

Analysis of National Early Childhood Curriculum in South Korea and Sweden through the Perspective of ESD

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Abstract

This study aims to analyze the national early childhood curricula of South Korea and Sweden through the perspective of education for sustainable development (ESD) and determine the ways of implementing ESD into the curriculum of South Korea. Therefore, frequency-inverse document frequency and network analysis are conducted on the texts of South Korea's 'Nuri curriculum' and Sweden's 'Curriculum for Preschool Lpfö 98' using the R program. The results are as follows: First, South Korea's curriculum emphasizes attitudes and values, while the Swedish curriculum focuses on practice and action. This highlights the need to add action- and practice-oriented dimensions to the contents of South Korea's curriculum. Second, the analysis of the degree centrality reveals that, in South Korea, the network takes the form of an intensive connection. In contrast, in Sweden, the network has a wide distribution of words from the socio-cultural, economic, and environmental sectors. This difference suggests that the contents of ESD should be reinforced in South Korea through an integrated approach. Third, South Korea's contains texts related to students' interactions with others, while Sweden's highlights agency. This suggests that South Korea's curriculum needs to be redesigned to emphasize agency to find an effective way of connecting it to ESD.

Keywords : ESD (Education for sustainable development), Network analysis, Curriculum, Early childhood education

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Introduction

Nowadays, our society looks to sustainable development (SD) as a solution to unpredictable changes and complex problems. In 2015, the United Nations (UN) declared 17 sustainable development goals (SDGs) in its ‘2030 Agenda for Sustainable Development.’ The Organization for Economic Cooperation and Development (OECD, 2018) emphasized sustainability as a core competence of the future society in ‘Education 2030 project.’ According to this agenda, South Korea established a presidential commission on sustainable development and 17 Korean SDGs (Ministry of Environment of South Korea, 2019). As part of humanity's collective effort to address the threat to our planet, SD addresses socio-cultural, economic, and environmental challenges (Shin & Park, 2012).

The international community considers the promotion of education for sustainable development (ESD) as a core value, which must start in early childhood. The UN designated the United Nations Educational, Scientific and Cultural Organization (UNESCO) as the educational institute for SD. UNESCO (2005) defined ESD as education toward a sustainable future and society, which allows students to learn behaviors, values, and lifestyles. The Gothenburg Recommendations on Education for Sustainable Development officially specified that ESD must start in early childhood (Davis et al., 2008). Therefore, there is an international consensus on the importance of ESD during early childhood.

In particular, the core principles and contents of ESD highlight its importance. ESD focuses on promoting changes in personal beliefs and attitudes towards life beyond knowledge acquisition through curriculum (Shin & Park, 2012; UNESCO, 2005). Therefore, early childhood, which provides the foundation for understanding and valuing life, is considered a crucial period to start ESD (Li et al., 2021; Yoo et al., 2015). The goals, principles, domains, and contents of ESD reflect its orientation towards promoting an understanding of SD while also nurturing the capacity to achieve it (UNESCO, 2005). By applying ecological, ethical, and political principles, ESD aims to foster changes in attitudes towards life beyond the ecological dimension. The contents of ESD are composed of three pillars, viewed from a social, economic, and environmental perspective (Shin & Park, 2012; UNESCO, 2005). The social pillar encompasses human rights, peace and security, cultural diversity, and international responsibility. The environmental pillar covers topics such as

energy, climate change, environmental problems, and sustainable local communities. Finally, the economic pillar encompasses sustainable production and consumption, corporate sustainability, market economy, and poverty reduction (Engdahl & Rabusicova, 2010; Shin & Park, 2012; UNESCO, 2005). In summary, ESD aims to promote changes in attitudes towards life and emphasizes the importance of early childhood in fostering attitudes and capacities that go beyond the conceptual understanding of SD.

Many academic discussions about the actual implementation of ESD have already taken place in light of its significance. Subsequent studies have examined the theories, concepts, direction of SD (Kwon, 2009; Pearson & Degotardi, 2009; Shin & Park, 2012), awareness, the actual reality of ESD (Anderson & Tate, 2014; Asano, 2011; Baik et al., 2014; Korean Institute of Child Care Education [KICCE], 2020a; Kim & Kim, 2019), ESD's future research directions (Davis, 2009; Hedefolk et al., 2015; Lee & Kim, 2021; Seo & Cho, 2015), different educational programs and cases (Kwak et al., 2013; Park & Park, 2014; Yu, 2014), South Korea's Early Childhood Curriculum and the correlation between different curricula and ESD (Choi & Jang, 2014; KICCE 2020a; Kim et al., 2013; You, 2016; Yoo et al., 2013a), and more. These research studies have emphasized the necessity to reflect on children's attitudes and capacities to think and act subjectively on sustainability beyond their intellectual comprehension by tying it to the national educational curriculum in order to effectively practice ESD during early childhood.

However, there are some differences in the way the program is implemented across countries. Sweden, the UK, and New Zealand cover ESD in their national curricula (Car & West, 2015; Korea International Cooperation Agency [KOICA], 2018; Lindberg, 2015). On the other hand, South Korea and Japan conduct ESD as field-centered (Hedefolk et al., 2014; Seo & Cho, 2015; Wals, 2012/2013). It is noteworthy that the former group of countries achieves the highest scores of the Inter-agency and Expert Group's (IAEG) SDGs (Ministry of Foreign Affairs of South Korea, 2017; Sachs et al., 2022). In contrast, South Korea achieves mid-range values for the same indicator, even though it has adopted a multidimensional approach to ESD (KOICA, 2018). This emphasizes the necessity to analyze the national educational curriculum of nations with high assessment scores in order to draw conclusions about the integration of educational curricula that reflect the principles of ESD.

Sweden ranks first out of 157 countries in fulfilling the UN's SDGs (KOICA, 2018).

Sweden hosted the UN Conference on the Human Environment, which adopted the 1972 Stockholm Declaration. The latter emphasized the importance of environmental education in order to solve some of mankind's problems. The long history of Sweden's SD dates back to the time of emergence of SD. Moreover, the country supports preemptive ESD at the national level. The Swedish government established the Swedish International Center of Education for Sustainable Development in 2008. In 2010, it adopted the New Education Act, which seeks to promote SD through the entire curriculum and encourages the solid operation of ESD at the national level. Therefore, an analysis of Sweden's educational curriculum, which plays a leading role in ESD, would provide insights for its meaningful approach in early childhood in South Korea by figuring out how its principles and contents are connected with Sweden's early childhood education curriculum.

In line with these goals, this study aims to analyze the national curriculum texts of Sweden and South Korea through the perspective of ESD. The principles of ESD are used as a basis for comparing and analyzing. Furthermore, a term frequency–inverse document frequency (TF–IDF) analysis and a network analysis method are utilized as the analysis method. These analysis methods are a sort of big data analytic technique that applies an automated algorithm to atypical and huge text data, such as those for policy and speech, and derives valuable knowledge and meanings (Noh et al., 2019; Reed, 2022). So far, curricula have been analyzed using traditional methods of content analysis, which make it possible to classify and compare different texts based on specific standards. Meanwhile, it can be affected by the researcher's subjective interpretations, which in turn could limit our understanding of the subject's general meaning (Kim, 2024; Kim & Jhun, 2021). The TF–IDF analysis and the network analysis remove the risk of such interventions by applying an automated algorithm. It can be used to analyze very lengthy texts, the importance of different pieces of text, the meaning of spacing between the lines, and the connections between different texts in a comprehensive and effective manner.

This study conducts both TF–IDF and network analyses. The TF–IDF analysis can figure out the core words by establishing a matrix from the complex frequency of each text unit. The network analysis method can elucidate structural relationships between keywords and the overall text, based on the frequency with which specific text appears in the two countries' curricula. Furthermore, it can identify the intellectual structure of the subjective text and help to understand the relationships between each word and the overall text structure (Han & Park,

2020; Park & Kim, 2024). Combined, the two analyses can compare the correlations between the two countries' curricula and ESD by analyzing each text's keywords and structure. The analysis early childhood curricula of Sweden and South Korea allows researchers to use novel methods to generally and objectively examine their characteristics from an international perspective.

In summary, this study presents an analysis of South Korea's and Sweden's early childhood education curricula through the perspective of ESD using the TF-IDF and network analyses. The latter can suggest effective ways to invigorate ESD on early childhood education of South Korea. This study compared the early childhood curricula of Sweden and South Korea in terms of: 1) word frequencies; 2) networks, including the degree centrality networks and the betweenness centrality networks.

Method

Research Subject and Data Collection

In this study, the texts of the national early childhood curriculum in South Korea and Sweden were analyzed. Therefore, the entire texts of the national early childhood curricula in both countries, including the characteristics, sections, and objectives, are collected, as shown in Table 1.

As shown in Table 1, this study analyzed the professional texts of South Korea's "Guide on the 2019 Revised Nuri Curriculum" (hereinafter, Nuri curriculum) (Ministry of Education and the Ministry of Education of South Korea, 2019), parts II and III, and Sweden's "Curriculum for the Preschool Lpfö 98" (Skolverket, 2010), chapters 1 and 2, which describe the general instruction, direction, objectives, and content of the early childhood curriculum.

First of all, the Nuri curriculum, which is the national curriculum for kindergarten and childcare centers for children aged 3 to 5 in South Korea, has been revised in 2019, seven years after its establishment in 2012. Its contents are explained based on the purpose of the revision in the 'Guide on Nuri Curriculum 2019', which has the characteristics of a curriculum document. Therefore, it was selected as the target document for analysis in this study. This document contains an explanation of the Nuri curriculum, its nature, and its

Table 1. *The collected text data of the two countries' early childhood curricula*

		Content area	Pages	Words
Nuri Curriculum	Part II.	Interpretation of General Instruction	28	6,555
		Understanding 5 content areas of the Nuri Curriculum	3	1,409
		1. Physical Activities & Health	9	3,806
	Part III.	2. Communication	9	2,489
		3. Social Relationships	10	2,743
		4. Artistic Experiences	10	2,951
		5. Nature Exploration	15	3,275
		Total	84	23,228
		Content area	Pages	Words
Curriculum of Preschool Lpfö 98		1. Fundamental values and tasks of the preschool	5	2,022
		2.1. Norms and Values	1	283
		2.2. Development and Learning	3	882
		2.3. Influence on the Child	1	239
		2.4. Preschool and Home	1	228
		2.5. Co-operation among the Preschool Class, School, and the Leisure-Time Center	1	177
		2.6. Follow-up, Evaluation, and Development	2	617
		2.7. Responsibility of the Head of the Preschool	1	268
		Total	15	3,916

Source: Reclassified based on the Ministry of Education of South Korea (2019); Skolverket (2010)

overall objectives and content by area. Specifically, part II, “Interpretation of General Instruction,” is composed of 6,555 words in 28 pages, while part III, “Interpretation of Goals and Contents by Content Area,” is composed of 1,409 words in three pages for each of the five areas: 1,409 words in three pages for the “Physical Activities and Health” area, 3,806 words in nine pages for the “Communication” area, 2,489 words in nine pages for the “Social Relationships” area, 2,743 words in 10 pages for the “Artistic Experiences” area, and 3,275 words in 15 pages for the “Natural Exploration” area. In part III, which describes the content of each area, examples of children’s playing moments are provided for each objective and content category, and a page is provided for each area to help integrate understanding between areas. The text data collected on South Korea’s Nuri curriculum includes a total of 23,228 words in 84 pages.

Sweden currently follows the “Curriculum for the Preschool Lpfö 98” (hereinafter, the Swedish curriculum) as its national early childhood curriculum (Skolverket, 2010). It was revised in 2010 as a national integrated education curriculum document for 1–5-year-old preschool education and childcare. This document includes the fundamental values and tasks of preschool education, as well as objectives and guidelines for each of the seven curriculum areas. “1. Fundamental values and tasks of preschool” consists of 2,022 words in five pages, while “2. Goals and Guidelines” consists of seven areas. Each area is as follows: the “Norms and Values” area has 283 words in one page, the “Development and Learning” area has 882 words in three pages, the “Influence of the Children” area has 239 words in one page, the “Preschool and Home” area contains 228 words in one page, the “Co-operation between the Preschool Class, School and Leisure-time Centre” area has 177 words in one page, the “Follow-up, Evaluation, and Development” area has 617 words in two pages, and finally, the “Responsibility of the Head of the Preschool” area consists of 268 words in one page. The Swedish curriculum specifies goals and guidelines for each area, but unlike South Korea's Nuri curriculum, it does not provide specific examples of play or integrated explanations between areas and is structured in a more concise format. The text data collected for this study from the Swedish curriculum document consists of a total of 3,916 words in 15 pages.

Analytical Procedures

In this study, TF-IDF and network analyses are conducted. The overall analyses relied on the R v4.2.1 program. Figure 1 presents a schematic representation of the analytical procedures in order of their implementation.

Step 1: Data collection

As Fig. 1 indicates, the analysis proceeded in three steps. The first step consisted of data collection and analysis unit setup. Researchers collected all national curriculum texts from the two countries between December 5, 2021, and August 5, 2022, identifying each curriculum's latest edition using a PDF file of each text's English version. Researchers eliminated the titles and spaces to leave only words from the curricula texts using the

Microsoft Word 2020 program. Researchers then checked the raw data against the original PDF files in order to ensure that there were no missing words. Through this process, 23,228 words from the Nuri curriculum and 3,917 words from the Swedish curriculum were collected as raw data.

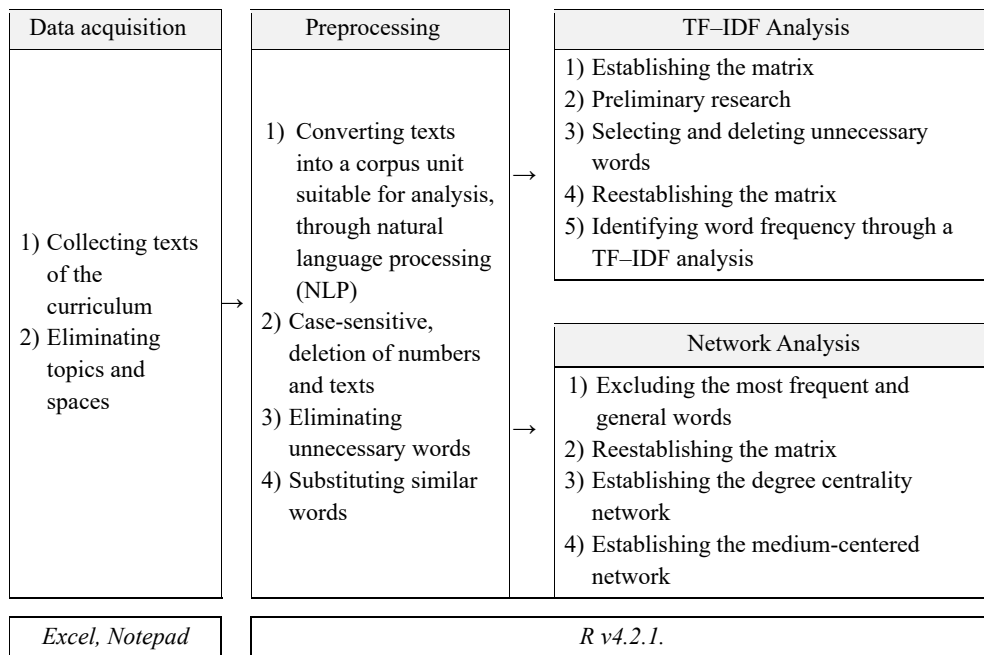


Figure 1. Analytical Procedures of the TF-IDF and Network Analyses

Step 2: Preprocessing

Before conducting preprocessing and analysis, it is necessary to define the unit of analysis for the collected data. In this study, researchers analyzed the text data by setting words as the unit of analysis to reveal the underlying structure of the text. The words in the collected data are atypical (natural language), so they need to be programmed in a format that computers can recognize before preprocessing and analysis. In this study, data coding was performed using R v4.2.1 programming to convert the data into a form recognizable by computers, followed by preprocessing. First, any special texts, text symbols, or numbers were deleted. All upper-case letters in the Swedish curriculum were converted into lower-case, and

subsequently conjunctions, modifiers, and other meaningless words were deleted. All words utilized as forms of the part of speech, such as a noun, an adjective, etc., were substituted for the infinitives of the corresponding words. For example, the word “develop” is used instead of the words “developing” and “developed.” For clear analysis, word substitution is necessary (Noh, 2019), but minimizing substitution operations was prioritized to avoid compromising the text structure. Through this process, as for the Nuri curriculum, 17,333 words were excluded. As a result, of the 23,228 words initially collected, the 5,895 remaining words were used as the final target words for analysis. In the Swedish curriculum, 1,396 words were excluded. Thus, of the 3,917 words initially collected, the remaining 1,396 words were used as the final target words for analysis.

Step 3-1: TF-IDF analysis

TF-IDF analysis can identify keywords by adding their values to the frequency of text per unit document and calculating their complex frequency. This analysis offers the value added to the TF (term frequency), with which words appear in the document, and multiplies the IDF (inverse document frequency) that the corresponding words are not found in other documents to identify keywords. When words' TF-IDF values converge to 1, they are considered keywords. In this study, researchers conducted analysis based on a single document, which is the education curriculum. Therefore, researchers regarded one paragraph that contains one single meaning (National Institute of Korean Language, n.d.) as a single document unit and performed TF-IDF analysis for each paragraph based on the words used to describe the education curricula of both countries.

Step 3-2: Network analysis

Network analysis is used to deduce the semantic structure of a text by establishing the relationship between different sections of texts in atypical documents (Kim & Kim, 2016). Researchers analyzed the curriculum's degree and betweenness centrality to identify the relationship between the keywords in each document. The degree centrality is an indicator that measures the most basic centrality of words. It calculates centrality based on the number

of nodes directly connected to the network, assuming that each word is a node. Specifically, the degree centrality measures the number of connected nodes. Words with a high degree centrality are locally important and contain the meaning of the analyzed texts (Kim & Kim, 2016; Noh et al., 2019). The betweenness centrality determines the degree to which the corresponding node plays the role of a mediator in the network. Here, the corresponding node measures the degree to which different words are connected. Words with a high betweenness centrality connect the words in a text, regardless of the word frequency that shapes the network structure (Kim & Kim, 2016, Noh et al., 2019).

Prior to network analysis, the words are re-examined to ensure the validity of the analysis results. This is because commonly used words that have excessively high frequencies or words with very low frequencies can hinder the understanding of the network structure and the production of meaningful results (Choi, 2019; Han & Park, 2020). In this study, both “children” and “curriculum,” which scored the highest frequency in the preliminary pilot TF–IDF analysis, are eliminated as the most used and generic words. Researchers then selected the words in terms of frequency and reconstructed the matrix to conduct network analysis.

Results

Word Frequencies in South Korea’s and Sweden’s Early Childhood Curricula

TF–IDF is conducted to calculate the word frequency of the final set of 5,895 words in the Nuri curriculum and 1,396 words in the Swedish curriculum. Table 2 shows the top 10 words with the highest frequency in each country’s curriculum.

The most used word in South Korea’s curriculum was ‘diversity’ (24 times, 22.22%), followed by ‘narrative’ (13 times, 12.04%), ‘enjoy’ (11 times, 10.19%), and ‘plants and animals’ (10 times, 9.26%). The results of the TF–IDF analysis show that the word ‘diversity’ has the highest frequency of emergence and is a crucial keyword in South Korea’s curriculum. Meanwhile, the word with the highest frequency of emergence in the Swedish curriculum for the Preschool Lpfö 98 was ‘develop’ (107 times, 17.89%), followed by ‘learn’ (56 times, 9.36%), ‘work’ (41 times, 6.85%), ‘ability’ (38 times, 6.35%), and ‘well’ (31 times, 4.01%).

The results indicate ‘develop’ as the most crucial keyword in the Swedish curriculum for the Preschool Lpfö 98.

Table 2. *Word frequencies in South Korea’s and Sweden’s early childhood curricula*

Rank	Nuri curriculum (<i>n</i> = 5,895)		Curriculum of Preschool Lpfö 98 (<i>n</i> = 1,396)	
	Word	Frequency (%)	Word	Frequency (%)
1	Diversity	24 (22.22)	Develop	107 (17.89)
2	Narrative	19 (17.59)	Learn	56 (9.36)
3	Value	13 (12.04)	Work	41 (6.85)
4	Enjoy	11 (10.19)	Ability	38 (6.35)
5	Plants and Animals	10 (9.26)	Well	31 (5.18)
6	Beauty	8 (7.41)	Opportunity	24 (4.01)
7	Community	6 (5.56)	Knowledge	23 (3.84)
8	Pleasure	6 (5.56)	Understand	23 (3.84)
9	Interaction	5 (4.63)	Activity	21 (3.51)
10	Curiosity	5 (4.63)	Provide	21 (3.51)

The most used words in each curriculum accounted for 22.22% and 17.59% of words, respectively. In Sweden, the top 3–10 words score approximately 5% each, while in South Korea, all words in the top 2–5 achieve rate of more than 10%. This means that compared to its Swedish counterpart, South Korea’s curriculum puts a heavier emphasis on keywords.

Networks of South Korea’s and Sweden’s Early Childhood Curricula

The network analysis is conducted on the target words of South Korea’s and Sweden’s early childhood curricula to calculate their degree centrality and betweenness centrality and to identify the text networks. The following section presents the results.

Degree Centrality Networks of South Korea’s and Sweden’s Early Childhood Curricula

Table 3 shows the top 5 words based on the degree centrality analysis of the curricula in both countries. Figure 2 plots the degree centrality networks of the two countries’ curricula.

Table 3. Degree Centrality of the Two Countries' Early Childhood Curricula

Nuri curriculum			Curriculum of Preschool Lpfö 98		
Rank	Word	Degree Centrality	Rank	Word	Degree Centrality
1	Respect	20.1214	1	Ability	16.6712
2	Difference	16.7883	2	Use	16.5671
3	Feeling	16.5602	3	Can	16.2331
4	Think	16.5323	4	Environment	14.8916
5	Emotion	12.3341	5	Opportunity	14.5523

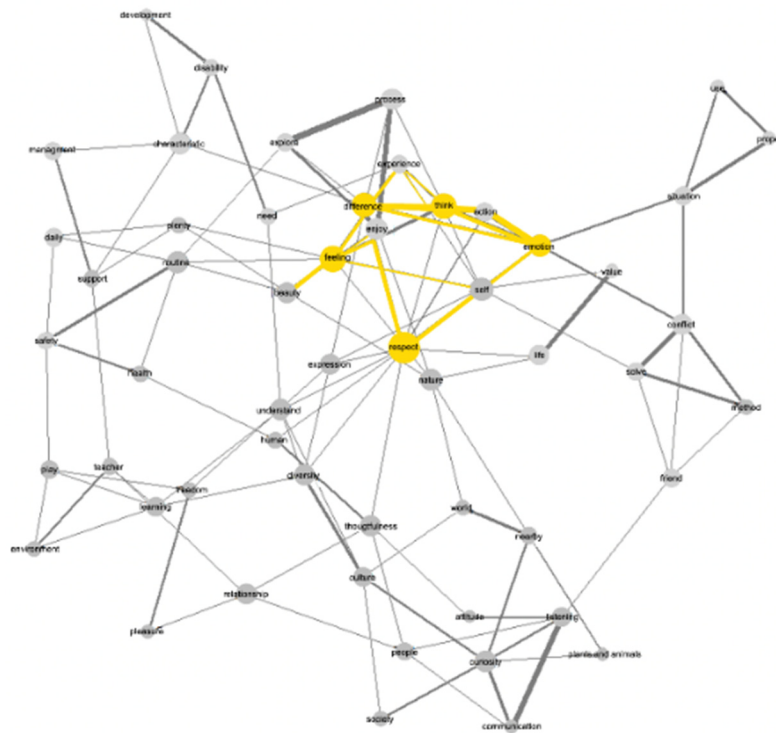


Figure 2. Degree Centrality Networks of Nuri curriculum of South Korea

Degree centrality is the extent to which a specific word is directly connected to other words and represents the centrality in the text network. A high degree centrality implies that the word plays an important role in forming meaning in the text network (Lee, 2012). Comparing the words with high degree centrality in the texts of the two countries' early childhood

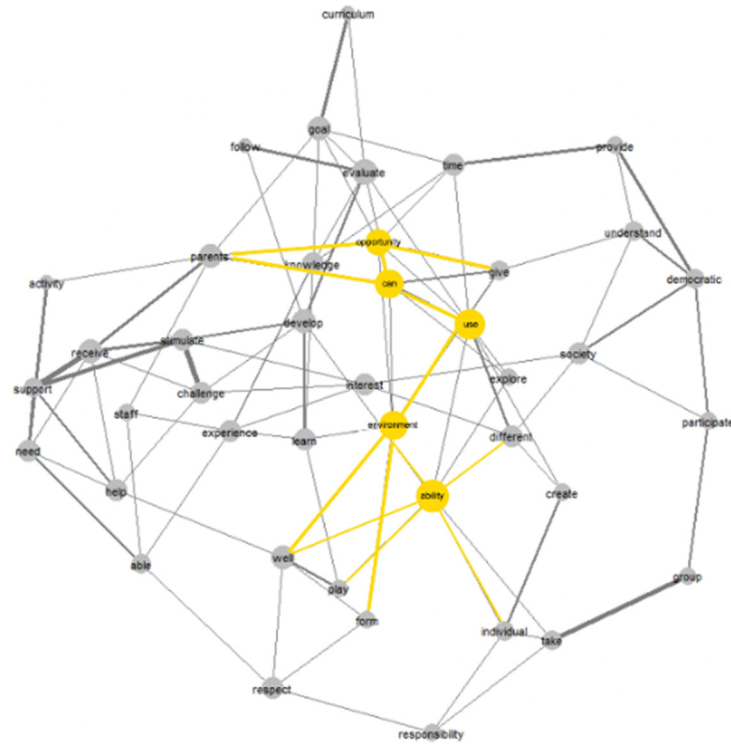


Figure 3. Degree Centrality Networks of Curriculum of Preschool Lpfö 98 of Sweden)

education curricula, Table 3 demonstrates that ‘respect’ (20.1214), ‘difference’ (16.7883), ‘feeling’ (16.5602), ‘think’ (16.5323), and ‘emotion’ (12.3341) achieve the highest rates in South Korea, while ‘ability’ (16.6712), ‘use’ (16.5671), ‘can’ (16.2331), ‘environment’ (14.8916), and ‘opportunity’ (14.5523) achieve the same for Sweden. This means that South Korea’s curriculum emphasizes respect, difference, feeling, thought, and emotion, whereas the Swedish Curriculum for Preschool Lpfö 98 highlights ability, use, can, environment, and opportunity. Comparing the two countries’ values of degree centrality reveals that Sweden’s is somewhat lower than South Korea’s. This means that in Sweden, multiple words account for a lot of the relationships, while in South Korea, the intensive network focusses on keywords.

South Korea’s degree centrality network in Fig. 2 shows that the shape is centered around the top five words in the middle of the network: respect-difference-feeling-thought-emotion.

The clusters: health-safety-life, narrative-listening-attitude, conflict-solving-method, nature-life-importance, concern-surrounding-world-culture, and beauty-feeling-enjoying also form a small network. This means that the network of the top words related to South Korea's degree centrality contains the meaning of the country's curriculum. Meanwhile, the network of the text of the Swedish curriculum shows that the links among the other words (not the top 5 words). The most used 'ability' is linked through many slim links compared to 'respect', the most-used South Korean word. In the case of Sweden, the network links are distributed more dispersedly. The words 'take-group-participate-democratic-provide', which are related to the text's degree centrality and fall outside the network, are linked to the words 'support-receive-stimulate-challenge-interest' in the opposite end of the network. Similarly, the words 'responsibility-respect-well' are linked to the nodes 'society' and 'environment' via the node 'ability.' In this context, the nodes show the links in the dispersedly distributed position. Thus, the keywords in the Swedish curriculum assume a less important ratio compared to those in South Korea's curriculum. Nevertheless, they do exert an influence on a larger circle.

Betweenness Centrality Networks of South Korea's and Sweden's Early Childhood Curricula

Table 4 presents the top 5 words based on the betweenness centrality analysis of the curricula in both countries. Figure 3 plots the betweenness centrality network of the two countries' curricula.

Table 4. *Betweenness Centrality of the Two Countries' Early Childhood Curricula*

Nuri curriculum			Curriculum of Preschool Lpfö 98		
Rank	Word	Betweenness Centrality	Rank	Word	Betweenness Centrality
1	Respect	.6649	1	Ability	.3459
2	Difference	.4199	2	Can	.2060
3	Emotion	.3879	3	Use	.1968
4	Feeling	.3441	4	Well	.1933
5	Understand	.3329	5	Parents	.1842

Betweenness centrality is measured by the degree to which a particular word is positioned between other words in the network. The higher the betweenness centrality, the more the particular word is positioned on the shortest link that connects two other words. This means that a high level of betweenness centrality can be interpreted as having an impact on the flow of meaning in the text network (Lee, 2012). Table 4 shows that the top five words with the highest betweenness centrality in South Korea are ‘respect’ (0.6649), ‘difference’ (0.4199), ‘emotion’ (0.3879), ‘feeling’ (0.3441), and ‘understanding’ (0.3329). In Sweden, ‘ability’ (0.3459), ‘can’ (0.2060), ‘use’ (0.1968), ‘well’ (0.1933), and ‘parents’ (0.1842) show the highest rates. These words mediate the meaning of other words in the structure of the curriculum. Based on these results, it can be concluded that the Nuri curriculum uses the words respect, difference, emotion, feeling, and understanding, and the Swedish curriculum employs the words: ‘ability’, ‘can’, ‘use’, ‘well’, and ‘parents’ to link the meaning of the curriculum texts. The value of betweenness centrality in South Korea is double that of

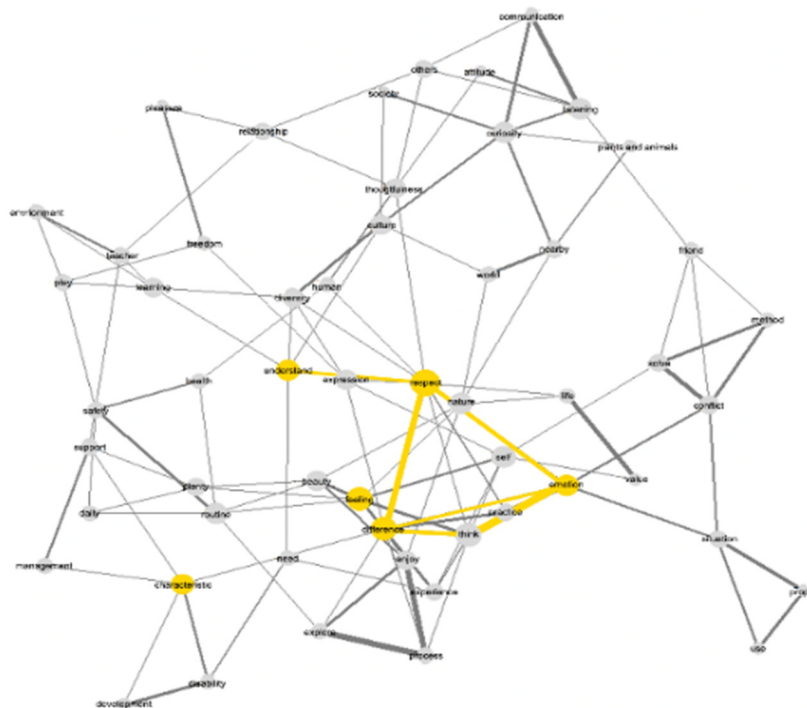


Figure 4. Betweenness Centrality Networks Nuri curriculum

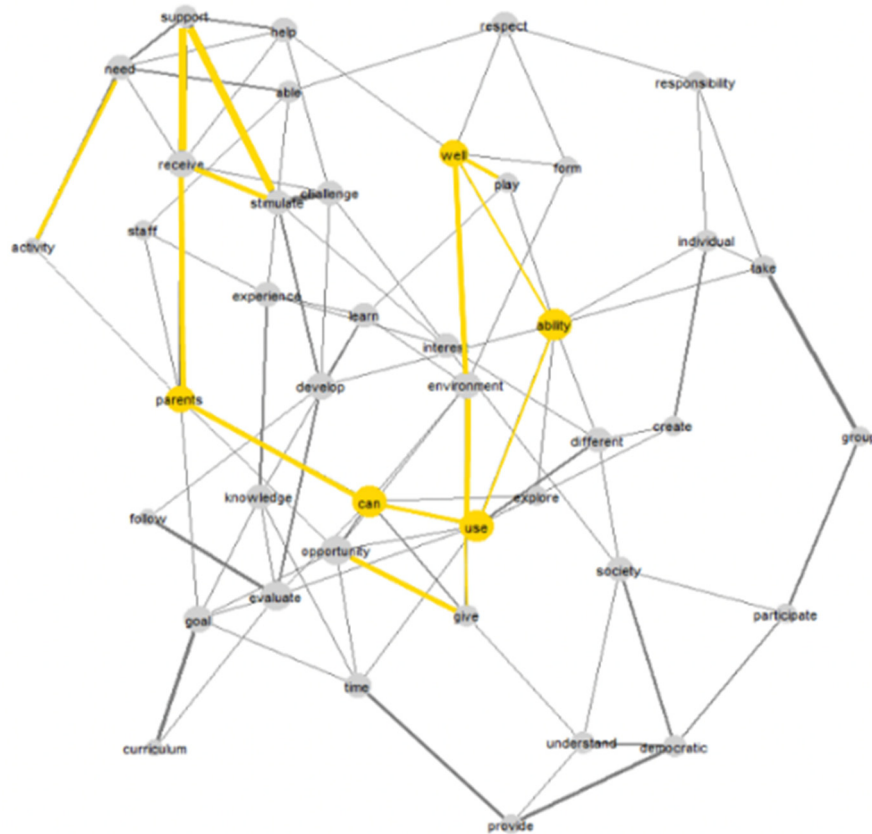


Figure 5. Betweenness Centrality Networks of Curriculum of Preschool Lpfö 98 of Sweden)

Sweden. This means that top words have a greater influence on South Korea's betweenness centrality.

The betweenness centrality networks in Fig. 3 show that the top words in the texts of the Nuri curriculum form at the bottom of the network, which is centered around the 'respect-difference-emotion' network. This network is directly associated with 'expression-understanding-diversity', 'nature-life-importance', 'exploration-process-enjoying', 'emotion-situation-adequate-use', and 'beauty-feeling'. This means that the network of the top words plays an important role in establishing the meaning of the curriculum. Meanwhile, the top words in the texts of the Swedish curriculum form a shape that is dispersedly distributed throughout the network, without mutual direct links with other words. The top word, 'ability',

mediates other words through the ‘play-well’, ‘interest-different,’ and ‘individual-take’ networks, and the word ‘can’ mediates other words through the ‘use-opportunity’ network. The betweenness centrality of the top 5 words, ‘parents’ mediates other words by establishing direct links to the words ‘activity,’ ‘receive,’ ‘can,’ ‘goal,’ ‘opportunity,’ and others. Moreover, the words ‘respect,’ ‘responsibility,’ ‘group,’ ‘participation,’ ‘democracy,’ ‘support’ and others link with different words outside the network. This means that the words related to betweenness centrality assume the role of linking the texts of the whole curriculum, even though these words are of low intensity.

Discussion

This study aims to analyze the national early childhood curricula of South Korea and Sweden through the perspective of ESD. It also finds meaningful ways to integrate and implement ESD into the national early childhood curriculum of South Korea. Therefore, TF-IDF and network analyses are conducted on the texts of South Korea’s “Nuri curriculum” and Sweden’s “Curriculum for Preschool Lpfö 98.” The following discussion is based on the results described above.

South Korea’s curriculum shows that the words—diversity, narrative, considering, valuable, enjoying, animals and plants, beauty, and local community—account for high shares of the total meaningful words. This is also the case for the words—develop, learn, work, ability, well, opportunity, and knowledge—in the texts of the Swedish curriculum. These findings suggest that South Korea’s curriculum faithfully reflects nature, such as animals and plants, and the local community, and emphasizes diversity and narrative, as well as the attitude of considering beauty valuable and enjoyable. This is in keeping with the curriculum’s focus on the pursuit of diversity and pleasure from play (Ministry of Education of South Korea, 2019) and its emphasis on attitudes and values. Meanwhile, the Swedish Curriculum highlights knowledge, ability, work, and opportunity, which convey practice and action based on development and learning. This confirms that the Swedish education system focuses on knowledge, development, and learning from early childhood (Choi, 2014).

From the perspective of ESD, these results suggest that South Korea’s curriculum needs

to be reoriented in a more practical direction regarding ESD. Moreover, ESD is not something that requires learning and deducing something new, but a direction to be pursued in the practical curriculum with the aim of changing individuals' convictions and attitudes toward life (Shin & Park, 2012). This means that a curriculum's emphasis on participatory practice would lead to an effective ESD. Such an interpretation bolsters scholars' claims that action and participation facilitate ESD (Siraj-Blatchford et al., 2012). This study reveals that South Korea's curriculum places heavy emphasis on values and attitudes. Therefore, ESD and the early childhood curriculum could be effectively synchronized if the action-oriented, practical approach pursued by ESD is included in the curriculum.

Second, the analysis of the degree centrality networks in the early childhood curricula of both countries revealed that South Korea had keywords, such as respect, feeling, and diversity. The network of degree centrality also showed an intensive connection between these keywords. This network was also locally connected to small networks representing the five content areas of the Nuri curriculum. On the other hand, Sweden's keywords were ability, can, and use. Although the strength of the degree centrality was lower than that of South Korea, it showed a certain centrality in various words, such as environment, democratic, evaluate, society, support, receive, and challenge. Unlike South Korea, which showed intensive connections around top words, Sweden showed a broader network of connections among various words.

From the perspective of ESD, the keywords in the South Korean curriculum were related to attitudes towards implementing the three dimensions of ESD: social-cultural, environmental, and economic. These words were used to mainly describe the curriculum. On the other hand, Sweden's keywords reflected the content of the three dimensions of ESD and were specifically identified in the social-cultural, environmental, and economic pillars of the curriculum. This indicates that ESD-related content is reflected in a comprehensive manner. This result can be attributed to the fact that South Korea significantly reduced some content to expand the autonomy of the early childhood education field and to practice a child-centered curriculum when revising the 2019 Nuri Curriculum. However, since the revision, discussions on the integration of ESD have continued in academia (KICCE, 2020a). This emphasizes the need to strengthen the educational content to encompass the three pillars of ESD while maintaining an integrated approach to prevent content segmentation between

areas.

In particular, South Korea's degree centrality network is embedded with words that connote an attitude, a fact that reflects the major objectives of the curriculum. This can be interpreted as a reflection of the Korean context, which emphasizes attitudes (Lee, 2016), and is significant in that it motivates people to practice ESD and leads them to internalize the value of ESD. However, in terms of ESD, the tendency in the revised 2019 Nuri curriculum can be seen as providing a foundation for effectively implementing ESD, as it involves changing not only knowledge but also the way of life. As far as cognitive factors in relation to "what" are concerned, children's experiences assume an educational value (Dewey, 1986). Therefore, the descriptions and methods that impart the value of ESD need to be supplemented with more concrete descriptive forms. Sweden mixes effective factors, such as attitudes, with cognitive factors, such as knowledge and education (Taguma et al., 2012). This is one of the reasons why the Swedish curriculum is considered a high-quality curriculum model (OECD, 2004). Therefore, if the educational content in the South Korean curriculum is strengthened with the three pillars of ESD as the focus, which have a foundation for practicing ESD attitudes, it will be possible to promote effective integration of ESD while maintaining a balance between content and attitude.

Third, betweenness centrality of the curricula in both countries shows that in South Korea, words such as respect, difference, emotion, feeling, and understanding were connecting words between the meanings of the curriculum. The network of betweenness centrality showed a concentrated form centered around these words, similar to the network of degree centrality. On the other hand, in Sweden, words such as ability, can, use, well, and parents were connecting words between the meanings of the curriculum. Hence, the network showed a widely distributed form. The betweenness centrality strength was higher in South Korea than in Sweden. A high betweenness centrality indicates a greater influence in controlling meaning depending on the presence or absence of a word in the text (Lee, 2012). Therefore, the content of the South Korean curriculum has a greater impact on the connection of meaning in the curriculum with words related to respect, difference, emotion, feeling, and understanding. While Sweden can be interpreted as having words, such as ability, can, use, well, and parents, as connecting words in the curriculum. In particular, if a word has a high degree of both degree centrality and betweenness centrality, it is considered to be a core word

in the text (Lee, 2012). Looking at the results of the degree centrality analysis and the betweenness centrality analysis of this study, South Korea had respect, difference, feeling, and understanding, while Sweden had ability, can, and use as top-ranked words in both degree centrality and betweenness centrality. Therefore, this shows that these words are core words in each country's curriculum.

From the perspective of sustainable development, the top-ranked betweenness centrality words in the South Korean curriculum are those that can be explained in interactions with others, which can be seen as words that are in line with the co-extensive perspective of ESD (Yoo et al., 2013b). On the other hand, the top-ranked betweenness centrality words in the Swedish education curriculum can be interpreted as words that explain an individual's practical competencies (KICCE, 2020b). This is supported by the argument (Yoo et al., 2013b) that children's active agency is necessary for effective ESD practice. In other words, the content of the South Korean curriculum reflects the values and attitudes of ESD, so there is a need to strengthen the contents related to children's agency for ESD practice in order to promote effective integration of ESD. The need for such practical competency is also evident in the OECD's student agency and transformative competencies (OECD, 2018). If the emphasis on relationships with others and co-existence in the South Korean curriculum is combined with contents describing children's active agency, it can become a curriculum where children can actively participate, act, and proactively practice ESD.

Based on the above discussion, the recommendations are as follows. The TF-IDF and network analyses used in this study derived objective and comprehensive results from a large amount of unstructured data. However, since this study is a literature review, it does not reflect the voices of active early childhood education practitioners of both countries. Various perspectives from teachers, children, and early childhood education institutions could provide new directions for the effective implementation of ESD. On the other hand, there might be differences in the interpretation of the semantic analysis of language due to the nature of the research methods used to analyze curriculum texts written in different languages. The addition of cross-country comparisons that reflect the combination of language and cultural context could allow discussions from a new perspective reflecting cultural differences. Finally, based on various insights into the analysis methods and study findings, it is suggested that follow-up research on various methods for more effective linkage between

national-level early childhood curricula and ESD be conducted.

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