A Study on the Characteristics of Real Estate Education in Korean Universities through Text Mining-based Curriculum Analysis

Dong Hyun Kim[1] & Changsoo Ok[2]

[1] Deptpartment of Architecture and Urban Studies, University of Ulsan, Daehak-ro 93, Nam-gu, Ulsan, 44610, South Korea

[2] Department of Industrial and Data Engineering, Hongik University, 94 Wausan-ro, Mapo-gu, Seoul 04066, Korea

Correspondence: Chagnsoo Ok, Department of Industrial and Data Engineering, Hongik University, 94 Wausan-ro, Mapo-gu, Seoul 04066, Korea. E-mail: okcs@hongik.ac.kr

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Abstract

Text mining is a method of analyzing text data to derive the characteristics or status of a described object. Since an educational program's curriculum reflects the content and goals it aims to teach, text analysis of the curriculum can reveal the characteristics of the program. This study employs text mining techniques to analyze the curricula of real estate education programs at Korean universities and proposes strategies for future development. The paper presents three main findings: First, by analyzing the curricula of universities in the UK and US that offer real estate education, the study identifies the unique characteristics of each country's approach, reaffirming previously identified differences between them. Second, real estate education at Korean universities features an eclectic curriculum that incorporates elements of both UK and US real estate education, resulting in diverse curricular offerings across institutions. Lastly, for individual Korean universities, the study provides guidelines for the development of their departmental education by indicating which UK or US universities have the most similar or different curricula.

Keywords: curriculum analysis, real estate, text mining, text similarity

1. Introduction

Real estate education in Korea is often seen as a compromise between British-style education, which focuses on training practitioners, and American-style education, which emphasizes business (Kim & Pior, 2018). In the UK, historically, the need to manage the land monopolized by lords led to the development of practitioner-centered education. In contrast, the United States has traditionally viewed real estate as private property, focusing on investment and profit generation. Since university education in Korea began in the 1950s, the country has developed a curriculum that blends the characteristics of both systems and has adapted it according to changes in the social and economic environment(N. Lee & Kang, 2021; Suh, 2007). However, this assessment of real estate education in Korea has been largely qualitative, based on the opinions of a few experts, with little quantitative evidence to support it. Therefore, this study aims to systematically and quantitatively analyze the real estate education curriculum at Korean universities using text mining techniques, and to discuss the current state and future directions for improving real estate education in Korea based on the results.

In order to effectively evaluate a topic through text mining, the data being analyzed should have the following characteristics (Tan & others, 1999; Yang et al., 2023).

(1) First, the text data describing the subject or object to be evaluated must include words that reflect its key characteristics. These characteristics serve as a fundamental premise for identifying the evaluation target's features through text mining.

(2) Second, to effectively use text data for evaluation, it should be written as objectively and reliably as possible. While text mining can reveal the evaluator's subjective preferences, the author's personal opinions or judgments should be minimized to maintain objectivity.

In this study, the list of courses in the university curriculum to be analyzed is assumed to meet these two conditions and effectively represent the characteristics of the program. First, the titles of courses taken by students indicate the main subjects intended to be taught, and the list of courses in a specific program (or major) reflects the overall goals and characteristics of the program. Second, university course titles are generally considered objective and reliable. Although a professor's personal preferences or exaggerated language may sometimes influence course titles, they usually provide concise information about the lecture content. Based on these assumptions, this study proposes a text mining-based analysis method to identify the goals and characteristics of a program from curriculum data. By presenting this analysis process, we offer guidelines on how to derive the goals or characteristics of other topics or objects using text data.

The analysis method and results presented in this paper can be summarized as follows. First, we analyze the educational goals and course offerings of real estate departments (or related majors in business schools) at American and British universities to identify the educational characteristics of each country; secondly, the educational goals and course offerings at korean universities are analyzed; and thirdly, using quantitative data we verify whether the educational goals of korean real estate departments indeed have eclectic characteristics. Finally, the paper proposes a direction for the development of domestic real estate education based on these findings.

2. Materials and Methods

2.1 Real Estate Education

Real estate education, which originated in the UK in the early 20th century and the US in the late 19th century, evolved into distinct bachelor's degree programs: estate management in the UK and real estate business in the US. These programs formed the foundation for the UK and US models of real estate university education. The UK model focuses on equipping students with professional skills needed for chartered surveyors. It incorporates a multi-disciplinary curriculum covering valuation, law, economics, building construction, and planning, alongside management and information technology. This approach enables graduates to develop a comprehensive understanding of fields such as architecture, land surveying, and engineering, all within the role of a chartered surveyor (Shi-Ming, 2001). In contrast, the US model is rooted in business management. Its real estate courses are designed to train business managers or administrators, preparing students to manage real estate functions within modern corporate structures (Weimer, 1956).

After World War II, real estate education expanded globally, with countries like Singapore offering degrees in long-term valuation and land economics in 1968, followed by Australia and New Zealand in the late 1970s and early 1980s. In Singapore and Australia, the curriculum evolved into a blend of UK and US models. It includes building construction and land surveying from the UK system, alongside American-style subjects like finance and business management. This eclectic approach has adapted to changing financial environments in real estate education (Shi-Ming, 2001). Since 2000, real estate higher education has become widespread globally. (Schulte, 2012) classified real estate programs in 39 countries into three categories: the UK's "surveying approach," the US's "investment and finance approach," and an "interdisciplinary approach" in Europe(Schulte, 2012).

Kim and Pior (2018) further categorized 28 of these countries based on their current education content, noting that many adopted an eclectic model, influenced by both the UK and US systems(Kim & Pior, 2018; Schulte, 2012; Shi-Ming, 2001). Some countries that initially followed the UK model later transitioned toward the US model as more professors earned degrees in the US. This study reveals that most countries now follow the eclectic model, highlighting the continued global influence of the UK and US in real estate education.

2.2 Curriculum Analysis with Text Mining

Numerous studies have utilized text mining techniques for curriculum analysis. Xun et al.(2015) proposed a method to identify the strengths and weaknesses of a degree program by mapping its courses to the skills required for graduates. Kawintiranon et al. (2016) developed a strategy to evaluate curricula by analyzing course descriptions and lecture materials using text mining. West (2017) used text mining to assess whether an interdisciplinary curriculum was designed in alignment with its intended goals. Föll & Thiesse (Föll & Thiesse, 2017) examined the suitability of subjects offered at German universities for digitalization through curriculum analysis, expert surveys, and interviews.

Lee et al. (2018) applied text mining to analyze changes in the Korean middle school curriculum by extracting key keywords and identifying shifts in core concepts from 10 national curricula published between 1954 and 2015. Chen (2022) analyzed the curricula of the world's top 46 business schools to explore the current and future state of A.I.-related education. While these studies provided valuable insights, they were often limited in scope and primarily used as supplementary tools for qualitative analysis. In contrast, this study will analyze the curricula of real estate departments in 56 universities across the UK, the US, and Korea, aiming to identify curriculum differences and characteristics by country and institution. This analysis will offer foundational information for curriculum reform.

3. Differences between the UK and US Curriculums

To explore the differences in real estate education between the UK and US, we collected curricula from 16 universities in each country, totaling 32 universities, and conducted both quantitative and qualitative analyses. First, through quantitative analysis, we identified the characteristics of each country's curriculum by focusing on high-frequency words. It is expected that terms related to curriculum goals or major fields will occur frequently and thus represent the specific focus of each country's curriculum.

The curricula from UK and US universities were represented as a Document-Term Matrix (DTM), feature vectors for each university were extracted, and clustering was performed using the K-means algorithm to highlight differences between UK and US universities. Principal component analysis (PCA) was also performed to visualize these results. To validate the effectiveness of the analysis method, we compared the findings with the historical review conducted by (Kim & Pior, 2018).

3.1 Quantitative Analysis on UK and US Curriculums

In this section, we calculate the similarity between the curricula of UK and US universities and quantitatively evaluate the differences through clustering. For the quantitative analysis, the curricula of each country and university are expressed as vectors based on the list of words that comprise the entire curriculum. During this process, numbers, Roman letters, and symbols included in course titles were removed, and words with similar meanings or plural forms were standardized to representative terms, resulting in a total of 326 unique words. Using these 326 words, the curricula for each country and university were vectorized, and a Document-Term Matrix (DTM) was created, as shown in Table 1.

Table 1. Curriculums in Document-Term Matrix (University-Term Matrix)

Universities in UK and US	abroad	academic	accounting	action	...	year
Harper Adams University (UK)	0	0	0	0		1
Oxford Brookes University (UK)	0	0	1	0		0
Liverpool John Moores University (UK)	0	1	0	0		0
University of Westminster (UK)	0	0	1	0		0
Birmingham City University (UK)	0	0	0	0		0
University of Reading (UK)	0	0	0	0		0
Sheffield Hallam University (UK)	0	0	0	0		0
Ulster University (UK)	0	0	1	0		0
Nottingham Trent University (UK)	0	1	0	0		0
University of the West of England (UK)	0	0	0	0		0
Northumbria University (UK)	1	1	0	0		2
Royal Agricultural University (UK)	0	1	0	0		0
Leeds Beckett University (UK)	0	0	0	0		0
University College of Estate Management (UK)	0	0	0	0		0
Kingston University (UK)	0	0	1	0		0
Edinburgh Napier University (UK)	0	0	0	0		1
University of Wisconsin-Madison (US)	0	0	2	0		0
University of Pennsylvania (US)	0	0	0	0		0
New York University (US)	0	0	1	0		0
University of Texas at Austin (US)	0	0	0	0		0
University of Georgia (US)	0	0	0	0		0
University of California, Berkeley (US)	0	0	2	0		0
University of Southern California (US)	0	0	1	0		0
Florida State University (US)	0	0	2	0		0
University of Florida (US)	0	0	0	0		0
University of North Carolina at Chapel Hill (US)	0	0	0	1		0
Cornell University (US)	0	0	0	0		0
University of Michigan-Ann Arbor (US)	0	0	1	0		0
Marquette University (US)	0	0	0	0		0
The Pennsylvania State University (US)	0	0	0	0		0
University of Connecticut (US)	0	0	0	0		0
University of San Diego (US)	0	0	2	0		0

Each row in Table 1 is a feature vector representing the curriculum of each university, and the curriculum similarity of the two universities can be calculated by substituting the vectors of the two universities into the following cosine similarity (1).

$$\text{Similarity}_{AB} = \frac{A \cdot B}{\|A\|\|B\|} = \frac{\sum_{i=1}^{n}(a_i \times b_i)}{\sqrt{\sum_{i=1}^{n} a_i^2} \times \sqrt{\sum_{i=1}^{n} b_i^2}} \quad (1)$$

In (1), A and B are feature vectors of the two given universities, and a and b represent each component of vectors A and B. Similarity increases as identical components have the same value, and becomes 0 as they differ. Tables 2 summarizes the list of universities that show the highest similarity to individual universities in the UK and US.

Table 2. Most Similar/Different universities of UK Universities

Universities	Most Similar		Most Different	
	Name	Sim.	Name	Sim.
Harper Adams University (UK)	Nottingham Trent University (UK)	0.761	University of North Carolina at Chapel Hill (US)	0.265
Oxford Brookes University (UK)	Kingston University (UK)	0.820	The Pennsylvania State University (US)	0.123
Liverpool John Moores University (UK)	University College of Estate Management (UK)	0.778	University of California, Berkeley (US)	0.125
University of Westminster (UK)	Oxford Brookes University (UK)	0.748	University of Georgia (US)	0.030
Birmingham City University (UK)	Ulster University (UK)	0.703	University of Pennsylvania (US)	0.105
University of Reading (UK)	Liverpool John Moores University (UK)	0.688	The Pennsylvania State University (US)	0.305
Sheffield Hallam University (UK)	Royal Agricultural University (UK)	0.591	Marquette University (US)	0.184
Ulster University (UK)	Leeds Beckett University (UK)	0.789	University of Florida (US)	0.238
Nottingham Trent University (UK)	Harper Adams University (UK)	0.761	University of North Carolina at Chapel Hill (US)	0.114
University of the West of England (UK)	Leeds Beckett University (UK)	0.737	The Pennsylvania State University (US)	0.101
Northumbria University (UK)	Nottingham Trent University (UK)	0.685	The Pennsylvania State University (US)	0.210
Royal Agricultural University (UK)	Nottingham Trent University (UK)	0.750	University of Florida (US)	0.210
Leeds Beckett University (UK)	Ulster University (UK)	0.789	University of California, Berkeley (US)	0.093
University College of Estate Management (UK)	Liverpool John Moores University (UK)	0.778	University of California, Berkeley (US)	0.104
Kingston University (UK)	Oxford Brookes University (UK)	0.820	Marquette University (US)	0.101
Edinburgh Napier University (UK)	Royal Agricultural University (UK)	0.663	University of Connecticut (US)	0.028
University of Wisconsin Madison (US)	Florida State University (US)	0.862	Leeds Beckett University (UK)	0.194
University of Pennsylvania (US)	Cornell University (US)	0.599	Edinburgh Napier University (UK)	0.090
New York University (US)	University of Reading (UK)	0.646	Sheffield Hallam University (UK)	0.285
University of Texas at Austin (US)	University of North Carolina at Chapel Hill (US)	0.652	Edinburgh Napier University (UK)	0.078
University of Georgia (US)	University of Pennsylvania (US)	0.540	University of Westminster (UK)	0.030
University of California,	Florida State University	0.872	Leeds Beckett University (UK)	0.093

Berkeley (US)	(US)			
University of Southern California (US)	University of Florida (US)	0.739	Birmingham City University (UK)	0.178
Florida State University (US)	University of California, Berkeley (US)	0.872	Leeds Beckett University (UK)	0.189
University of Florida (US)	University of Southern California (US)	0.739	University of Georgia (US)	0.112
University of North Carolina at Chapel Hill (US)	University of Michigan-Ann Arbor (US)	0.665	Nottingham Trent University (UK)	0.114
Cornell University (US)	University of Southern California (US)	0.713	Birmingham City University (UK)	0.207
University of Michigan-Ann Arbor (US)	Cornell University (US)	0.682	The Pennsylvania State University (US)	0.203
Marquette University (US)	Cornell University (US)	0.546	Kingston University (UK)	0.101
The Pennsylvania State University (US)	New York University (US)	0.495	University of the West of England (UK)	0.101
University of Connecticut (US)	Kingston University (UK)	0.548	Edinburgh Napier University (UK)	0.028
University of San Diego (US)	Florida State University (US)	0.823	Liverpool John Moores University (UK)	0.163

As shown in Table 2, the curriculum of every UK university is most similar to that of another UK university and most different from that of a US university. For US universities, except for New York University and the University of Connecticut, the curriculum of each is most similar to another US university and most different from a UK university, with the exceptions of the University of Florida and the University of Michigan. These results confirm that the curricula of universities in the two countries exhibit distinct characteristics.

However, due to cultural and linguistic differences between the UK and the US, there is a possibility that curricula within the same country may show high similarity, while curricula between the two countries may show lower similarity, even when the same subject is labeled with different terms. To minimize the impact of these factors, the analysis was adjusted by standardizing similar words that express the same meaning or topic across both countries' curricula.

Table 3. The clustering results with K-mean algorithms (K = 2, 3, 4)

Universities in UK and US	K = 2	K = 3	K = 4
Harper Adams University (UK)	0	0	0
Oxford Brookes University (UK)	0	0	0
Liverpool John Moores University (UK)	0	0	0
University of Westminster (UK)	0	0	0
Birmingham City University (UK)	0	0	0
University of Reading (UK)	0	0	0
Sheffield Hallam University (UK)	0	1	1
Ulster University (UK)	0	0	0
Nottingham Trent University (UK)	0	0	0
University of the West of England (UK)	0	0	0
Northumbria University (UK)	0	0	0
Royal Agricultural University (UK)	0	0	0
Leeds Beckett University (UK)	0	0	0
University College of Estate Management (UK)	0	0	0
Kingston University (UK)	0	0	0
Edinburgh Napier University (UK)	0	0	0
University of Wisconsin-Madison (US)	0	1	1
University of Pennsylvania (US)	0	1	1
New York University (US)	0	1	1
University of Texas at Austin (US)	0	1	1
University of Georgia (US)	0	1	1
University of California, Berkeley (US)	0	1	1
University of Southern California (US)	1	2	2
Florida State University (US)	0	1	1
University of Florida (US)	0	1	1
University of North Carolina at Chapel Hill (US)	0	1	1
Cornell University (US)	1	2	3
University of Michigan-Ann Arbor (US)	1	2	2
Marquette University (US)	0	1	1
The Pennsylvania State University (US)	0	1	1
University of Connecticut (US)	0	1	1
University of San Diego (US)	0	1	1

As a second approach to identifying differences in real estate education between the UK and the US, clustering was performed using feature vectors from universities in both countries. By analyzing the countries of the universities grouped within the same clusters, the differences in curricula between the UK and US were revealed. While DTM-based clustering is typically used for sentence classification, in this study, it was applied to identify variations in curricula across universities. Clustering was performed with 2, 3, and 4 clusters, and the results are shown in Table 3.

For K = 2, all UK universities and some US universities were grouped into one cluster, indicating a lower ability to distinguish between the curricula of the two countries. For K = 3, all UK universities, except Sheffield Hallam

University, were grouped into a single cluster, while all US universities were divided into the remaining two clusters, clearly highlighting the differences between the real estate programs in UK and US universities. Similarly, for K = 4, UK and US universities, again with the exception of Sheffield Hallam University, were placed in distinct clusters, further confirming that universities in the two countries offer different curricula.

Additionally, when K = 3 and 4 were used, US universities were split across several clusters, suggesting that US institutions tend to operate more independent or varied curricula. In contrast, most UK universities were consistently grouped within the same cluster, indicating that their curricula are more uniform across institutions.

Next, principal component analysis was conducted on the characteristic vectors of universities to visualize differences in real estate education between the UK and the US. Figure 2 presents a graphical representation of 32 universities based on two main components, highlighting the distinct separation between UK and US institutions. Increasing the number of main components to seven achieves a high explanatory power of 72%. Additionally, clustering with K = 3 using the main component values confirms the differences in curriculum between the two countries, consistent with the results in Table 4.

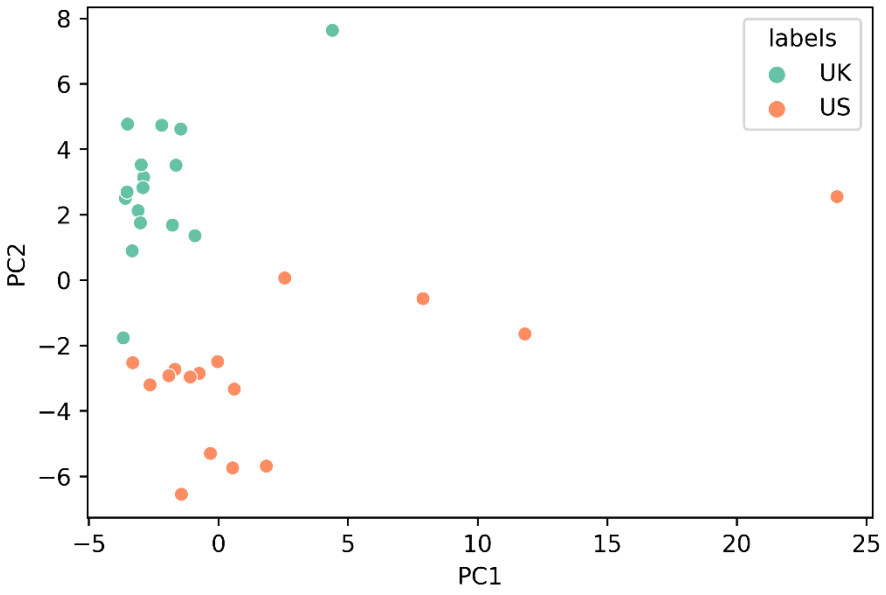

Figure 1. UK and US universities in Principal Component Analysis Domain

The results of the above two quantitative analyzes lead to the same conclusion as the analysis that the UK and US curricula are different through the historical review conducted in (Kim & Pior, 2018).

3.2 Features of UK and US Curriculums: Qualitative Approach

A qualitative analysis of high-frequency words found in the curricula of UK and US universities was conducted. The words from both curricula were sorted by frequency, with the top 20 words listed in Table 4. In the UK curriculum, words such as property, valuation, management, act, law, and practice appeared most frequently, while in the US curriculum, words like finance, analysis, business, development, introduction, and economics were prominent. These findings align with the historical trend where UK education has focused on practical training, while US education has traditionally emphasized investment and finance.

Additionally, nine words were common to both countries' curricula. The educational characteristics of each country can be understood by analyzing the relative frequency of these words. For instance, "law" has a greater presence in the UK curriculum, indicating a stronger emphasis on legal education. In contrast, the word "finance" appears more frequently in the US, reflecting the country's focus on finance-related education. Moreover, words like "development," "plan," and "environment" are similarly weighted in both curricula, indicating that these topics hold comparable importance in both educational systems.

In summary, the UK curriculum is clearly centered on practical education to train professionals like surveyors, while the US curriculum has evolved to emphasize management education rooted in investment and finance.

Table 4. The 20 most common words in UK and US curriculums

No.	UK			US		
	Words	Frequency	Ratio	Words	Frequency	Ratio
1	property	54	6.98%	finance	62	5.92%
2	valuation	47	6.07%	analysis	35	3.34%
3	management	37	4.78%	business	34	3.24%
4	law	33	4.26%	development	33	3.15%
5	practice	31	4.01%	introduction	33	3.15%
6	development	29	3.75%	management	30	2.86%
7	introduction	28	3.62%	urban	28	2.67%
8	plan	23	2.97%	investment	24	2.29%
9	project	22	2.84%	economic	20	1.91%
10	economic	20	2.58%	plan	19	1.81%
11	appraisal	19	2.45%	principle	17	1.62%
12	profession	19	2.45%	construction	15	1.43%
13	investment	17	2.20%	law	15	1.43%
14	environment	16	2.07%	market	15	1.43%
15	construction	15	1.94%	environment	13	1.24%
16	Build	14	1.81%	city	12	1.15%
17	finance	13	1.68%	commercial	12	1.15%
18	technology	13	1.68%	design	12	1.15%
19	building	10	1.29%	accounting	11	1.05%
20	business	10	1.29%	sustainability	11	1.05%

The analysis revealed distinct differences in the curricula of UK and US universities, establishing them as the two primary axes of real estate education. In the next chapter, we will explore the similarities and differences in real estate education at Korean universities, which are relatively new to this field, compared to their counterparts in the UK and US.

4. Korean Universities in the UK-US Domain

In this chapter, we examine the real estate curriculum at korean universities by comparing it with the identified features of UK and US real estate education from the previous chapter. By mapping each Korean university's curriculum within the UK-US framework, we can identify specific characteristics and select the most comparable universities as references for potential curriculum reform. Our analysis focuses on 24 real estate courses offered at four-year universities in Korea (see Table 5). While various curricula are available as minors or vocational programs at other institutions, we believe excluding these offerings will not significantly affect the conclusions of this study.

Table 5. 24 real estate related departments in Korean Universities

No	Name of Universities	Name of Departments
1	Kangnam University	Division of Real Estate and Construction Engineering
2	Gangneung-wonju National University	Department of Urban Planning and Real Estate
3	Kangwon National University	Department of Real Estate
4	Konkuk University	Department of Real Estate
5	Korea Nazarene University	Department of Real Estate
6	Kyungil University	Department of Real Estate and Cadastral Science
7	Namseoul University	Department of Real Estate
8	Dankook University	Department of Real Estate
9	Daegu University	Department of Real Estate and Land Administration
10	Daejin University	Department of Urban and Realty Engineering
11	Dong-Eui University	Department of Real Estate Finance, Asset Management
12	Myongji University	Department of Real Estate
13	Mokwon University	Department of Real Estate Finance Insurance Convergence
14	University of Seoul	Major of Urban Real Estate Planning and Management
15	Semyung University	Department of Real Estate
16	Suwon University	Division of Architecture for Urban Planning & Real Estate Development
17	Youngsan University	Department of Real Estate
18	Jeonju University	Department of Real Estate
19	Jeju International University	Department of Realty Law Administration
20	Changshin University	Department of Real Estate and Finance
21	Cheongju University	Department of Urban Planning and Real Estate
22	PyeongTaek University	Department of Global Urban and Real Estate
23	International University of Korea	Department of Urban Planning and Real Estate
24	Hansung University	Department of Real Estate

For experimental analysis, the english names of courses offered at 24 universities were collected through each department's website, and in cases where English courses were not provided, they were translated by referring to the contents of other courses. First, the top 20 most frequent words for each country in the UK, US, and Korean are extracted as follows.

Table 6. Top 20 most frequent words in UK, US and Korea Curriculums

UK			US			KR		
Words	Freq.	Ratio	Words	Freq.	Ratio	Words	Freq.	Ratio
property	54	6.98%	finance	62	5.92%	theory	100	7.09%
valuation	47	6.07%	analysis	35	3.34%	urban	99	7.02%
management	37	4.78%	business	34	3.24%	practice	71	5.03%
law	33	4.26%	development	33	3.15%	plan	66	4.68%
practice	31	4.01%	introduction	33	3.15%	law	60	4.25%
development	29	3.75%	management	30	2.86%	development	50	3.54%
introduction	28	3.62%	urban	28	2.67%	finance	50	3.54%
plan	23	2.97%	investment	24	2.29%	management	47	3.33%
project	22	2.84%	economic	20	1.91%	design	38	2.69%
economic	20	2.58%	plan	19	1.81%	analysis	37	2.62%
appraisal	19	2.45%	principle	17	1.62%	economic	36	2.55%
profession	19	2.45%	construction	15	1.43%	introduction	36	2.55%
investment	17	2.20%	law	15	1.43%	information	32	2.27%
environment	16	2.07%	market	15	1.43%	investment	30	2.13%
construction	15	1.94%	environment	13	1.24%	land	28	1.98%
build	14	1.81%	city	12	1.15%	policy	27	1.91%
finance	13	1.68%	commercial	12	1.15%	market	26	1.84%
technology	13	1.68%	design	12	1.15%	public	26	1.84%
building	10	1.29%	accounting	11	1.05%	appraisal	24	1.70%
business	10	1.29%	sustainability	11	1.05%	survey	20	1.42%

To understand the similarities and differences in each country's curriculum, we present a Venn diagram in Figure 2, based on a set of 20 frequently used words for each country (see Table 6). Common terms across all three countries include "development," "economic," "finance," "introduction," "investment," "law," "management," and "plan," which are fundamental to real estate education. Additionally, terms like "appraisal" and "practice" are shared by the UK and Korea, while "analysis," "design," "market," and "urban" appear in both the US and Korea. This suggests that the Korean curriculum may have been shaped by UK practices and US analysis and market-oriented education.

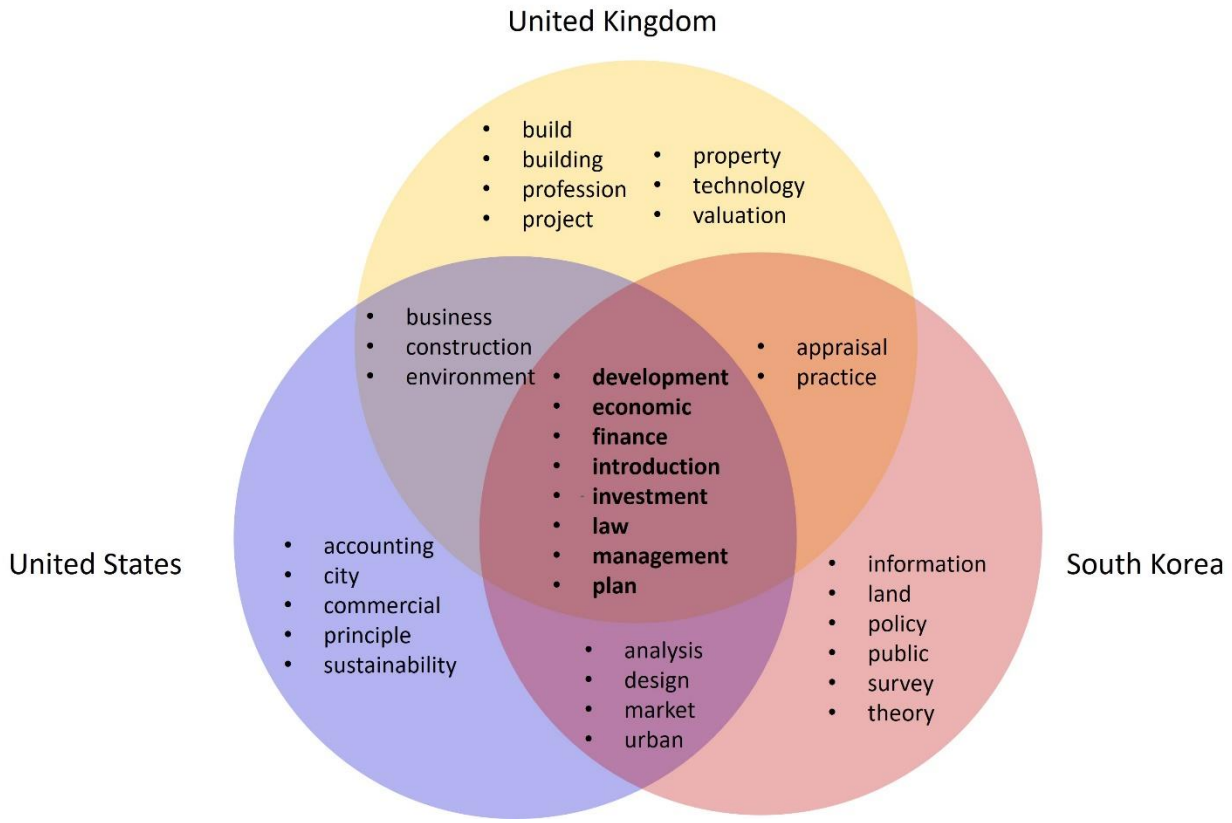

Figure 2. Venn Diagram for the top 20 words in UK, US, and Korea Curriculums

Finally, words unique to each country include "build," "building," "profession," "project," "property," "technology," and "valuation" for the UK; "accounting," "city," "commercial," "principle," and "sustainability" for the US; and "information," "land," "policy," "public," "survey," and "theory" for Korea. These findings indicate that the UK curriculum emphasizes asset valuation, the US focuses on technology for business, and Korea highlights information, policy, and theory.

Next, we will calculate the similarity between the curriculum of each Korean university and those of the UK and US, plotting these results in the UK-US domain using x and y coordinates. This analysis aims to assess whether the curriculum at each Korean university aligns more closely with that of the UK or the US, or if it exhibits unique characteristics.

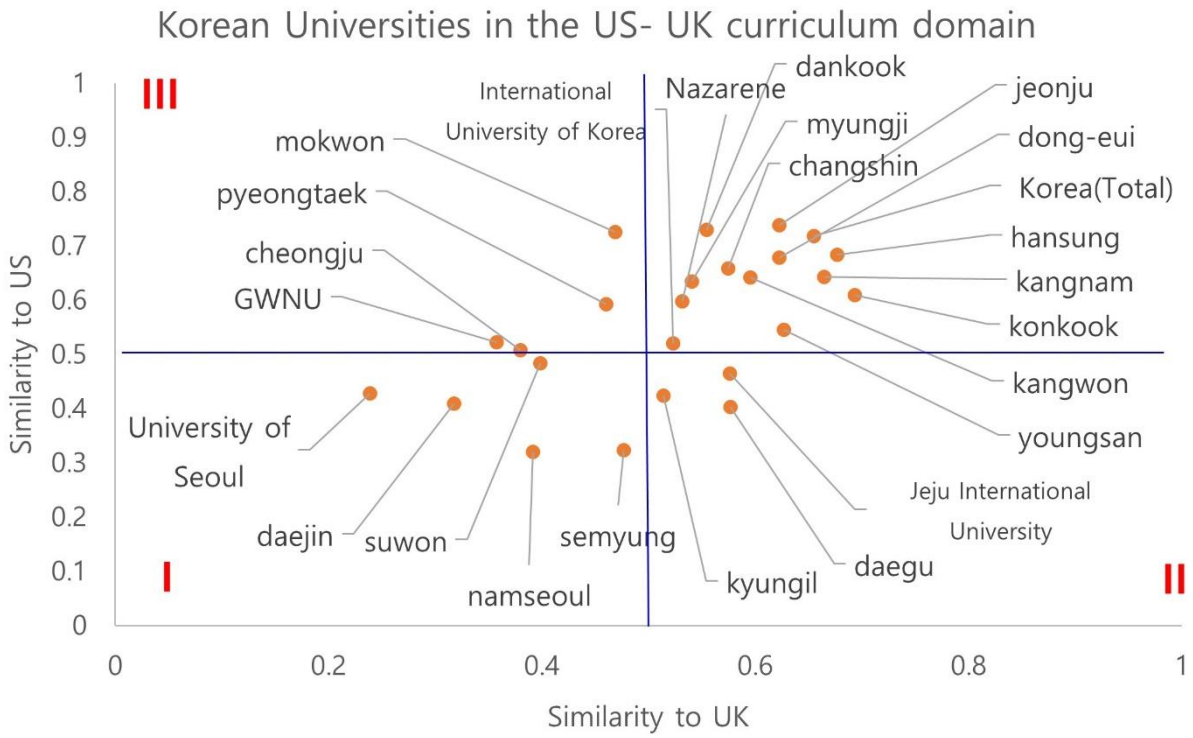

Figure 3. Korean Universities in the UK-US domain

In the graph above, the four areas are categorized as follows: UK-US independent (Area I), UK dependent (Area II), US dependent (Area III), and UK-US dependent (Area IV). The coordinates illustrate each university's curriculum similarity to those of the UK and US. From this graph, we observe that "Jeju International University" and "Daegu University" have curricula resembling those of the UK, while "Monwon University" and "Pyeongtaek University" align more closely with the US. Additionally, "Konkook University," "Kangnam University," "Hansung University," and "Jeonju University" reflect elements from both UK and US curricula. Conversely, "University of Seoul," "Daejin University," and "Namseoul University" exhibit curricula that differ from both the UK and US standards.

The overall similarity of the Korean real estate curriculum with the UK curriculum is 0.655068, while the similarity with the US curriculum is 0.718018, both of which are notably high (see Korea (total) in Figure 3). This indicates that the Korean real estate curriculum represents an eclectic blend of both national systems. These findings support the previous study's assertion that Korean real estate education has evolved into a compromise between UK and US models since its inception in 1950. Moreover, Korean universities can be classified into 13 eclectic types, 4 UK types, 3 US types, and 5 independent curricula, highlighting the overall eclectic nature of the system while also offering a diverse range of programs.

5. Reference Universities for Korean Universities

Table 7 illustrates which UK or US university has the most similar curriculum to each korean university, as well as which university has the most different curriculum. The number in parentheses next to each university's name indicates the level of similarity in their courses. These insights enable individual Korean universities to identify opportunities for curriculum improvement by closely examining the educational goals and curricula of both the most similar and the most different institutions.

Table 7. Reference universities for Korean Universities

Korean Universities	References (Most Similar / Most Different)
kangnam	University of Reading (0.606) / University of Florida (0.137)
GWNU	University of North Carolina at Chapel Hill (0.534) / The Pennsylvania State University (0.091)
kangwon	University of Southern California (0.555) / University of Georgia (0.209)
konkook	Oxford Brookes University (0.6) / University of Florida (0.178)
kyungil	Oxford Brookes University (0.281) / University of California, Berkeley (0.053)
Nazarene	University of San Diego (0.695) / Birmingham City University (0.15)
dankook	Harper Adams University (0.678) / Sheffield Hallam University (0.272)
daegu	Kingston University (0.573) / University of California, Berkeley (0.071)
daejin	University of Southern California (0.4) / University of Georgia (0.077)
dong-eui	Ulster University (0.574) / University of Florida (0.101)
myungji	University of Southern California (0.618) / The Pennsylvania State University (0.207)
mokwon	University of San Diego (0.461) / Edinburgh Napier University (0.08)
UOS	University of North Carolina at Chapel Hill (0.476) / University of San Diego (0.104)
semyung	Kingston University (0.582) / The Pennsylvania State University (0.08)
suwon	University of Southern California (0.536) / Birmingham City University (0.068)
youngsan	Oxford Brookes University (0.559) / University of California, Berkeley (0.158)
jeonju	Harper Adams University (0.563) / Edinburgh Napier University (0.251)
JIU	Oxford Brookes University (0.554) / University of Florida (0.144)
changshin	University of Connecticut (0.617) / Edinburgh Napier University (0.159)
NSU	Royal Agricultural University (0.314) / Marquette University (0.036)
cheongju	University of North Carolina at Chapel Hill (0.494) / University of Georgia (0.113)
pyeongtaek	University of Michigan-Ann Arbor (0.488) / Florida State University (0.126)
IUK	Oxford Brookes University (0.48) / University of California, Berkeley (0.139)
hansung	Harper Adams University (0.509) / University of California, Berkeley (0.202)

For instance, Nazarence University features frequently used terms like "practice," "finance," "business," "law," and "principle" in its curriculum. Its closest counterpart, the University of San Diego, includes "finance," "business," "principle," "management," and "commercial." If Nazarence University aims to align its curriculum more closely with that of the University of San Diego, it would be beneficial to incorporate courses focused on "management" and "commercial." Conversely, Birmingham City University, which has the most dissimilar curriculum, emphasizes terms such as "property," "build," "environment," "introduction," and "law," which are less prevalent in Nazarence University's offerings. Using this foundational data, Nazarence University could innovate its curriculum by adding courses related to "property," "build," and "environment," or it might choose to reinforce its current educational approach by removing less relevant courses. In this manner, universities can identify their closest and furthest counterparts, analyze their curricula, and determine strategic directions for curriculum development.

6. Conclusions

This study introduced a text mining-based analysis methodology aimed at assessing the current state and development direction of real estate education in Korean universities. Initially, text data from UK and US curricula were analyzed through frequency analysis, similarity analysis, and clustering to identify the characteristics and differences in real estate education between the two countries. Following this, a similar analysis was performed on the curricula of Korean universities, confirming that Korean real estate education represents a compromise between the UK and US frameworks.

Furthermore, by identifying universities with the most similar and most different curricula, this study highlights areas where Korean programs may lack and where future improvements are needed, providing a basis for curriculum reform. The text data-based evaluation method developed here can be adapted to other topics and subjects, and for more in-depth analysis, further research into methods using hypernym-hyponym relationships or representative terms is recommended(Ferrucci, 2022).

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