
| RESEARCH ARTICLE

University Campus Architects and Their Influences from the Perspective of Bibliometrics

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| ABSTRACT

With the development of high-tech, digital cities and other information means, higher education is an important part of modern talent training. The construction of higher education is also related to the university system, the construction of university campuses, and the connotation of university culture. Therefore, the construction of university campuses has long been an issue of academic concern. Therefore, the influence of university campus architects also provides a good environment for university campus construction and university culture and provides a new research direction for higher education campus architecture. This paper uses CiteSpace software and Web of Science visual analysis platform to conduct text mining and visual analysis of the existing literature in the international Web of Science academic database and plot the number of published papers, subject distribution, and frequent citations of "University Campus Architect Research". A knowledge graph of literature and research hotspots, research topics, and research trends. Combing the current research status of University Campus Architect, we hope to provide theoretical support for further research on improving higher education campus construction and the frontier dynamics of academic research.

| KEYWORDS

University Campus Architect, Bibliometrics, CiteSpace, Visual Analysis

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1. Introduction

Campus culture is the specific spiritual environment and cultural atmosphere of the school. It includes the materialized content of campus architectural design, campus landscape, greening and beautification, as well as the school's tradition, school spirit, study style, interpersonal relationship, and collective public opinion. Chen Jin's article published in the fourth issue of "Cooperative Economy and Technology" in 2014 pointed out that architecture is a science and technology and a work that includes spiritual culture. The architecture of different eras can integrate the culture and philosophy of an era. College campus is an important place for teaching and educating people. The buildings inside the campus serve the teaching of colleges and universities, and they have the function of education. Therefore, more cultural connotations will be injected into the architectural landscape of colleges and universities. The campus architecture of a university is the concentrated expression of a school's school-running conditions and teaching philosophy. The cultural characteristics presented by the campus architecture of a university are an important part of campus culture. Therefore, in the planning and construction of colleges and universities, we should build campus buildings with their own characteristics, and we should also reflect the profound cultural connotation of campus buildings and strive to create an educational environment for buildings and a strong campus cultural environment.

Similarly, in modern China, with the development of higher education, many master architects returned from studying in other countries, and they also brought some style influences into the architectural design of university campuses, developing a unique art form of campus architecture. From the perspective of architectural heritage, universities have a long history and unique design forms, and their campus architectural styles also influence modern campus design. The current articles on university campus

architects are also very rich, covering university cultural construction, architects and engineering, campus cultural heritage protection and other aspects. Therefore, this study uses Citespace as the analysis tool and the corresponding research literature on University Campus Architect as the object of analysis and calculation. Visualization and computational analysis of documents in the Science database.

Through the construction and design of these designers in campus buildings, the data statistics and collation provide the main influence of university campus architects from the perspective of literature and also sort out a context of influence for more research. Through the statistical data of the achievements and influence between designers and buildings, more university culture, It provides a new idea for the protection of campus cultural heritage and buildings.

2. Data source and analysis condition settings

Bibliometrics was proposed by Alan Pritchard in 1969, and it is defined as; the application of mathematical and statistical methods to show the processing of textual information by calculating and analyzing different levels of textual information and the development of a discipline nature and trends. Bibliometrics, Informatometrics and Scientometrics, referred to as "Three Metrics", are the foundations of Internet Information Metrics. Bibliometric research is a research technique that provides a quantitative overview of a field of study. It involves cluster analysis, including citation analysis, co-citation analysis, bibliographic coupling, co-author analysis, and co-word analysis. Based on bibliometric techniques, current research areas and potential future research directions are identified, providing a roadmap for further research.

In order to increase the credibility of the bibliometric research analysis, the authoritative foreign literature database "Web of Science™ Core Collection", namely the Web of Science Core Collection (1978-present), was selected as the data source, and the index type was SCI, -EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI, CCR-EXPANDED, IC. The search topics are " University Campus Architect; the filter article types are "Document type=Article" and "Document type=Proceedings Papers"; The longest span of time is selected; the source database is selected as default; the search deadline is February 17, 2022. After narrowing down the literature types, only 659 pieces of literature were actually calculated and analyzed. The version of software computing is CiteSpace.5.8.R3 (64-bit) (the previous version, CiteSpace.5.8.R3, lasted until February 17, 2022, and can no longer be used).

3. Analysis results and Discussion

Judging from the year and time period of literature publication, the annual publication volume of community public space and facility research papers generally increases year by year. There was a decrease in individual years, but the decrease was not much different from the previous year (Figure 1). The current year with the largest number of publications is 2017, with 73 publications, accounting for 11.077%. Followed by 2018, 69 papers will be published, accounting for 10.470%. The period from 2015 to 2020 is the peak of the number of publications. Therefore, the research on University Campus Architect has shown a good development trend as a whole, indicating that its topics are also attracting the attention of the academic circle.

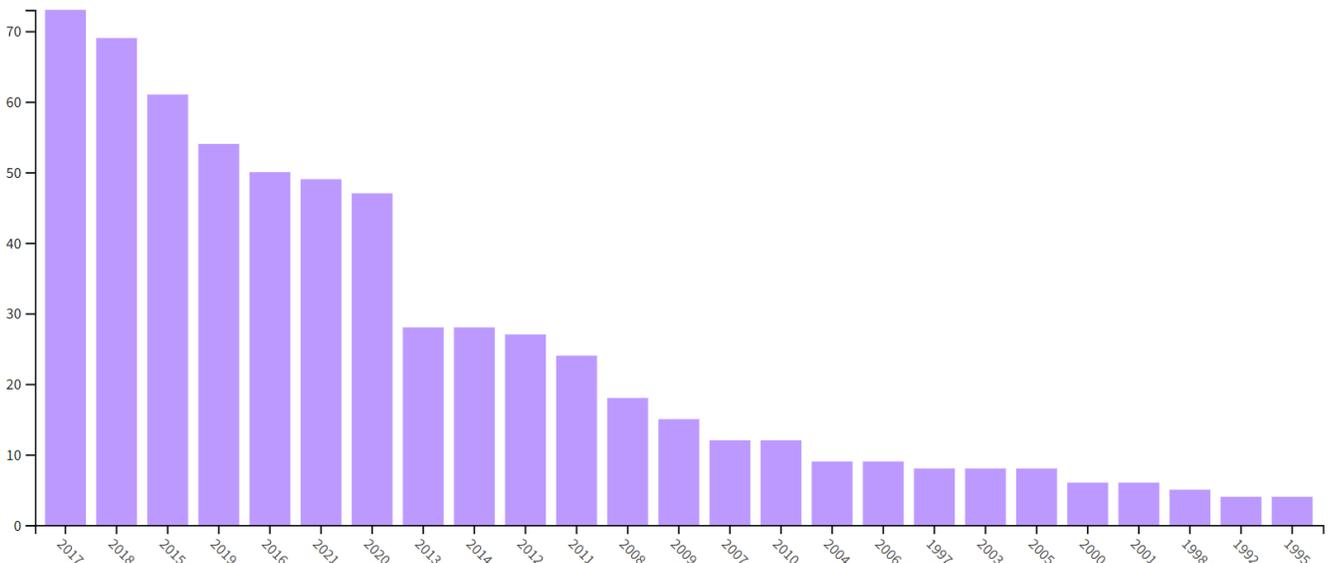


Figure 1 Statistics of publication years of University Campus Architect research literature
Image source: Intercepted from Web of Science database platform analysis

According to the subject classification of the literature, the current subject with the most is Architecture, with 169 literature, accounting for 25.645%, followed by: Construction Building Technology, Engineering Civil, Computer Science Software Engineering, Computer Science Hardware Architecture, Art, Green Sustainable Science Technology, Computer Science Theory Methods, Education Educational Research, Energy Fuels, Engineering Electrical Electronic, Environmental Studies. Among them, POLYTECHNIC UNIVERSITY OF CATALONIA, UNIVERSITI TEKNOLOGI MARA, UNIVERSITY OF MELBOURNE, DEAKIN UNIVERSITY, UNIVERSITA DELLA CAMPANIA VANVITELLI are mostly concentrated in academic institutions in European and American countries.

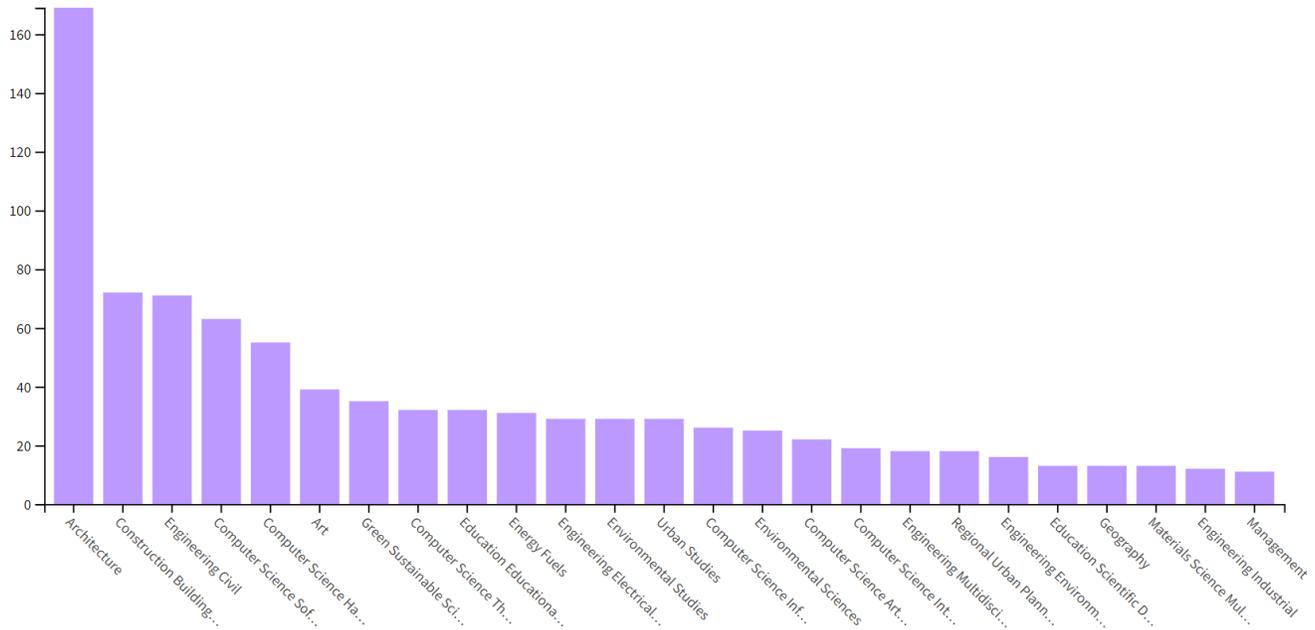


Figure 2 Statistics of subject classification of University Campus Architect research literature
Image source: Intercepted from Web of Science database platform analysis



Figure 3 Statistics of affiliated institutions of University Campus Architect research literature
Image source: Intercepted from Web of Science database platform analysis

Firstly, the data obtained from Web of Science will be checked for duplicates, tested, converted into formats, and imported into CiteSpace. Using the Log-likelihood rate (LLR algorithm), a beating cluster map was obtained. At the same time, check the clusters obtained by the operation, open the statistical view of Summary of Clusters, and check the Silhouette column, that is, the S value,

which represents the calculated average contour value of the clusters. It is generally considered that $S > 0.5$ clusters are reasonable. $S > 0.7$ means that the clustering is convincing (Li Jie, Chen Chaomei, 2014). After inspection, it is found that the S values of this operation analysis are all over 0.7, and most of them are above 0.9; that is, the operation results are valid (Figure 4).

Summary of Clusters -

Save/Show as HTML: cluster_summary.html Save Label Terms as a Whitelist

Select	Cluster ID	Size	Silhouette	mean(Year)	Top Terms (LSI)	Top Terms (log-likelihood ..	Terms (mutual informatio...
<input type="checkbox"/>	0	42	0.869	2013	musical ability; hand pref.	musical ability (142.97, 1.0...	many complex activities (...)
<input type="checkbox"/>	1	32	0.854	2012	architectural education; au	recent graduate architect (...)	conflict sensitivity (2.8); m...
<input type="checkbox"/>	2	31	0.925	2017	lift-up design; outdoor ther.	lift-up design (81.1, 1.0E-4...	interviewing people (1.52);...
<input type="checkbox"/>	3	25	0.958	2018	open-plan office; styrene-..	open-plan office (36.66, 1...	shelter architecture (0.22)...
<input type="checkbox"/>	4	21	0.897	2013	consumer choice; food se.	consumer choice (129.71, ...)	energy resource (0.19); g...
<input type="checkbox"/>	5	16	0.971	2008	case study; system archit.	case study (53.87, 1.0E-4...	cooperative personnel (0...
<input type="checkbox"/>	6	15	0.999	2009	median; patient; prognosi.	median (70.82, 1.0E-4); p...	human epididymis protein ...
<input type="checkbox"/>	30	4	1	2019	this article discusses the r.	planning (29.21, 1.0E-4); a...	conflict sensitivity (0.02); ...

Figure 4 Perform a Silhouette test on the clusters resulting from the operation
Image source: The author intercepted according to Citespace

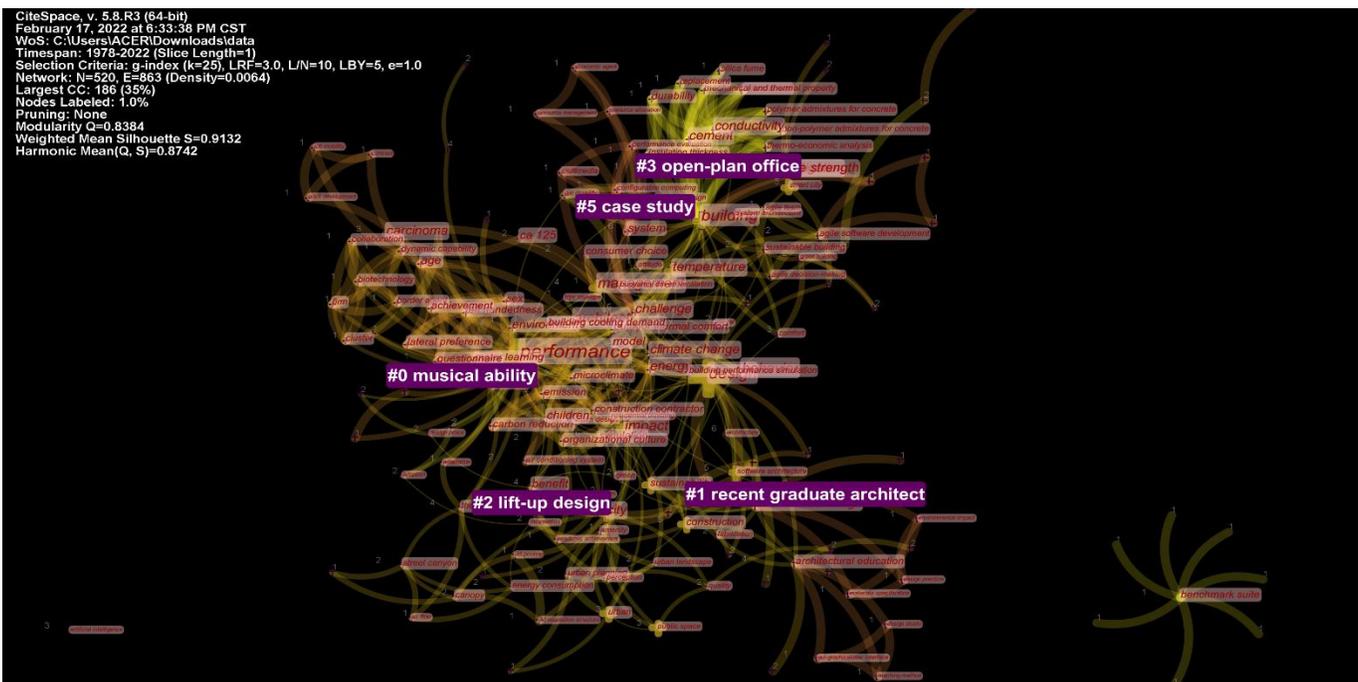


Figure 5 Cluster labels derived from the operation (Image source: The author exported according to Citespace)

Through operation analysis, 5 groups of cluster labels are formed (Figure 5). The operation result shows Network: N=520, E=863 (density=0.0064), N represents the number of network nodes, E is the current number of connections, and Density is the density of the network. It is presented in the form of a space-time diagram(Figure 6), which are: musical ability, recent graduate architect, lift-up design, open-plan office, case study. And through this analysis, it is found that the research of architects is closely integrated with the architectural design of universities, and there is very little literature on the background, life and personal design style of architects. When performing cluster analysis, the upper right of the interface shows that the number of clusters is 6, but the actual cluster image shows only 5. Because the software system automatically displays clusters with more than 10 members, the number that does not meet this condition is # 4 is not displayed this time. At the same time, it also shows that in the current literature research, the research potential space is still very large.

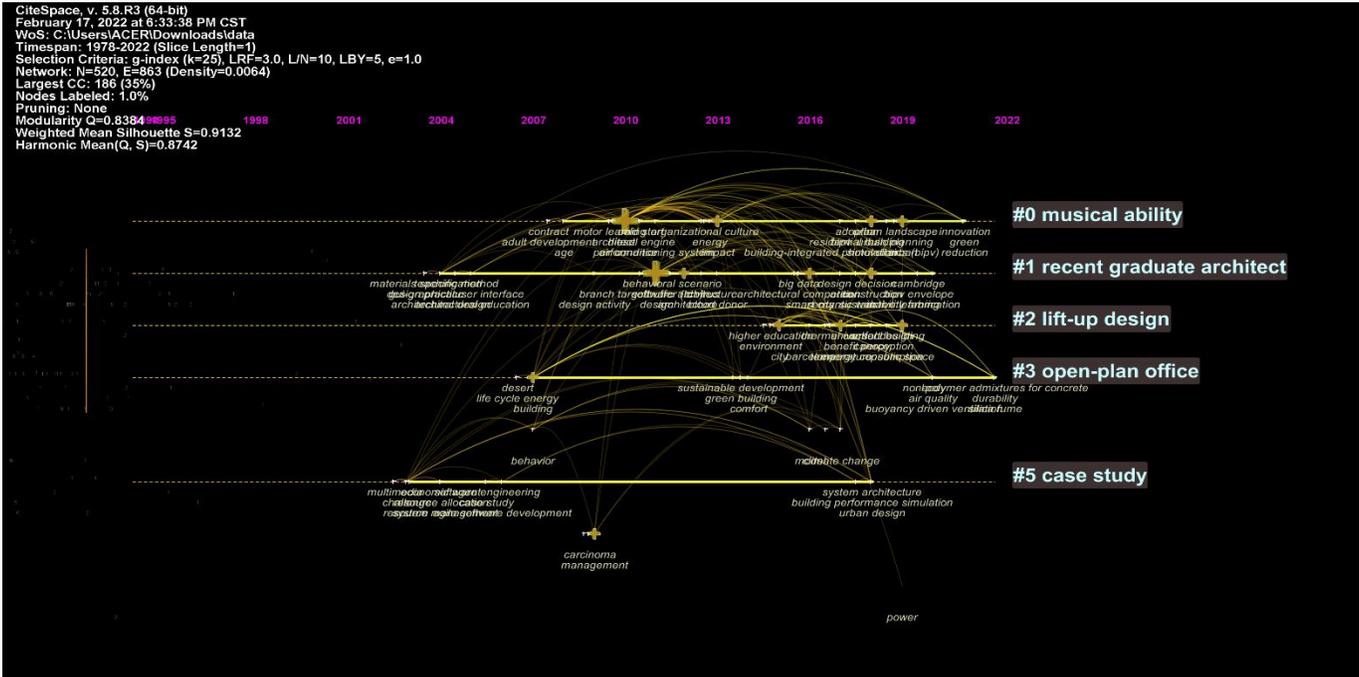


Figure 6 The spatiotemporal graph of the cluster labels obtained by the operation (Image source: The author exported according to Citespace)

Top 20 Terms with the Strongest Citation Bursts

Terms	Year	Strength	Begin	End	1978 - 2022
design	1978	2.58	2012	2016	-----
architecture	1978	4.98	2013	2016	-----
sustainable development	1978	2.99	2014	2020	-----
design process	1978	3.94	2015	2022	-----
sustainability	1978	3.53	2015	2015	-----
cultural heritage	1978	2.84	2015	2017	-----
architectural design	1978	2.67	2015	2022	-----
urban design	1978	2.53	2015	2019	-----
survey	1978	2.45	2015	2015	-----
energy consumption	1978	3.62	2016	2018	-----
university campus	1978	2.53	2016	2019	-----
software architects	1978	4.26	2017	2018	-----
energy efficiency	1978	3.63	2017	2019	-----
software architecture	1978	3.23	2017	2018	-----
outdoor thermal comfort	1978	2.45	2017	2017	-----
urban designers	1978	2.69	2018	2019	-----
building design	1978	2.69	2018	2019	-----
urban area	1978	2.64	2018	2022	-----
construction industry	1978	2.72	2020	2022	-----
architectural education	1978	2.4	2020	2020	-----

Figure 7 Distribution map obtained by Burst detection operation (Image source: The author derived from Citespace)

At the same time, burst detection is also carried out through the CiteSpace operation. The algorithm principle is to count the frequency of words in the titles and abstracts of papers in related fields, and then according to the growth rate of these words, to determine the current research frontier hot words, emerging words year etc. The evolution of c University Campus Architects in foreign literature research is actually a reflection of the progress of urban development and the development of theoretical systems. Run the Burst test to get the calculation results of the top 20 frontier hotspots. The red mark is the time node distribution of the burst. They are design, architecture, sustainable development, design process, sustainability, cultural heritage, architectural design, urban design, survey, energy consumption, university campus, software architects, energy efficiency, software architecture, outdoor thermal comfort, urban designers, building design, urban area, construction industry, architectural education (Figure 7). Since 2012, the research hotspots have constantly been changing and showing diversification. The highest intensity calculated is the perception of strength=4.98, which also shows that in the University Campus Architects, the relationship between people's feelings, outdoor thermal comfort, energy efficiency, behaviors and space is constantly becoming an Academic focus of University Campus Architects research.

4. High-frequency literature analysis

Through the method of bibliometrics, some frequently cited documents were also obtained. What they almost have in common is that the university campus designed and built by the architect has a long history and is still in use today, and the style brought by the architect combines the regional characteristics of different countries and regions to form a unique architectural art form.

Gitler Inbal Ben-Asher wrote about the work of Israeli architect Arie Sharon, who considered Arie Sharon, a Bauhaus graduate, to be one of the most important figures in the history of Israeli architecture and to represent Israeli and Palestinian architectural styles from the mid-1930s to the present. He discusses typical cases of postcolonial African modernist styles through analysis by Obafemi Awolowo University (OAU)(Figure 8), Ile-Ife, Nigeria (GITLER, N. I. B. A. 2010).



Figure 8 The University of Ife, now known as Obafemi Awolowo University, (Image source: Dima Stouhi. "Obafemi Awolowo University: A Look at Africa's Most Beautiful Campus" 10 Mar 2020. ArchDaily. Accessed 27 Feb 2022.)

Fabbri Garcia Martin surveyed the campus of the University of Lima in 2013, using architect Hector Velarde Bergmann as a starting point to find commonalities in architecture among Catholic campuses of the same type (Fabbri Garcia, M., Montestrucque Bisso, O., & Maqueira Yamasaki, A.,2013). Comte Yvon analyzes the design of the campus of the Faculty of Letters and Humanities at today's Paul-Valery University-Montpellier III (Figure 9)from the aesthetics endowed by architects and sculptors (Comte, Y. 2017). Sanchez

Munoz David analyzed the main influence and contribution of the 20th-century Spanish architecture representative of the Campus of Blasco Ibanez (Valencia) and its architect Fernando Moreno Barbera (Sanchez Munoz, D.,2018).



Figure 9 today's Paul-Valery University-Montpellier III. (Image source: Internet data URL:https://commons.wikimedia.org/wiki/File:Beziers_Guesclin.jpg)

Gutierrez-Mozo, Maria-Elia and others analyzed the architects and architectural designs of the University of Alicante (Figure 10) Campus in Spain and believed that female architects in this project could relate the campus construction to space, time and type. Male architects, on the other hand, contribute more to solutions in practical engineering (Gutiérrez-Mozo, M. E., Parra-Martínez, J., & Gilsanz-Díaz, A.,2020, June).



Figure 10 today's the University of Alicante. (Image source: Internet data, Author: José Manuel Pérez URL:<https://commons.wikimedia.org/wiki/File:UA-Aulario2.jpg>)

Xie, Y., in his research on the Lingnan University campus (Figure 11), argues that this Christian university built in China with a Western missionary background features a hybrid campus in which "Chinese-style" buildings are arranged in the Academy of Fine Arts planning scheme. Its campus planning and architectural design are shaped by Guangzhou's unique quasi-colonial power interactions, involving cooperation and conflict between multiple forces - Western missionaries and architects, local governments, businessmen at home and abroad, and Guangzhou's ordinary people. In addition, the architectural design of Lingnan University is also influenced by American architects, which integrates the traditional Chinese style and reflects the locality and adaptability of the building (Xie, Y., & Walker, P., 2021).

Unlike the literature of university architects in other regions, campus architects in China, because their university campus model is a direct evolution of the Western University campus model, their architects' design style incorporates more elements of the theological education system of monasteries in the European and American campus model, such as Soochow University (Figure 12), which was established in 1900. During this period, special mention should be made of architect Henry Killam Murphy, whose design had a far-reaching impact on the Republic of China. With more architects from the United States and Germany going to China to build more university campuses, limited by many factors such as local culture and the political turmoil in China at that time, these buildings are not based on the complete European and American paradigm of university campuses as the main body, but their construction connotation can reflect the core of American campus, which brings far-reaching influence. It lays the keynote for the university campus design of the main body in the Republic of China era. (Peters, T. F., 2003). Like many underdeveloped areas at the same time, for example, the university campus buildings in Peru were deeply influenced by the international design trend at that time. The local overseas designers represented by Héctor Velarde Bergmann applied the advanced design concepts of Europe and the United States to the design of the university campus buildings in Peru. The architect combines local

characteristics with the advanced design of the times and obtains a modern design building that can be accepted by both, which has been preserved to this day. (Fabbri García, M., Montestruque Bisso, O., & Maqueira Yamasaki, Á. 2013)



Figure 11 the 1900's-1920's Lingnan University campus. (Image source: Internet data, URL:http://blog.sina.com.cn/s/blog_4be4a7f10100pwi1.html)

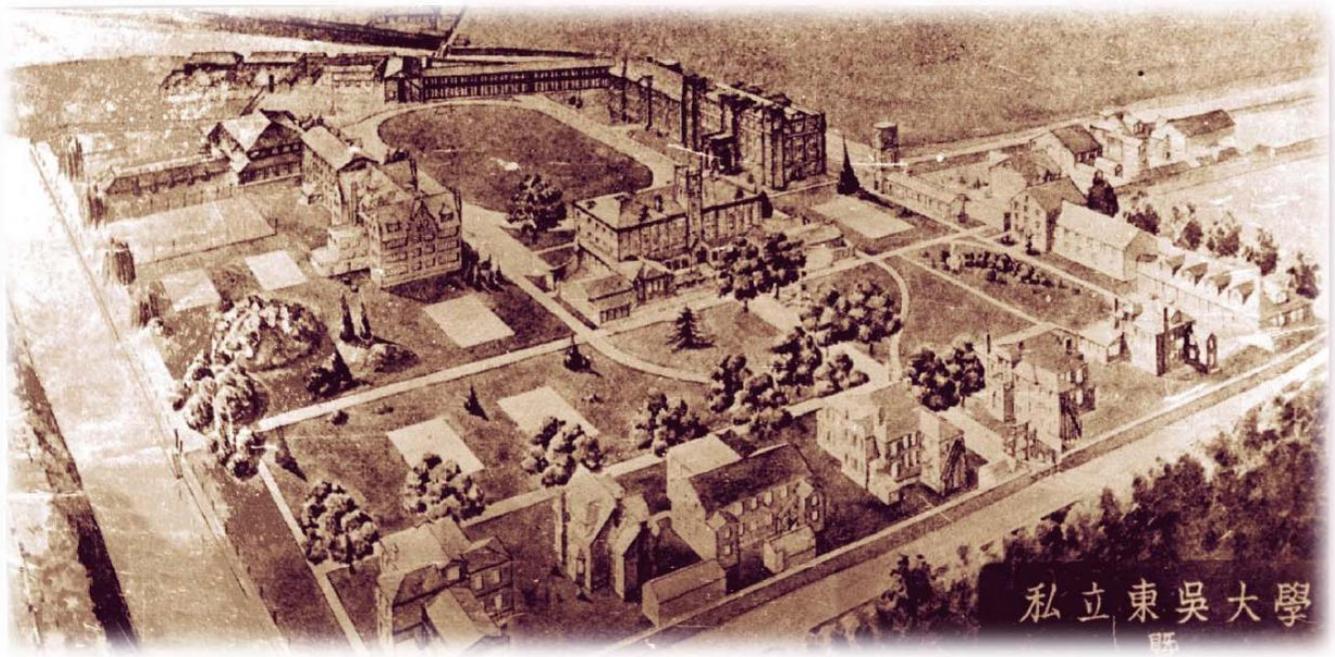


Figure 12 the 1900's-1920's Soochow University campus. (Image source: Internet data)

In Africa, South Africa, where university education is more developed, Modern Movement buildings campus for the University of South Africa and the University of Pretoria (Figure 13) designed by architects represented by Brian Sandrock Architects, its

preference for elevating buildings on columns; its inconsistent approach to shielding windows from the sun's rays, and the firm's experimentation with the integration of Brutalism and the International Style at Unisa's Muckleneuk campus. (Brink, B.2012). However, campus architects in Africa are faced with the difficulty of finding information, which provides a challenge for us to find the cultural factors behind designers in related fields and university campuses and the depth of campus design, which is a problem that African architects need to. (Noble, J. A. 2016)



Figure 13 the Administrative Building of the University of Pretoria. (Image source: Internet data, URL:https://en.wikipedia.org/wiki/File:Die_skip_University_of_pretoria.JPG)

Among the universities in Hong Kong, there are also significant differences between the campus buildings designed by local designers and those designed by overseas designers. Chinese University of Hong Kong(Figure 14) and Chu Hai College of Higher Education(Figure 15), which are designed by designers who graduated from local universities in Hong Kong and represented by Rocco Yim, have maintained certain popularity. It provides a solid foundation for the selection of local designers for the subsequent campus design of the University Campus Hong Kong. At the same time, local designers have no cultural gap in related fields. After the 1990s, they began to renovate and modify some of the original university buildings in Hong Kong, incorporating more emerging technologies and providing a better cultural experience of blending Chinese and Western cultures. (Xue, C. Q. 2016)



Figure 14 the Lee Woo Sing College (Belongs to the Chinese University of Hong Kong) campus. (Image source: Internet data, [URL:https://commons.wikimedia.org/wiki/File:Lee_Woo_Sing_College_2016.jpg](https://commons.wikimedia.org/wiki/File:Lee_Woo_Sing_College_2016.jpg))



Figure 15 Chu Hai College of Higher Education. (Image source: Internet data, [URL:https://www.chuhai.edu.hk/zh-hant/%E6%A0%A1%E8%88%8D%E8%A8%AD%E6%96%BD](https://www.chuhai.edu.hk/zh-hant/%E6%A0%A1%E8%88%8D%E8%A8%AD%E6%96%BD))

4.1 Features of the relevant literature

Through the bibliometric analysis of campus architects, we can see that by 2022, most of the articles related to campus architects are exponential growth after 2015, and the content related to campus architects for campus culture is also a hot topic in recent years. Analyzing the architects behind the university campus to get more contemporary university design and construction during the cultural characteristics and the connotation of the times is a major feature of the analysis of campus architects, while the current surge in the number of researchers is behind the trend of multidisciplinary and interdisciplinary research, Through the way of interdisciplinary research, we can further get the connection between campus culture and architectural background, while the discipline background is more related to architectural engineering, design and art.

In the data, we can also find that the current research on university campus buildings is more concentrated in European and American research institutes and universities in Europe and the United States, while the research on campus areas of universities in other regions is relatively scarce, mainly in Asian universities, which often have higher academic rankings. It makes it easier for people to pay attention to the history behind these universities' construction background and provides more detailed information for the history of architecture.

5. Conclusion

The so-called architecture is a "stone history book", which shows that architecture can not only meet the needs of people's production and life but also means a kind of "permanence" in a sense. Ancient and modern, all over the world, in the long history and the vast world, human beings have left countless architectural works that can be called "classic". They have been passed down from generation to generation, and some of them are still imprinted on university campuses that "collect the culmination of world culture". Because of their long-standing academic attention, they have developed in a diversified direction. Therefore, we can use bibliometrics to obtain the latest research trends in the face of cutting-edge exploration in many directions and constantly updating and changing related literature.

The process of architectural history can not be without the existence of architects; in the above cases, we can see that architects have many favorable factors for the design of a regional university campus; we need to consider from many angles the background of the times in which the architects were and the educational background and working background of the designers themselves, so as to analyze the university campus they designed. It is very difficult to carry out a comparative study and detailed historical origin without the above relevant information. A characteristic of this research is to carry on an analysis with the university campus design from the designer's angle, find out the connection of design and society from it, through this kind of connection more effective with today's specialization, the university campus of the company designs to carry on the contrast, become specialization nowadays, the professional design company of the collectivization from the campus design that led by architect one person or small team in the past. The influence process between the university campus and the architects under the historical process is found from the large-scale horizontal.

The study found that the international research hotspots on University Campus Architects are developing in a diversified way, and the research knowledge base and its evolution are relatively concentrated and scattered. At present, European and American countries have made the largest contribution to related research, and the distribution of research institutions is dominated by universities. In addition to imitating and inheriting similar buildings in the past in form, university campus buildings also inherit their architectural styles. The relevant case analysis also shows to a certain extent that the architectural art style of university campuses will also be influenced by architects. At present, most of the analysis and research of university campus architects are still based on the combination of campus architectural design, and it is true that there are very few architects alone. Perhaps due to multiple reasons such as the age, the serious loss of drawing files, the lack of digital preservation, and the difficulty of textual research, there is still a lot of room for improvement in international research in this area. In the future, we should overcome these difficulties and continue to develop the specialized research of university campus architects.

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