed a comparative study of Ibero-American universities in Top500 of ARWU 2019 - 2020 [2] [8], relating WR values and indicators: A, Aw, HiCi, N&S, PUB and PCP in the same periods, and to determinate the gap with best positioned universities and, also, to highlight which have the best results of indicators according to ARWU criteria.

3.1. Ibero-American universities in World Rank 101-150

Fig. 1 shows Ibero-American universities located in WR 101-150 of ARWU 2019 - 2020 [2] [8]. There is only University of Sao Paulo (USP) from BR. Both graphs are similar. USP (BR) has values of zero in SA and SAw indicators. In 2019, USP (BR) has 9.6; 8.5; and 0.6 points below the OSU (US) in SHiCi, SN&S and SPCP, respectively. However, in SPUB, bridge the OSU (US) in 11.4 points and the gap with HARVARD (US) is of 22.5 points below. In 2020, USP has 5.3; 10.3 and 4.4, points below FUDAN (CN) and, equally, overcome it in SPUB in 6.9 points. With HARVARD, the gap is kept in 22.5 points below in SPUB.

3.1. Ibero-American universities in World Rank 151-200

Fig. 2 presents Ibero-American universities located in WR 151-200 of ARWU 2019 - 2020 [2] [8]. Both graphs are similar. Two universities are maintained: University of Lisbon (ULISBOA) from PT and University of Barcelona (UB) from ES. In SA indicator, all the universities have the value of zero. In 2019, in SAw indicator, ULISBOA (PT) has 8 points above USP (BR). In SHiNi, UB (ES) is located 9.6 points above USP (BR) and ULISBOA (PT). In respect to SN&S, three universities practically have the same value. In SPUB, highlights the gap of 26.2 above USP (BR) with both universities. However, in SPCP, USP (BR) is located below ULISBOA (PT) and UB (ES) with 9.6 and 4.6; respectively.

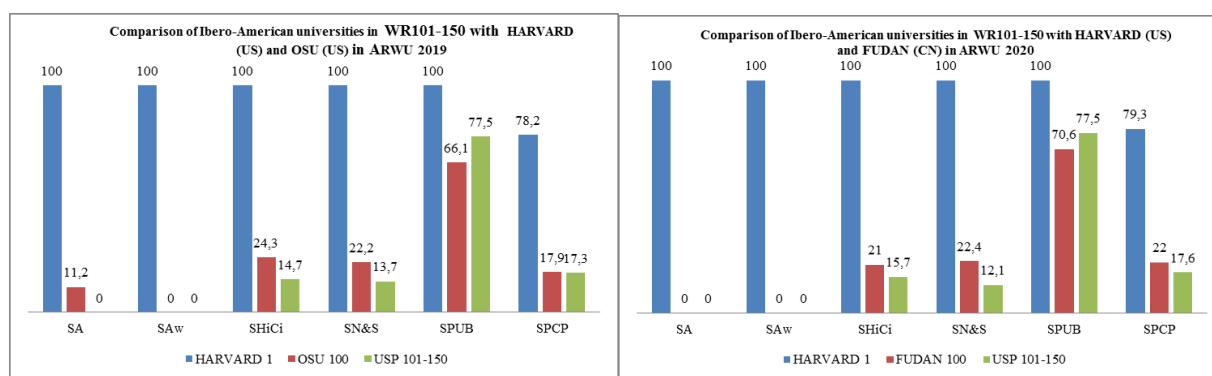


Fig. 1. Ibero-American universities located in Top500 of ARWU 2019 - 2020 [4] [4].

In 2020, in SAw indicator, ULISBOA (PT) has 7.9 points above USP (BR). In SHiNi, UB (SP) is located 6.4 points above USP (BR). In respect to SN&S, three universities are so similar; however, a gap is above 0.8 points of UB (ES) in respect to USP (BR). In SPUB, highlights the gap of 26.1 above

USP (BR) with ULISBOA (PT) and of 26.8 with UB (ES). Nonetheless, in SPCP, USP (BR) is located below ULISBOA (PT) and UB (ES) with 3.9 and 4.1; respectively.

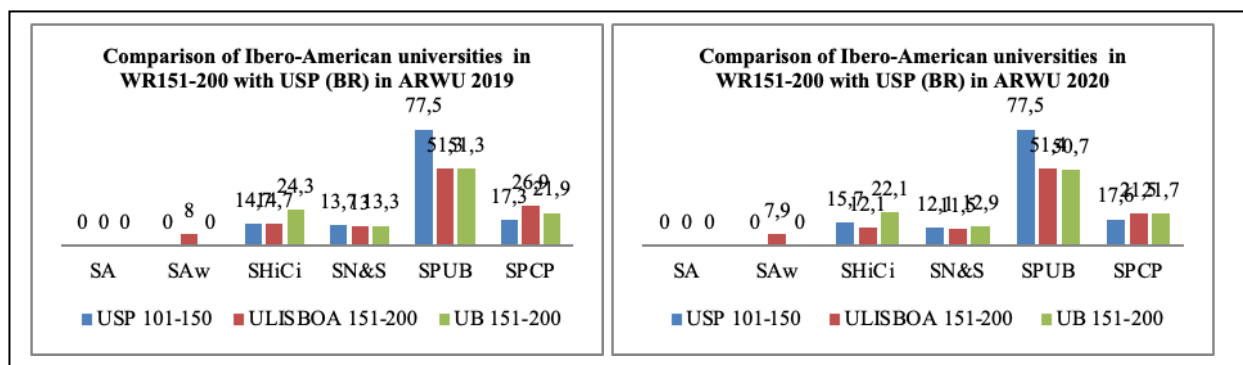


Fig. 2. Comparison of Ibero-American universities in WR151-200 with USP (BR) in ARWU 2019 - 2020 [2] [8].

3.2. Ibero-American universities in World Rank 201 -300

Fig. 3 shows Ibero-American universities located in WR 201-300 of ARWU 2019 - 2020 [2] [8]. Repeat, in both years, the same six universities, four Spanish, one Mexican and one Argentine: Autonomous University of Barcelona (UAB), Complutense University of Madrid (UCM), University of Granada (UGR), University of Valencia (UV), National Autonomous University of Mexico (UNAM) and University of Buenos Aires (UBA). Both graphs are similar.

In 2019, in SA indicator, UCM (ES) has 17.7 points above USP (BR), and also UNAM (MX) and UBA (AR) are 12.5 points above USP (BR). In SAw, UBA (AR) highlights with 23.7 points above USP (BR). In SHiNi, UGR (ES) is located 8.5 points above USP (BR). UV (ES) has the same value than USP (BR) and the other universities with a low value of 14.7. In respect to SN&S, UCM (ES) is located 1.1 points below USP (BR). In SPUB, highlights the gap of 24 points above USP (BR) with UNAM (MX), while SPCP has a gap of 9.6 above USP (BR).

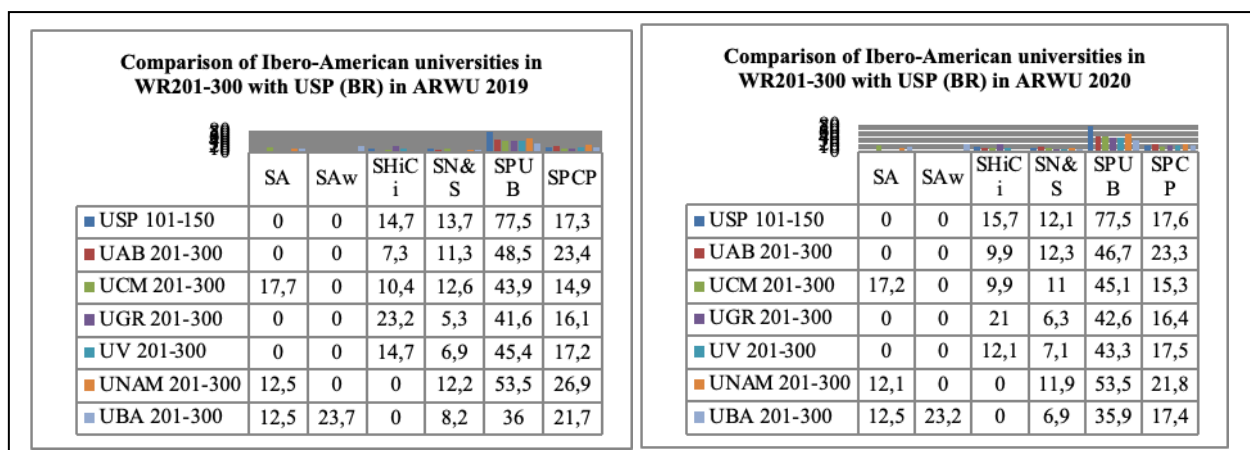


Fig. 3. Comparison of Ibero-American universities in WR201-300 with USP (BR) in ARWU 2019 - 2020 [2] [8].

In 2020, in SA indicator, UCM (ES) has 17.2 points above USP (BR), and also UNAM (MX) and UBA (AR) are 12.1 and 12.5 points above USP (BR). In SAw, UBA (AR) highlights with 23.2 points above USP (BR). In SHiNi, UGR (ES) is located 5.3 points above USP (BR) and UV (ES) is located 3.6 points below USP (BR). In respect to SN&S, UAB (ES) is located 0.2 points above USP (BR) and UNAM (MX) is 0.2 points below USP (BR). In SPUB, the gap of 24 points is maintained above USP (BR) with UNAM (MX), while in SPCP, UAB (ES) has a gap of 5.7 above USP (BR).

3.3. Ibero-American universities in World Rank 301-400

Fig. 4 presents Ibero-American universities located in WR 301-400 of ARWU 2019 - 2020 [2] [8]. In 2019 are listed six institutions: Autonomous University of Madrid (UAM) from ES, University of Porto (UP) from PT, Pompeu Fabra University (UPF) from ES, Federal University of Rio de Janeiro (UFRJ) from BR, Universidad Estatal Paulista "Julio de Mesquita Filho" (UNESP) from BR and University of Campinas (UNICAMP) from BR. In 2020, repeat five universities: UAM (ES), UPF (ES), UP (PT), UNESP (BR) and UNICAMP (BR) and appear two Spanish universities: Polytechnic University of Valencia (UPV) and University of the Basque Country (EHU). As in previous items, both graphs are similar.

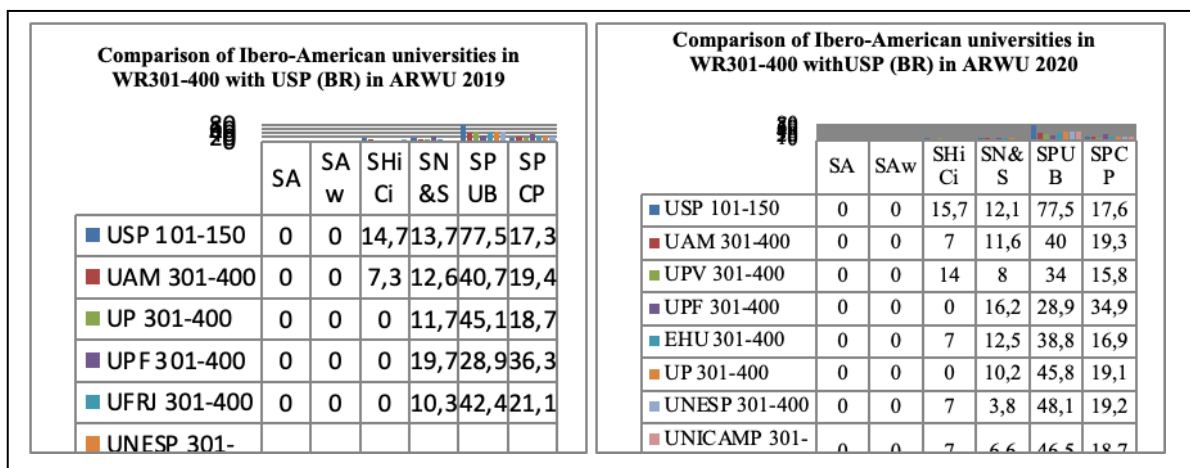


Fig. 4. Comparison Ibero-American universities in WR301-400 with USP (BR) in ARWU 2019 - 2020 [2] [8].

In 2019, all the universities have zero in SA and SAw indicators. In SHiCi indicator, USP (BR) has 7.4 points above UAM (ES) and UNICAMP (BR). In SN&S, UPF (ES) is located 6 points above USP (BR); all others are below USP (BR). In SPUB, highlights the gap of 32.4 points above USP (BR) with UP (ES). And finally, in SPCP, USP (BR) is located below all the universities; the largest gap is 9 points with UPF (ES).

In 2020, all the universities also has zero in SA and SAw indicators. In SHiCi indicator, USP (BR) has a gap of 1.7 points above UPV (ES) and of 8.7 points with UAM (ES), EHU (ES), UNESP (BR) and UNICAMP (BR). UPF (ES) and EHU (ES) have a gap above of 4.1 and 0.4 points, respectively, with USP (BR) in SN&S, and the other universities are below USP (BR). In SPUB, highlights the gap of 29.4 points above USP (BR) with UNESP (BR). And finally, in SPCP, USP (BR) is located below universities: UAM (ES), UPF (ES), UP (PT), UNESP (BR) and UNICAMP (BR), the largest gap is 17.3 points with UPF (ES).

3.4. Ibero-American universities in World Rank 401-500

Fig. 5 presents Ibero-American universities located in WR401-500 of ARWU 2019 - 2020 [2] [8]. Both graphs are similar. In 2019, ten institutions are listed: New University of Lisbon (UNL) from PT, Polytechnic University of Valencia (UPV) from ES, University of Oviedo (UNIOVI) from ES, University of Seville (US) from ES, University of the Balearic Islands (UIB) from ES, University of the Basque Country (EHU) from ES, University of Zaragoza (UNIZAR) from ES, Universidade Federal de Minas Gerais (UFMG) from BR, Universidade Federal do Rio Grande do Sul (UFRGS) from BR and University of Chile (UCHILE). In 2020, repeat UNIOVI (ES), US (ES), UNIZAR (ES), UFRGS (BR) and UCHILE (CL), and appear four universities: University of Santiago Compostela (USC) from ES, University of Minho (UMINHO) from PT, Federal University of Minas Gerais (UFMG) from BR and Federal University of Rio de Janeiro (UFRJ) from BR.

Comparison of Ibero-American universities in WR401-500 with USP (BR) in ARWU 2019						
	SA	SA _w	SHiCi	SN&S	SPUB	SPCP
■ USP 101-150	0	0	14,7	13,7	77,5	17,3
■ UNL 401-500	0	0	7,3	9,9	30	17,6
■ UPV 401-500	0	0	10,4	8,2	34,2	15,1
■ UNIOVI 401-500	0	0	7,3	9,7	29,7	14,3
■ US 401-500	0	0	10,4	6,7	36,6	13,3
■ UIB 401-500	0	0	14,7	6,4	22,2	20,4
■ EHU 401-500	0	0	0	11,6	39,2	16,4
■ UNIZAR 401-500	0	0	7,3	7,1	33,6	14,3
■ UFMG 401-500	0	0	0	3,7	40,3	19,6
■ UFRGS 401-500	0	0	0	5,7	42,3	20,7

Fig. 5. Comparison of Ibero-American universities in WR401-500 with USP (BR) in ARWU 2019 - 2020 [2] [8].

In 2019, just UCHILE (CL) obtained 5.6 points in SA. In SA_w, all the universities have zero. In respect to SHiCi, either USP (BR) or UIB (ES) obtain the same value of 14.7. In SN&S, the gap between USP (BR) and EHU (ES) is 2.1 points. In respect to SPUB, highlights the gap of 38.3 points above USP (BR) with EHU (ES). And finally, in SPCP, USP (BR) is located below UNL (PT), UIB (ES), UFMG (BR), UFRGS (BR) and UCHILE (CL).

In 2020, just UCHILE (CL) obtained 5.4 points in SA. In SA_w, all the universities have zero. In SHiCi indicator, USP (BR) has a gap of 3.6 points above UMINHO (PT). In SN&S, USP (BR) is above all others; the lowest gap is 2.3 with UFRJ (BR). In respect to SPUB, USP (BR) is also located above the others; the lowest gap is 35.2 with UFRGS (BR). And finally, in SPCP, USP (BR) is passed for 0.2 points by UMINHO (PT).

In summary form, Table 1 shows the best Ibero-American universities by comparison with each other in WR in 2019 - 2020 edition of ARWU.

Table 1. Ibero-American universities located in Top500 of ARWU 2019 - 2020 with the best scores of indicators by Word Rank [2] [8].

	Quality of Education		Quality of Faculty				Research Output				Per Capita Performance	
	Score on Alumni (10%)		Score on Award (20%)		Score on HiCi (20%)		Score on N&S (20%)		Score on PUB (20%)		Score on PCP (10%)	
World Rank/Weight	2019	2020	2019	2020	2019	2020	2019	2020	2019	2020	2019	2020
1	HARVARD (US)	HARVARD (US)	HARVARD (US)	HARVARD (US)	HARVARD (US)	HARVARD (US)	HARVARD (US)	HARVARD (US)	HARVARD (US)	HARVARD (US)	HARVARD (US)	HARVARD (US)
	100	100	100	100	100	100	100	100	100	100	78,2	79,3
100	OSU (US)				OSU (US)	FUDAN (CN)	OSU (US)	FUDAN (CN)	OSU (US)	FUDAN (CN)	OSU (US)	FUDAN (CN)
	11,2				24,3	21	22,2	22,4	66,1	70,6	17,9	22
101-150					USP (BR)	USP (BR)	USP (BR)	USP (BR)	USP (BR)	USP (BR)	USP (BR)	USP (BR)
					14,7	15,7	13,7	12,1	77,5	77,5	17,3	17,6
151-200			ULISBOA (PT)	ULISBOA (PT)	UB (ES)	UB (ES)	UB (ES)	UB (ES)	UB (ES) - ULISBOA (PT)	ULISBOA (PT)	ULISBOA (PT)	UB (ES)
			8	7,9	24,3	22,1	13,3	12,9	51,3	51,4	26,9	21,7
201-300	UCM (ES)	UCM (ES)	UBA (AR)	UBA (AR)	UGR (ES)	UGR (ES)	UCM (ES)	UAB (ES)	UNAM (MX)	UNAM (MX)	UNAM (MX)	UAB (ES)
	17,7	17,2	23,7	23,2	23,2	21	12,6	12,3	53,5	53,5	26,9	23,3
301-400					UNICAMP (BR) - UAM (ES)	UPV (ES)	UPF (ES)	UPF (ES)	UNESP (BR)	UNESP (BR)	UPF (ES)	UPF (ES)
					7,3	14	19,7	16,2	47,4	48,1	20,7	34,9
401-500	UCHILE (CL)	UCHILE (CL)			UIB (ES)	UMINHO (PT)	UPV (ES)	UFRJ (BR)	UFRGS (BR)	UFRGS (BR)	UFRGS (BR)	UMINHO (PT)
	5,6	5,4			14,7	12,1	11,6	9,8	42,3	42,3	20,7	17,8

3.5. *Best Ibero-American universities in Quality of Education criterion*

In this criterion of ARWU, highlights in both years, 2019 - 2020, UCM (ES), located in WR 201-300, with SA values of 17.7 and 17.2, respectively (Table 1).

3.6. *Best Ibero-American universities in Quality of Faculty criterion*

This criterion is related with two indicators: Aw and HiCi.

UBA (AR) is positioned in WR 201-300, in both years, gets the highest SAw values of 23.7 and 23.2; respectively (Table 1).

UB (ES) is positioned in WR 151-200, in both years, gets the highest SHiCi values of 24.3 and 22.1; respectively (Table 1).

3.7. *Best Ibero-American universities in Research Output criterion*

This criterion is related with two indicators: N&S y PUB.

UPF (ES) is positioned in WR 301-400, in both years, gets the highest SN&S values of 19.7 and 16.2; respectively (Table 1).

USP (BR) is positioned in WR 101-150, in both years, gets the highest SPUB values of 77.5 (Table 1).

3.8. *Best Ibero-American universities in Per Capita Performance criterion*

In this criterion of ARWU, highlights in 2019, ULISBOA (PT) and UNAM (MX) which match in SPCP with value of 26.9; although the first one is in WR 151-200 and the second one is in WR 201-300. In 2020, UPF (ES) is positioned in WR 301-400 with SPCP equal to 34.9 (Table 1).

4. CONCLUSIONS

Since 2003, Academic Ranking of World Universities (ARWU) classifies universities around the world according to four criteria, relating six indicators: quality of education (Alumni), quality of faculty (Award and HiCi), research output (N&S and PUB) and per capita performance (PCP), which measure the academic and research performance, and most especially this last one, because quality of faculty and research output have a weight of 40% each one and their indicators reflect the Nobel Prize or Fields Medal won by their academic staff, the number of Hight Cited Researchers selected by Clarivate Analytics, papers published in Nature and Science and papers (articles) indexed in Science Citation Index-Expanded and Social Science Citation Index.

More than 1,800 universities are classified in 2019 edition and, more than 2,000 institutions in 2020 edition. However, the list of the top 1,000 universities is edited on the website through a classification gave by a World Rank value (WR).

A comparative study had been performed, through a descriptive analysis, of Ibero-American universities in Top500 of ARWU 2019 and ARWU 2020, to relate and compare their indicators, and to determine the gap with better placed universities and, also, highlights which have best indicator results according to ARWU criteria. This report first presents information about ranking criteria and indicators, then, results of criteria and indicators of the best Ibero-American universities are showed, along with their gaps with better placed universities.

As results highlights that either in 2019 or in 2020, Ibero-American universities positioned in Top 500 are 25: thirteen are Spanish, six Brazilian, three Portuguese, one Mexican, one Argentine and one Chilean. They keep their WR in both analyzed years: USP(BR) in WR 101-150; ULISBOA (PT) and UB (ES) in WR 151-200; UAB (ES), UCM (ES), UGR (ES), UV (ES), UNAM (MX) and UBA (AR) in WR 201-300. In WRs 301-400 and 401-500 is a variation of universities positioned.

Comparing indicators by WR, the graphs are practically similar in form and values. It highlights, even if USP (BR) is the best Ibero-American university positioned in WR 101-150 and presents the highest value of PUB (77.5), even higher than OSU (US) and FUDAN (CN) which occupy WR 100 positions in 2019 and 2020, in Quality Education criterion, UCM (ES) highlights in two years with SA values of 17.7 and 17.2. In Quality of Faculty criterion, UBA (AR) is positioned in WR 201-300, in

both years, with the highest SAw values of 23.7 and 23.2; and UB (ES), positioned in WR 151-200, in both years, gets the highest SHiCi values of 24.3 and 22.1.

Additionally, UPF (ES), positioned in WR 301-400, gets the highest SN&S values of 19.7 and 16.2 in both years, completing the Research Output criterion with USP (BR) and SPUB. And finally, in Per Capita Performance criterion, highlight in 2019, ULISBOA (PT) and UNAM (MX) matching in SPCP with the value of 26.9; although the first one is in WR 151-200 and the second one is in WR 201-300. In 2020, UPF (ES) is located in WR 301-400, with SPCP equal to 34.9.

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