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Research paper

A Study of Research Trends on Education for Sustainable Development in China through Social Network Analysis

Xiu-Ying Ding[1], Boo-Kyung Cho[2]*

[1]Dept. of Early Childhood Education, Korea National University of Education
[2]Dept. of Early Childhood Education, Korea National University of Education
**Corresponding author E-mail: bcho@knue.ac.kr*

Abstract

The purpose of this research is to provide implications for researches on the education for sustainable development in China by analyzing the network between keywords in the researches on the education for sustainable development. To this end, a total of 1186 papers for academic journals and degree published over the last 10 years were collected from CNKI(China National Knowledge Infrastructure), the leading Chinese academic paper research site. After the keyword refinement process of the collected paper, the top 20 keywords were obtained, and the analysis results were expressed as a keyword network map through Net Miner 4 after conducting a centralization analysis of 20 keywords using UCINET 6. As a result, it was found that 'vocational education' appeared most frequently with 'education for sustainable development', followed by 'environment'. As a result of the centrality analysis, it was found that 'environment' and 'teaching' are hight. This shows that research on education for sustainable development in China is focused mainly on 'environment' and 'vocational education' and that schools are conducting education for sustainable development through various curricula. This suggests that the study of education for sustainable development should be conducted in a broader and more diverse way. Education for sustainable development is mainly conducted through classes, and research on educational goals, contents and methods are required, and measures are needed to enhance teachers' systematic understanding and awareness of sustainable development education.

Keywords: *Education for Sustainable development, Social networking analysis, Environment, Vocational Education*

1. Introduction

In recent years, the world is making remarkable development compared to the past， it seems we are living in a happy and affluent life, but poor people are still living a tough life, complaining of hunger, in some parts of the global village. In addition, climate change, global warming, depletion of natural resources, destruction of eco-system, financial crisis and infringement on human rights, which were not considered serious in the past, are increasingly threatening the lives of mankind. As these global threats become more apparent, it is not simply a matter of a specific region or country, but a matter to be solved globally for the survival of mankind [1]. Interests in the sustainable development (SD), which aims to find solutions to these problems mankind faces to live a better life in the present and future through the coexistence of mankind and nature, are increasing.

The sustainable development has its primary goal in changing the attitudes and values of individuals, so it shall be ultimately associated with the problem of education. Education is a key strategy for establishing the values required to pursue and achieve sustainable development. For the sustainable development, education from the macro perspective, that encompasses environment, socio-culture, and economy from a macro perspective by reflecting the needs of both the present and future generation, is required[2]. UNESCO proclaimed 'UN Decade of Education for Sustainable Development(ESD), 2005-2014' adopted at the 57th UN General Assembly in 2002, and is operating the scheme[3]. This has served as a foundation for the concept of sustainable development that has emerged since the second half of the 20th century, that is the concept of 'the development that can meet the present needs of future generations without compromising the ability of future generations to meet their needs', to become the center of axes of the national operation: economy, society, and environment. The establishment of a sustainable society presupposes changes in philosophy and ideology of individuals and society, so it eventually becomes a problem of education. Education is the kernel of strategies to promote the acquisition and spread of the values needed to promote and achieve sustainable development. Therefore, developing countries China and India as well as developed countries such as Germany, Sweden, and Japan, tend to preoccupy agendas of the UN Education for Sustainable Development (ESD), taking the initiatives in the implementation of resolutions.

In China, since 1998, the Ministry of Education and local governments have begun researches on the ESD and, as a result, the ESD has gradually begun to integrate into the educational system of China. The ESD was referred to in the 'Mid to Long-term National Education Reform and Development Plan (2012-2020)', which became a new strategy to promote education reform in China. In China, the ESD has been continuously and theoretically explored for the purpose of establishing it as the concept of social development in China. By adding the respect of 4 values (respect of difference, diversity, environment, and resources) to UN's agenda ESD, China has published 'Guidelines for Education for Sustainable Development in Chin toa', 'Guideline for Education for Sustainable Development in China'.

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In line with 'UN Decade of ESD, 2005-2014', China stresses the ESD. In 2010, 'A stress emphasis on the ESD' was included in the 'National Long-term Education Reform and Development Plan (2010-2020)' as one of the strategic themes. This is a process in which the ESD is localized according to the actual situation of China, and the theory of sustainable development education peculiar to China is intensified and converted creatively. ESD is mostly based on foreign theories. In recent years, many schools in China raise opinions that foreign theories, which are undergoing education and teaching reform should be transformed into theories appropriate for the actual situation of China instead of being accommodated as they are, and the theories appropriate for the education in China should be devised in accordance with the demands of society and education in China. Based on this judgment, China has reorganized the concept, value, and significance of the ESD. China has defined the concept of the ESD as education for sustainable generation focusing on the core value of sustainable development. The contents of the ESD are comprised of 'one core' and 'three reference points'. The core content is the education on the values of sustainable development, basic contents are composed of three contents: science knowledge ESD, education for sustainable learning ability and education for a sustainable lifestyle. The ESD is meaningful in two aspects. The sustainable development of society, economy, environment and culture, and humans stresses the ecological civil society, indicating the achievement of the harmonious development of society, economy, environment, and culture by escaping the society focused on the conventional economic development. Sustainable development of humans also means the sustainable development of whole humankind and whole and healthy development of individual life. The content and significance of China's ESD stress the establishment of the status of the ESD to realize a society that has developed sustainably through conversable education according to the demands of the society, and the core is to reform teaching and learning. The ESD should be able to develop the ability of learners to observe and solve social problems by developing an integrative perspective on society, economy, environment, and culture on the basis of respecting the culture of respective regions and the connectivity between such cultures. China has reinterpreted the ESD according to the actual situation in China. It can be said that the ESD in China has achieved great results over the last 10 years. As mentioned above, China has not only systematized the theory related to the ESD but also implemented the ESD education nationwide by including in the framework of the mid to long-term education reform. In addition, to link the ESD to respective curriculum subjects, each region complied various textbooks such as 'Elementary and Secondary Education Activities ESD' and 'Future of Sustainable Development', developed and utilized various educational resources to promote the ESD. To revitalize the ESD and to lead it in the right direction, education by teachers cannot be neglected, so each region holds an international forum for sustainable development on a regular basis or trains teachers specialized for the ESD (Beijing, Shanghai, Guangzhou, and Hong Kong)[4]. Regarding the development direction of the ESD in China, Fang ZX said that it is necessary to continue to share theories and practices related to the ESD with other countries to learn new outcomes and experiences from abroad and to publicize the achievements of China abroad to promote exchanges and cooperation between countries. It was also suggested that the policy at the national level should be established as soon as possible so that each region can implement education suited to regional characteristics. Xu XR[5] argued that ESD should be promoted from basic education to higher education, vocational education and informal education. It was suggested that the connection between educational institutions should be strengthened and a systematic sustainable development education center should be established for the development and sharing of educational materials and for the research of contents, teaching methods and curriculum. It was also stressed that that being aware of the importance and necessity of ESD, education is implemented at each educational level in a way to pursue the importance, but those involved in education lack knowledge of the ESD and cannot establish accurate knowledge system, so the National School of Education Administration and other training institutes should open training courses related to the ESD and select them as essential contents for training teachers, so that those involved in education can improve their understanding and level of the ESD. To this end, it is necessary to establish a complete theoretical system through constant theoretical review and researches on the ESD education. In addition, by pointing out various issues such as farming safety issues, excessive exploitation of natural resources, ecological environment destruction, and inequality in education, it was said that the ESD education should be implemented in rural areas to lay the foundation for new rural construction. It was also said that reducing the educational gap between urban and rural areas by seeking balanced rural by connecting the basic education and the ESD in rural areas would solve the problems faced by rural areas. In recent years, with high interest in the ESD, China has made various achievements. The conceptual implication of the ESD has become more systematic. The schools that have implemented ESD have been found to have achieved a corresponding effect on their educational goals, and training for sustainable development is being standardized. In addition, activities of the youth relating to the ESD are abundantly underway, and international collaboration leads to the implementation of the ESD[6].

However, as a result of analyzing the papers relating to the ESD education, it was found that the studies were about plans to promote the ESD and practices; there were not many studies that have analyzed them in depth; and there were not many studies that have analyzed the ESD from various from different perspectives including experimental studies and conceptual studies[7].

This research is meaningful in that it would help to establish sustainable development educational policy in the future and to provide implications for the directions of future researches by comprehending the actual situation of the ESD in China.

2. Research Method

2.1. Data Collection

In this research, to comprehend the research trend on the ESD in China, papers published from 2008 to 2017 were collected from CNKI (China National Knowledge Infrastructure), one of the leading Chinese academic paper research sites. In line with 'UN Decade of ESD, 2005-2014', China stresses the ESD. In 2010, 'a stress emphasis on the ESD' was included in the 'National Long-term Education Reform and Development Plan (2010-2020)' as one of the strategic themes. In response, the study collected 2008 to 2017 paper that examined the trends of sustainable development education in China based on 2010 as an important strategy for national education reform. To collect the papers for analysis, a total of 1526 papers(1203 papers journals and 323 papers for degree) were collected by searching for papers using keywords of 'education for sustainable development' and 'education for sustainability'.

2.2. Data Processing

The data were processed in two stages. In the first processing, the duplicated papers, the papers missing author and abstract, and the papers that were not in the form of the academic journal were excluded and a total of 1186 papers(926 papers for an academic journal and 260 papers for degree) were selected for analysis. After the first processing, the keywords selected for the composition of the semantic network for the keywords in 1186 papers. The reason why we chose the keywords for the paper to be analyzed is just an effective abbre-

viation of the content of the paper and the research field. By using the Excel 2010 program, the list of high-frequency keywords from 1186 papers was created. For the selected keywords, appropriate keywords were selected by controlling acronyms, synonyms, broader terms, connotations, etc., For example, the words 'environment', 'eco-system', 'environmental protection', 'nature and forest' were unified into 'environment' because these words express the common meaning of 'environment' even though the user may be different; 'vocational education' and 'advanced vocational education' were unified into 'vocational education'; and 'area', 'province', 'OO province' and 'OOcity' were unified into 'area'. After unifying the keywords, the second processing was performed to find out whether or not the keywords appeared simultaneously in 1187 papers. The frequency of the keyword was conducted in 2 modes and converted into 1 mode as below using the Excel program to use the duplicate matrices for analysis. Over the past 10 years, a total of 4,465 keywords were found in 1,186 papers on sustainable development education in China. Among them, 3984 keywords were analyzed except for the keywords 'sustainable development' and 'education'. The process involved combining duplicate keywords, similar keywords, to analyze the frequency of keywords. In this process, 128 keywords were integrated with similar meaning to other keywords and leaving only one duplicate keyword, which ultimately analyzed the frequency of a total of 1292 keywords.

Table 1: Keyword 1-mode network

	Vocational education	Environment	Literacy	Higher education	Area
Vocational education					
Environment	12				
Literacy	49	44			
Higher education	3	32	30		
Area	30	19	7	16	

2.3. Data Analysis

Based on the data from the second processing, top 20 keywords were selected by analyzing the simultaneous appearance of the words in 1186 papers using Excel 2010 program, and the semantic network was analyzed by building a keyword network through a matrix indicating whether or not the keywords appeared simultaneously. The analysis focused on the top 20 keywords in the keyword, which accounts for half of the frequency of the keyword, which is considered to be meaningful in analyzing trends related to sustainable development education. Keyword network analysis is a useful way to figure out the meaning of the text through the network connection structure and the frequency of the keywords in articles, blogs, and articles. For the analysis of the keyword network, 'degree centrality', 'closeness centrality' and 'betweenness centrality' were analyzed using social network analysis tool UCINET 6.

2.4. Visualization of Social Network

The results of the analysis were expressed by a keyword network map using Net Miner 4, and the main keywords were visualized through the word cloud.

3. Results

3.1. Keyword Frequency Analysis

A total of 1292 keywords were founded in the papers about ESD published from 2008 to 2017 in China, and the total frequency was 3984. In the top 20 high-frequency keywords related to the ESD, 'vocational education' appeared most frequently(262 times), followed by 'environment' (240 times), 'literacy' (189 times), 'higher education' (149 times) and 'area' (126 times).

Table 2: The frequency rank of the keywords appearing with 'Education for Sustainable Development'

Rank	Keyword	Frequency	Rank	Keyword	Frequency
1	Vocational education	262	11	Economy	74
2	Environment	240	12	Life-long education	64
3	Literacy	189	13	Elementary education	44
4	Higher education	149	14	Teacher	32
5	Area	126	15	Diversity	28
6	Teaching	121	16	Early childhood education	24
7	Secondary education	112	17	Save resources	22
8	Policy	110	18	Remote education	21
9	Overseas research	102	19	Cooperation	20
10	Rural area	89	20	Design	20
			Total Frequency		1849

The results of visualizing the high-frequency keywords through the word cloud are shown in Figure 1 below.

Fig. 1: The word cloud visualized with the main keyword of 'Education for Sustainable Development'

3.2. Centrality Analysis

Table 3 shows the results of the centrality analysis performed to comprehend the main keywords among the keywords related to 'the ESD'.

The degree centrality is an indicator of the direct network between nodes, so it increases when there are many direct networks with other nodes. As a result of analyzing the degree centrality, it was found that the 'environment' had the highest interaction by appearing in conjunction with other keywords, followed by 'vocational education', 'literacy', 'area', and 'secondary education'.

Table 3: Results of degree analysis

Rank	Degree		Rank	Degree	
1	Environment	254.000	11	Elementary education	102.000
2	Vocational education	250.000	12	Overseas research	89.000
3	Literacy	232.000	13	Lifelong education	61.000
4	Area	170.000	14	Teacher	56.000
5	Secondary education	170.000	15	Early childhood education	51.000
6	Teaching	157.000	16	Diversity	48.000
7	Policy	150.000	17	Remote education	42.000
8	Higher education	147.000	18	Save Resources	38.000
9	Rural area	125.000	19	Cooperation	36.000
10	Economy	109.000	20	Design	25.000

Table 4 shows the results of the closeness analysis performed to comprehend the main keywords among the keywords related to 'the ESD'.

The closeness centrality is an indicator showing the degree of closeness between one node and another node, and the lower the sum of path distances, the greater the centrality. As a result of analyzing closeness centrality, it was found that the keywords with the highest centrality were 'teaching', followed by 'vocational education', 'literacy' and 'area'.

Table 4: Results of closeness analysis

Rank	Closeness		Rank	Closeness	
1	Teaching	100.000	11	Economy	79.167
2	Literacy	95.000	12	Early childhood education	79.167
3	Area	95.000	13	Diversity	76.000
4	Environment	90.476	14	Life-long education	76.000
5	Overseas research	86.364	15	Elementary education	76.000
6	Policy	86.364	16	Teacher	76.000
7	Secondary education	86.364	17	Save resources	70.370
8	Rural area	86.364	18	Remote Education	70.370
9	Higher education	82.609	19	Cooperation	70.370
10	Vocational education	82.609	20	Design	61.290

Table 5 shows the results of the betweenness analysis performed to comprehend the main keywords among the keywords related to 'the ESD'.

The betweenness centrality is the degree of the location of one node between other nodes, and the closer to the center, the higher the betweenness centrality. As a result of analyzing betweenness centrality, it was found that the 'teaching' showed the highest centrality, which was the same as the result of the degree centrality analysis, followed by 'literacy', 'environment' and 'area'.

Table 5: Results of the betweenness analysis

Rank	Betweenness		Rank	Betweenness	
1	Teaching	5.789	11	Economy	1.831
2	Literacy	5.205	12	Policy	1.806
3	Environment	3.919	13	Diversity	1.378
4	Area	3.487	14	Life-long Education	1.344
5	Higher education	3.352	15	Teacher	1.155
6	Early childhood education	2.829	16	Save resources	1.154

7	Vocational education	2.798	17	Elementary education	1.098
8	Secondary Education	2.635	18	Remote Education	0.625
9	Overseas research	2.512	19	Cooperation	0.494
10	Rural area	2.310	20	Design	0.278

3.3. Main Keyword Network Analysis

To examine the network of the keywords with high centrality, the keywords were visualized by simplifying the keyword network flaws and the results are shown in Figure 2-6.
As a result of the analysis, 'environment' had high network strength with 'literacy', 'overseas research', 'higher education', 'teaching', 'policy', 'economy', 'secondary education', and 'area'. As shown in Figure 2.

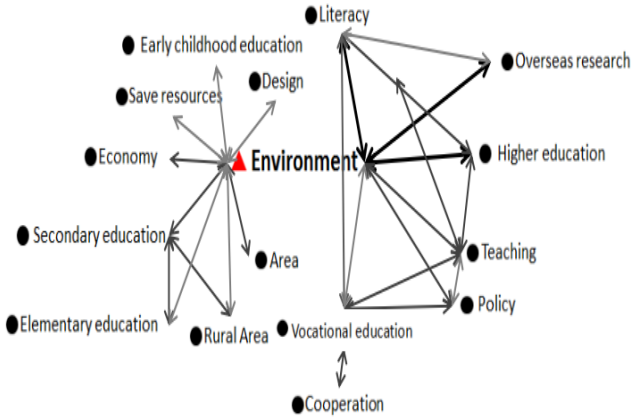

Fig. 2: Keyword Network Analysis of 'Environment'

The 'vocational education' had high network strength with 'literacy', 'policy', 'area', 'teaching', 'cooperation', 'teacher', and economy, and was networked with 'higher education' and 'environment' via 'teaching'. As shown in Figure 3.

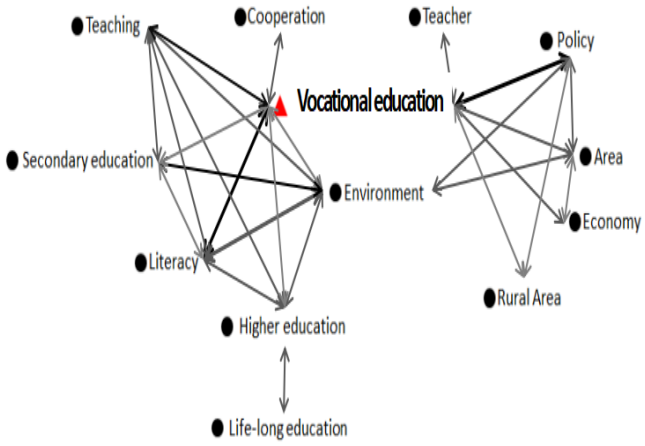

Fig. 3: Keyword Network Analysis of 'Vocational education'

'literacy' had high network strength with 'vocational education', 'environment' , 'higher education', 'secondary education', 'teaching', 'elementary education' and 'higher education'. As shown in Figure 4.

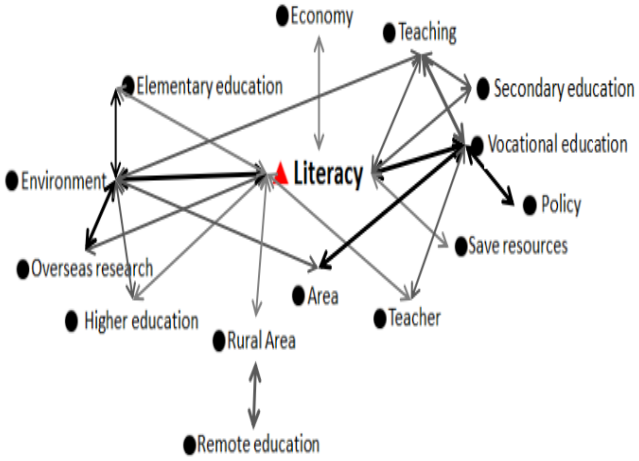

Fig. 4: Keyword Network Analysis of 'Literacy'

'area' had high network strength with 'rural area', 'diversity', 'environment', 'higher education', 'policy', 'economy', 'vocational education' and was networked with 'literacy' and 'secondary education' via 'teaching'. As shown in Figure 5.

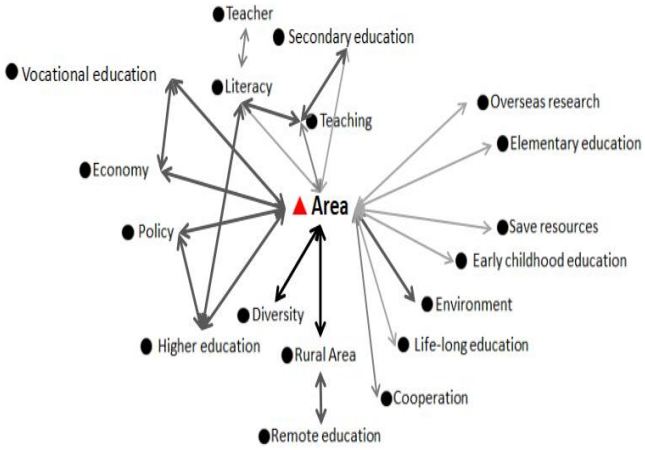

Fig. 5: Keyword Network Analysis of 'Area

'secondary education' had high network strength with 'literacy', 'teaching', 'environment', 'elementary education' and 'rural area'. As shown in Figure 6.

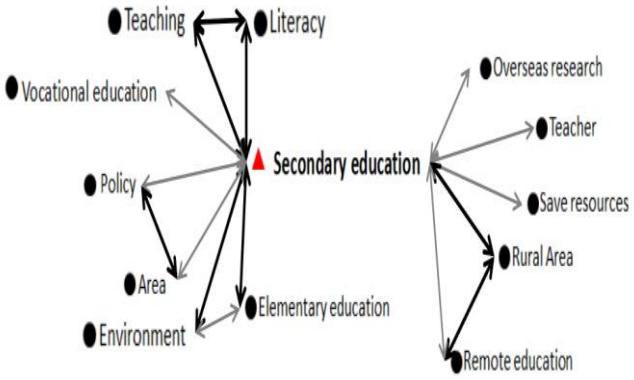

Fig. 6: Keyword Network Analysis of 'Secondary education'

4. Conclusion

To examine the research trends on the ESD in China in the context of the big data, the authors have conducted a keyword network analysis focusing on the keyword of ESD in the papers published from 2008 to 2017 and archived in CNKI site in China. From the above research results, the following conclusions can be obtained about trends in China's sustainable development education.

First, as a result of keyword frequency analysis, it was found that among all keywords, 'vocational education', 'environment', 'literacy', 'higher education' appeared most frequently with ESD. This means that research on sustainable development education in China is mainly focused on ' vocational education ', 'environment', ' literacy ' and ' Higher education'. At present, China is an economic turning point, making a big change in industrial restructuring. At this point, the above results indicate that it is imperative not only to implement voca-

tional education for workers in various industries but also to enhance their literacy. The second most frequent keyword with 'vocational education' is 'environment'. In China, environmental problems have been continuously raised from the past, but with the implementation of strategies for sustainable development and ESD, the environmental problems have rapidly emerged as a social issue.

Sustainable development means not only environmental protection but also sustainable development of economy and society. However, the results of this research showed that among the keywords related to ESD in China. The frequency of 'environment' was significantly high and the frequency of the keywords related to the economy and society was relatively low. ESD is an educational paradigm that pursues transformation in all areas including environment, economy, society, culture, and pursues a global perspective encompassing a broader scope[8]. Therefore, education that can embrace all of these aspects should be applied. Among the related keywords, 'higher education' and 'secondary education' ranked high whereas 'early childhood education' ranked low, indicating that there are few types of research conducted on the ESD. This result indicates that there is the necessity of researching the early childhood education in the ESD in China from the perspective that early childhood education is important because the ESD basically pursues action by changing attitude and value of individuals[9].

Second, as the result of centrality analysis, it was found that the keywords with the highest degree centrality were 'environment', followed by 'vocational education', 'literacy' and 'area', and the keyword with highest closeness centrality and betweenness centrality were 'teaching', followed by 'literacy', 'area' and 'environment'. The highly ranked keywords in degree centrality, closeness centrality, and betweenness centrality were all similar, indicating that many types of research are being conducted focusing on these keywords.

The network of major keywords is as follows.

'Environment' and 'literacy' had high network strength. In the frequency of ESD, both 'environment' and 'literacy' ranked high and had high network degree, indicating that many types of research are being conducted on the enhancement of literacy and awareness of people in the aspect of 'environment'. As the new values such as ecological civilization and sustainable development have been raised, the scope of the traditional values of China has begun to widen, and it is believed that the formation of environmental literacy(morality) starting from the perspective of traditional morality is an important way to solve ecological and environmental issues in the present times[10]. China, which regards environmental issues important in various aspects of sustainable development, said that to cultivate environmental literacy (morality) of the whole nation. It is required to enhance the awareness of environmental protection by disseminating knowledge of eco-system and environmental laws. In addition, China claims that it is required to establish a new value called environmental literacy (morality), to seek harmonious development with nature by respecting the nature as our good friend[11]. As a result of examining the Chinese university students' awareness of the environment, they lack knowledge of the environment and do not protect the environment in everyday life despite their high awareness of environmental issues[12]. Mostly, the enhancement of environmental literacy and awareness is implemented in schools as part of school curriculums, which implies that the individuals, schools, governments, and society should work together to promote the harmonious development of mankind and nature and the development of society because it cannot be achieved only by school education.

'Vocational education' shows a strong network with 'policy' and 'literacy'. There appear to be constant calls for policies for the advancement of vocational education. Since 2004, China has begun reforming its vocational education system under the ideology of sustainable development and has made remarkable progress over the past decade as a result of the implementation of the Ministry of Education's 'Mid to Long-term National Education Reform and Development Plan(2010-2020)'. For the development of vocational education in China, since China is still overlooking the social importance of vocational education in comparison with the developed countries, and lacks detailed policies for vocational education, there are problems in satisfying the demands of society[13]. This implies that it is urgent to seek policies and plans for the development of vocational education at the government level.

Also, the strong link between vocational education and 'literacy' means that it is highly interested in enhancing learners' skills in vocational education. To date, vocational education has been focused only on acquiring vocational skills and technical education, but neglected the core competencies and vocational literacy of individuals, but not anymore[14]. In particular, by considering the value of sustainable development in vocational education to be important, students should be able to solve problems with the environment, economy, society, and culture that is faced by mankind and society based on values of sustainable development. To this end, education of vocational literacy for students is required in the stage of vocational education, because it is an important index for determining success or failure of vocational education, and also has a critical effect on student' understanding of their occupation and adaptation to society after entering the society. In fact, in recent years, vocational literacy is regarded by many companies to be important when recruiting talents. But every year, the occupational literacy of college graduates falls short of the expectations of companies, which is one of the causes of China's 'unemployment' crisis[15] 'Vocational education' is an important part of ESD in China. Detailed policies, contemplating the education of talents, concrete measures enhance the vocational literacy of the students who enter the society after graduation.

'Area' showed a strong network with 'diversity' and 'rural area'. China is comprised of 56 ethnic groups. 55 minority ethnic groups account for 8.49% of the total population, which is more than 100 million people, and the populated area accounts for 60% of the total areas of the country. To respect diverse cultures and characteristics of ethnic minorities, China implements a system of 'communities for minority ethnics' and 'autonomous provinces for minority ethnics' to implement the policies of the national government in minority ethnic areas to suit the culture and circumstances of each ethnic group. This implies that in the implementation of ESD, each area is implementing the ESD reflecting characteristics of the area and minority ethnic groups in accordance with the policy of the Ministry of Education and the Committee on Sustainable Development. China is a multi-ethnic nation consisting of 56 ethnic groups. Each ethnic groups and area have its own distinctive characteristics, which make it difficult to promote ESD through unified national policies and measures. Therefore, in each area, ESD should be implemented in a way that meets the local situation.

'Rural area', which has a strong connection with the 'area', is also linked to 'remote education'. This shows that the rural communities in China are currently seeking to provide sustainable development education through remote education. Agriculture has become the backbone of economic development in China as the central axis of the economy, and the rural population accounts for half of the total population. The economic development and educational development of the rural area is one of the problems that must be solved in China today. In particular, the basic education in the rural area is receiving high attention from the Chinese government as an important issue for the sustainable development in the rural area. In China where the rural population accounts for more than 50% of the total population, the basic education in rural areas plays an important role in enhancing the overall literacy of workers in the rural area and developing rural economy[16]. However, most educational institutions are located in urban areas or relatively large rural areas. Most rural areas lacking educational institutions do not provide a place for rural residents to study. To resolve this problem, China builds learning centers in rural areas, providing remote education for rural residents. Remote education is made up of topics appropriate for the needs of the farmers and the reality of the rural area, thereby enhancing the overall level of awareness of the rural people[17]. The introduction of remote education will let rural residents understand the development of the country and science and technology, narrowing the gap of wealth between

urban and rural area[18]. However, there are various problems with the remote education in rural areas such as lack of awareness, aggressiveness, and motivation, implying that researches on plans to resolve this problem should be actively conducted [19].

'Area' is networked with 'literacy' and 'secondary education' via 'teaching'. This implies that ESD in each region is implemented through 'teaching' in schools. Schools pursue changes in teaching goals, teaching contents, and teaching methods in order to better implement the ESD education, and constantly contemplate improvement measures[20]. Teachers should make efforts to make learners understand what is the meaning of sustainable development and what is the meaning of the hope for the future and optimistic thinking. To this end, a variety of training and education programs should be developed so that teachers can establish an accurate view on the sustainable development.

'Secondary education' also shows a strong network with 'teaching', means that it communicates the value of sustainable development through various subjects (geography, physics, biology, physical education, art, etc.) at the secondary level. Such efforts to integrate the values of curriculum and sustainable development, and the consideration of teaching methods and education, are seen as positive moves to actively realize sustainable development education in China. While most sustainable development education is conducted on school grounds, teachers still lack awareness and knowledge about sustainable development education. Therefore, teachers need to have an educational program on the exact concept of sustainable development and how to conduct sustainable development education in the field of education[21].

In this study, we looked at research trends over the last 10 years from studies on sustainable development in China. In conclusion, suggestions for the following research are as follows:

First, During the process of refining keywords, the researchers refined the keywords on the premise that the refining would not distort the meaning of the keywords as much as possible. However, since researchers refined the keywords with subjective judgment, there might be a limit to the process of integrating keywords.

Second, due to the nature of the social network analysis, the sub-community structure may not perfectly match the actual study trend. In addition, the analysis with three to four keywords presented in the paper is limited to the analysis of the content because it is not sufficient to represent the entire study results. A further study will be needed to examine and analyze the details of Chinese studies on sustainable development education.

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References

[1] Choi JY, Lee SW, Hwang DG & Lee TS, "Development of the Education for Sustainable Development(ESD) Program for Elementary School Student", *Journal of Korean Practical Arts Education*, Vol.19, No.2, (2013), pp. 169-194.
[2] Yoon BH, "The analysis of 'the Market Project' as the case of education for sustainable development", *KCI Accredited Journal*, Vol.15, No.2, (2014), pp. 866-874.
[3] UNESCO, *"United Nations Decade of Education for Sustainable Development 2005-2014: Draft International Implementation Scheme.* UNESCO, Paris, 2004.
[4] Xu XR, "China's sustainable development education localization achievements and future development", *Moral Education China*, No, 17, pp. 29-34.
[5] Fang ZX, "Education for Sustainable Development: to tomorrow's education-Reviewing and future looking forward to the Education for Sustainable Development in China 15 years", *Journal of World Education*, No, 5, pp. 18-21.
[6] Zhang J, "Education for Sustainable Development: Achievements in China and the Global Prospect", Journal of Teacher Education, Vol.3, No.3, (2016), pp. 7-16.
[7] Qi J, "China's education for sustainable development research review and outlook", Journal of Science and Economy, No.19, (2017), pp. 161.
[8] UNESCO, *Shaping the Education of Tomorrow: 2012 Full-length Report.* Paris, France: UNESCO, (2012).
[9] Siraj-Blatchford J, "Editorial: Education for sustainable development in early childhood", *International Journal of Early Childhood*, Vol.41, No.2, (2009), pp.9-22.
[10] Yang WH, "Research on Environmental Literacy of Undergraduates in Tianjin" Unpublished master dissertation, Tianjin Normal University, Tianjin, (2014).
[11] Shi HS, "On the sustainable development concept of environmental moral education", *Theory Research*, No.35, (2010), pp.114-116.
[12] Huang WL, "A Survey and Suggestion on the Actual Condition of Ecology of University Students", *The Party Building and Ideological Education in Schools*, No.18, (2011), pp.152-154.
[13] Liu YM, "A Study on Vocation Education Process and Sustainable Development based on Policy", C*hinese vocational and technical education*, No.22, (2016), pp.55-58.
[14] Ding X, "Sustainable Development to train vocational school students professional skills", *Education and Vocation*, No.11, (2015), pp.85-86.
[15] Fang H, "On Higher Vocational Students' Vocational Quality Fostering Based on sustainable development concept", *Modern Education Management*, No.9, (2013), pp.93-96.
[16] Zhou XL & Liao XM, "On the sustainable development of basic education in rural China", *Theory and Practice of contemporary education*, Vol.1, No.5, (2009), pp.106-108.
[17] Yao HX, Wang HY & Zhou XZ, "The community learning center to promote distance education study on Sustainable Development in the countryside", *China Adult Education*, No.5, (2014), pp.157-160.
[18] Wang JD & Feng YH, "The Development of 'Project of Modern Distance Education of Rural Primary and Middle Schools' and Its Enlightenment to the Informatization of Basic Education in China", *Education Research*, No.2, (2012), pp.65-73.
[19] Liang QB, "Based on the breed of rural farmers new remote education training system innovation research", *Continue Education Research*, No.6, (2016), pp.24-26.
[20] Wang GY, "Education for Sustainable Development led the teaching mode change", *Journal of World Education*, No.5, (2015), pp.48-49.
[21] Sun LR, "Exploration of Teacher Factors Affecting the Implementation of Education for Sustainable Development", Select about the essay, No.9, (2017), pp. 205.