Research Article

Recent Trends in Measures to Correct Educational Inequalities in OECD Countries: Application of Text Mining Method

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Abstract
The aim of this study is to analyse how OECD countries view educational inequality, and what the important policy issues are in relation to the education inequality that these countries are experiencing. Analysis results were obtained, through the text mining analysis method, for academic papers dealing with educational inequality in OECD countries. As a result of the analysis, various policy issues faced by OECD countries were classified into five categories. These five policy topics can be summarized as: inequality in primary schools; reform of support programmes for university students; measures to recognize the diversity of migrants; legislation regarding educational inequality measures; and promotion of protection for women in the labour market.

Keywords: *education inequality, affirmative action, text mining method.*

1. Introduction

Theoretically, the education system should be able to achieve excellence and equity simultaneously; and at the same time, these efforts should be specifically reflected in education policy (Ball, 2017; Chitty, 2014; Griggs, 2013). Over the past fifty years, countries such as the USA have invested huge financial resources in reducing educational inequality and related education reform. However, it is difficult for many academic researchers to agree on whether these policies have succeeded in reconciling excellence and equity in the education system. It has been pointed out that even in the USA the educational gap has only deepened, and this educational gap is also affecting the social life of individuals and is becoming a hindrance to the revitalization of social mobility (Ladd, 2012; Sullivan et al., 2014; Reay,2017). This point of view also applies to countries such as Korea where the gap between rich and the poor is enormous. Improving educational equity and vitalizing social mobility are important for social integration and human resource utilization. Therefore, finding solutions in order to create a more inclusive, fair, and dynamically socially mobile society is an important educational policy aim for all countries, both developed and underdeveloped (McCulloch, 2006; Major &Machin, 2018; Simmons, 2019).

Many researchers (Anders, 2012; Brooks, 2002; Callender &Jackson, 2008) agree that the root of socio-economic problems such as youth unemployment and social polarization lies in educational inequality or in education policy itself. It is argued that, in order to address this problem, the roles of education and society more broadly should interact and build a virtuous circle. In respect of this virtuous circle structure, it is pointed out that education should not only nurture students to be well-equipped with the competencies required by existing society, but should also play a role in strengthening students' competencies so that they can create a new society. In particular, there is widespread agreement with the argument that government and society should take a strong interest in students who are socially disadvantaged, and prepare various career paths so that these students can fully demonstrate their abilities.

However, notwithstanding this justifiable argument, in reality, equality and inclusiveness in the education

system are not readily compatible with educational excellence (Callender &Jackson, 2008; Christie, 2005). Against this background, the aim of this study is to analyse the basic perspectives that OECD countries have on the issue of educational inequality, and the important policy agendas of these countries. Thereby, it will be possible to derive policy ideas that can help countries, such as Korea, which are identified as having severe educational inequalities to alleviate these and so achieve greater educational equity and inclusiveness.

2. Theoretical Background

In order to deal with the problem of inequality in education, it is necessary first to define some concepts (Fielden, 2010; Engberg &Wolniak, 2018). First: *excellence in education* has two main meanings. One is the sense of being superior in a certain area to the object of comparison; the other is excellence in the sense of personal strength. On the other hand, *educational equity* refers to equality of educational opportunities: that everyone should be given the opportunity to enter the educational establishment that is necessary for their self-realization; that the educational process should foster equality; that the same educational conditions and courses should be available to everyone; and that the socio-economic status of parents should not matter in terms of their children's academic achievement. Various viewpoints, such as equality of educational results, that the impact should be minimized are suggested.

Even if there are some differences regarding the concepts of educational excellence or equity, from an educational point of view they should be viewed as complementing each other. The problem here is that these two concepts are not applied in a balanced way in reality, but instead they gradually aggravate inequality in education owing to various social factors.

On the basis of various research results which confirm that the parental generation has a large influence on the children's generation in today's society, many researchers have found that the social and economic inequalities applying to the parental generation continue to expand into the children's generation, leading to a deepening of the educational gap between classes (Dorling & Pritchard, 2010; Green &Kynaston, 2019; Gibbons &Vignoles, 2011). They argue, further, that this will exacerbate mobility and solidify the gap between classes. According to this argument, the influence of parental background on students' academic achievement is huge, and this is a problem which should in the end be resolved by the state.

In countries such as The Netherlands, strict school separation according to socio-economic status, and the consequent applying of incentives for equity, have been pointed out as the biggest problem blocking equity, and the necessity of implementing policies that can solve this problem has been emphasized (Major &Machin, 2018; Manley &Johnston, 2014). . In Japan too following World War II, as a result of large investment in education aimed specifically at achieving rapid economic development, the positive role education can play on the social mobility ladder was weakened. As a result, educational inequities have increased.

The problem is that, in the end, there is a close relationship between family background and academic achievement, and this is apt to lead to social inequality. In Japan and some European countries, free-high school education, support for kindergarten expenses and scholarships for higher education are being implemented to address this problem.

As numerous studies (Parker et al., 2015; Simmons, 2019; Boliver, 2013; Times Higher Education, 2017) reveal, education does not function in isolation, but is affected by many other conditions, and affects other conditions, at the same time. Many social, economic and cultural factors influence the establishment and implementation of education policies, and education drives social change. However, in many developed countries, including Europe, the influence of social, economic and cultural factors on educational outcomes is increasing, but the influence of these outcomes on society gradually decreasing. In other words, education no longer serves as a ladder assisting social mobility, but is considered a major cause of social polarization. Given this reality, educational equity should be pursued on the two axes of

educational innovation and social innovation simultaneously. Only when this process is successful will we be able to create a society in which educational excellence and equity are achieved at the same time.

Most people agree that equity and excellence in education should be important policy goals, but it is not easy to realize this in reality. Of course, in countries such as Singapore, Japan and Finland, as studies have shown, students belonging to the poorest 20 per cent of the population perform better in exams than the wealthiest 20 per cent in Slovakia, Uruguay, Brazil and Bulgaria.

In most countries, efforts are being made to promote inter-class mobility, but again this is not easy. For example, a report published by the OECD in 2019 found that inter-class mobility in the UK has slowed so much that it takes five generations for the poor to attain average incomes. Although meritocracy is a principle that a democratic system must guarantee, this weakening of inter-class mobility is obviously an enormous problem.

Several studies (McCulloch, 2006; Manly &Jhonston, 2014) have examined whether measures to reduce inequality sustain economic growth, but their conclusions are not all consistent with each other. Some scholars (Sullivan et al., 2014; Reay, 2017) argue that inclusive policies are hugely important in terms of sustaining growth, while others argue the opposite. What is important is that education policy should not be pursued in one direction only; rather, it is necessary to pursue it in a balanced way so that excellence and equity in education can be properly maintained. The most important thing that emerges from such debates is that the educational opportunities provided by the system, along with the level of education that individuals acquire, are the most important variables that mediate socio-economic inequality in the course of an individual's life.

If this is so, how can educational inequality be alleviated? This is not a simple matter. Against this background, this study aims to identify the large and small policy agendas that OECD countries are implementing to solve the problem of educational inequality. This is meaningful, because it can offer directions regarding what to do and how to do it to countries that have a responsibility to alleviate the problem of educational inequality.

3. Analysis Design

3.1 Analysis target

As of end April 2020, the number of OECD member countries was 37. However, since it is difficult to explore the educational policies of all these countries, this study analyses academic papers in whose titles the terms 'OECD' and 'educational inequality' are included. Since the number of academic papers relating to educational inequality is enormous, in this study, Cyram (www.cyram.com), the supplier of the Netminer program, the analysis software used in this study, made academic papers accessible via a co-operative relationship.

As a result of extracting papers containing the terms 'OECD', 'affirmative action', 'education', etc. in the title or as keywords set by the author using the Netminer program, a total of 705 papers were extracted. The number of words in the papers was 7,180. However, the total number of words to be analysed was 7,134, since words unnecessary for the analysis, such as 'paper', 'article' and 'chapter', were excluded.

3.2 Analysis method

Many different methods have been employed for analysing policy agendas relating to education inequality in OECD countries. This can be done using qualitative or quantitative methods. In this study, the text mining method is used so as to increase the study's practical validity. This method has the characteristic of combining quantitative and qualitative methods. It provides meaningful information by comprehensively analysing the frequency of the words included in the sentence, the role of these words, and the status of the words in the network structure, using the sentences in the text to be analysed as the unit of analysis (Bowen, 2009; Choi, 2019;Choi, 2021; Jang, 2019; Sohn, 2005; Kwack, 2018).

4. Analysis Result

4.1 Word frequency and cloud analysis

First, as mentioned above, the number of words appearing in the extracted papers was 7,130. In order of frequency of appearance, as Table 1 shows 'education' appears 650 times, followed by 'policy' (526 times) and 'woman' (353 times).

Table 1 Words appearing in the extracted papers (in order of frequency)

		1	2	3	4	5
		rt of Speech(PC	Frequency	Word length	Name Type	Author Keyword
1	education	Common Noun"	650.0	9.0	"-"	"False"
2	policy	Common Noun"	526.0	6.0	"-"	"False"
3	woman	Common Noun"	353.0	5.0	"-"	"False"
4	country	Common Noun"	330.0	7.0	"-"	"False"
5	gender	Common Noun"	307.0	6.0	"-"	"False"
6	inequality	Common Noun"	258.0	10.0	"-"	"False"
7	development	Common Noun"	257.0	11.0	"-"	"False"
8	system	Common Noun"	246.0	6.0	"-"	"False"
9	student	Common Noun"	234.0	7.0	"-"	"False"
10	state	Common Noun"	178.0	5.0	"-"	"False"
11	university	Common Noun"	176.0	10.0	"-"	"False"
12	school	Common Noun"	174.0	6.0	"-"	"False"
13	level	Common Noun"	172.0	5.0	"-"	"False"
14	change	Common Noun"	168.0	6.0	"-"	"False"
15	issue	Common Noun"	166.0	5.0	"-"	"False"
16	role	Common Noun"	158.0	4.0	"-"	"False"
17	analysis	Common Noun"	157.0	8.0	"-"	"False"
18	context	Common Noun"	149.0	7.0	"-"	"False"
19	practice	Common Noun"	139.0	8.0	"-"	"False"
20	market	Common Noun"	139.0	6.0	"-"	"False"
21	opportunity	Common Noun"	138.0	11.0	"-"	"False"
22	result	Common Noun"	135.0	6.0	"-"	"False"
23	group	Common Noun"	135.0	5.0	"-"	"False"
24	gap	Common Noun"	135.0	3.0	"-"	"False"
25	government	Common Noun"	131.0	10.0	"-"	"False"
26	factor	Common Noun"	126.0	6.0	"-"	"False"
27	approach	Common Noun"	126.0	8.0	"-"	"False"
28	institution	Common Noun"	125.0	11.0	"-"	"False"
29	employment	Common Noun"	122.0	10.0	"-"	"False"
30	economy	Common Noun"	120.0	7.0	"-"	"False"
31	datum	Common Noun"	120.0	5.0	"-"	"False"
32	equality	Common Noun"	116.0	8.0	"-"	"False"
33	access	Common Noun"	116.0	6.0	"-"	"False"

Note. Only words with a high frequency of occurrence are partially exemplified.

Figure 1 shows the overall status of the appearing words using word cloud analysis. The larger t he size of a word, the higher the frequency of its occurrence.

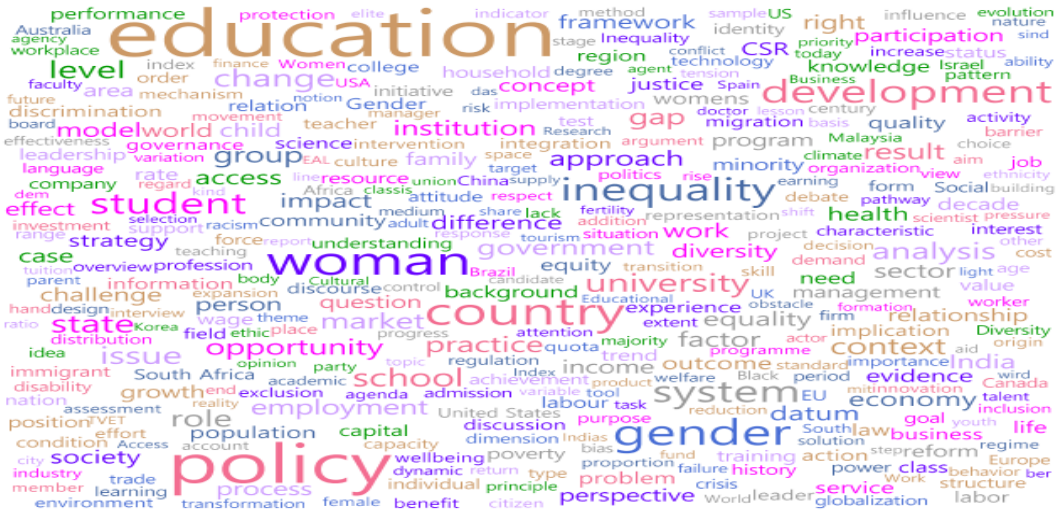

Figure 1 Word cloud analysis results

As the number of words to be analysed reaches 7,130, the network structure of these words bec omes too complex, and there is a need to simplify it. Therefore, the frequency of occurrence of words was limited to 15, so that only words occurring 15 times or more were extracted again. As a result, a total of 482 words were extracted. For further analysis, these 482 words were con verted into 2-mode data, and the converted data set is shown in Table 2.

Table 2 Data converted to 2-mode

		1	2	3	4	5	6	7	8	9	10
		Access	Africa	American	Australia	Black	Brazil	Business	CSR	Canada	China
1	Access	0.000	0.000	0.000	0.000	0.000	0.107	0.000	0.000	0.000	0.000
2	Africa	0.000	0.000	0.000	0.031	0.000	0.029	0.000	0.000	0.033	0.028
3	American	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4	Australia	0.000	0.031	0.000	0.000	0.000	0.027	0.038	0.000	0.172	0.026
5	Black	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.050	0.105	0.000
6	Brazil	0.107	0.029	0.000	0.027	0.000	0.000	0.000	0.000	0.029	0.105
7	Business	0.000	0.000	0.000	0.038	0.000	0.000	0.000	0.042	0.000	0.000
8	CSR	0.000	0.000	0.000	0.000	0.050	0.000	0.042	0.000	0.032	0.000
9	Canada	0.000	0.033	0.000	0.172	0.105	0.029	0.000	0.032	0.000	0.056
10	China	0.000	0.028	0.000	0.026	0.000	0.105	0.000	0.000	0.056	0.000
11	Cultural	0.000	0.000	0.000	0.036	0.000	0.000	0.053	0.000	0.000	0.031
12	Development	0.000	0.077	0.000	0.000	0.000	0.000	0.000	0.036	0.000	0.000
13	Diversity	0.000	0.000	0.030	0.028	0.000	0.000	0.037	0.061	0.000	0.000
14	EU	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
15	Educational	0.000	0.000	0.000	0.030	0.000	0.000	0.000	0.000	0.032	0.000
16	Employment	0.000	0.000	0.000	0.029	0.000	0.000	0.000	0.031	0.000	0.000
17	Equality	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
18	Europe	0.000	0.026	0.026	0.049	0.000	0.023	0.000	0.000	0.025	0.022
19	Gender	0.000	0.026	0.000	0.025	0.000	0.000	0.000	0.013	0.000	0.012
20	Higher Education	0.000	0.021	0.000	0.000	0.000	0.019	0.000	0.000	0.000	0.018
21	Hong Kong	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
22	Index	0.000	0.000	0.045	0.000	0.000	0.000	0.000	0.043	0.000	0.000
23	India	0.017	0.016	0.000	0.015	0.000	0.063	0.000	0.049	0.032	0.167
24	Indias	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.032
25	Inequality	0.000	0.021	0.021	0.000	0.000	0.000	0.000	0.000	0.000	0.000
26	Integration	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.031
27	Introduction	0.000	0.067	0.000	0.000	0.000	0.000	0.000	0.031	0.000	0.000
28	Israel	0.000	0.000	0.000	0.037	0.000	0.000	0.000	0.000	0.000	0.000
29	Korea	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	Latin America	0.000	0.000	0.042	0.000	0.000	0.034	0.000	0.000	0.000	0.032

Note. Only some of the data converted to 2-mode are shown as examples.

4.2 Topic analysis

Possessing now a network of 482 words, we tried to visualize this network. The result is shown in Figure 2.

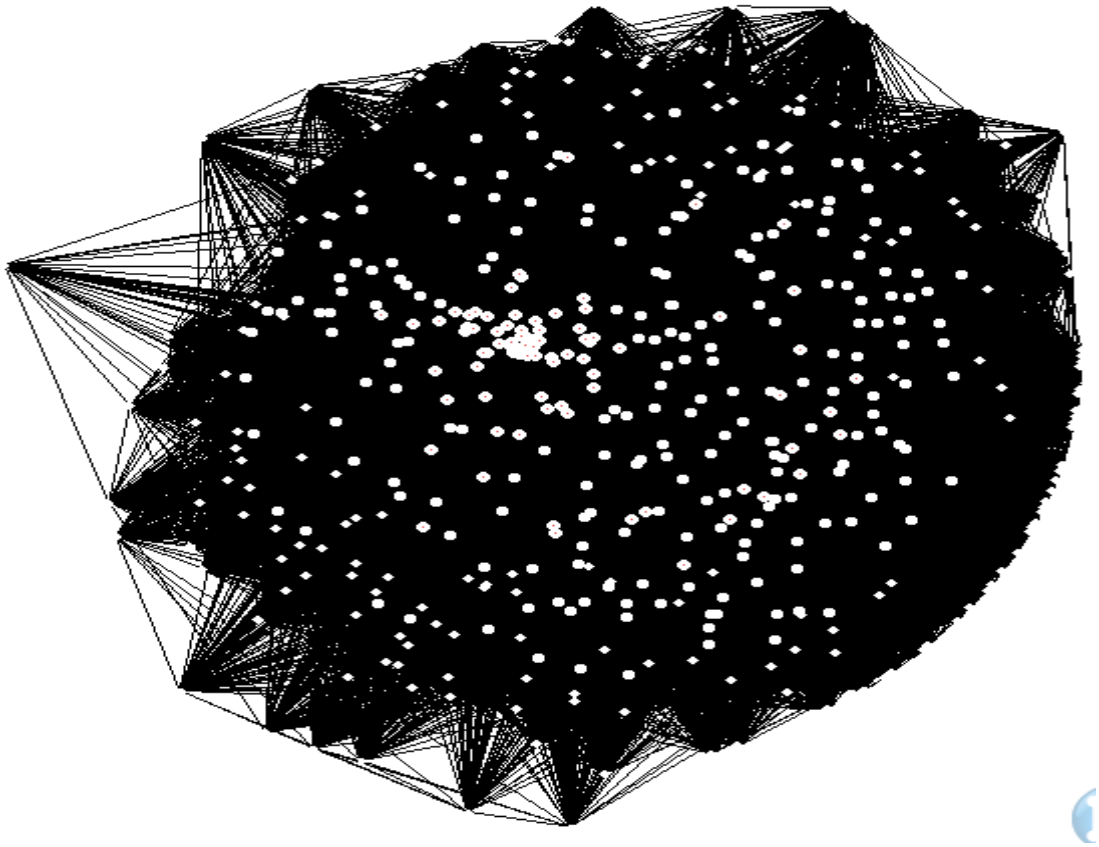

Figure 2 482-word network structure

As Figure 2 indicates, the 482-word network structure is still too complex to understand, so it is necessary to abbreviate it. In order to do this, we reduced it to a 10 per cent core network using the PFnet function. The abbreviated network structure is shown in Figure 3.

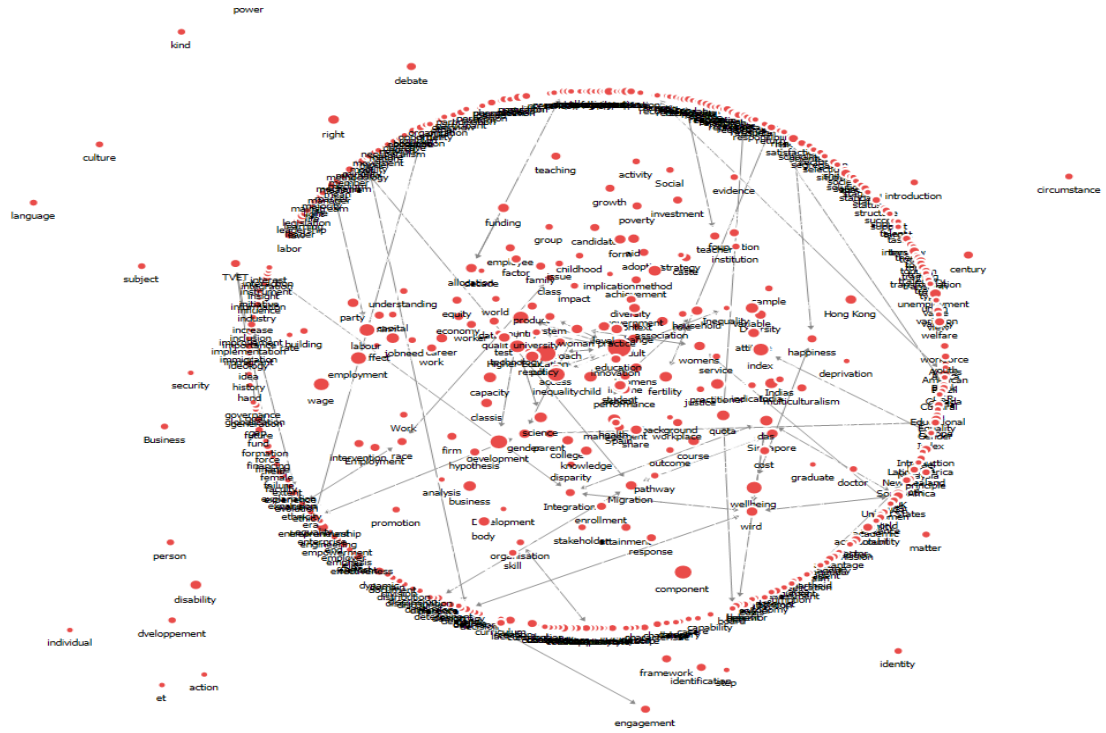

Figure 3 Network abbreviated by PFnet function

The abbreviated network is much more streamlined than the original network. Using this simplified network, topic analysis was performed again. Topic analysis allows us to ascertain into which topic the 482 words are classified. Figure 4 shows the results of topic analysis classifying the words into five categories.

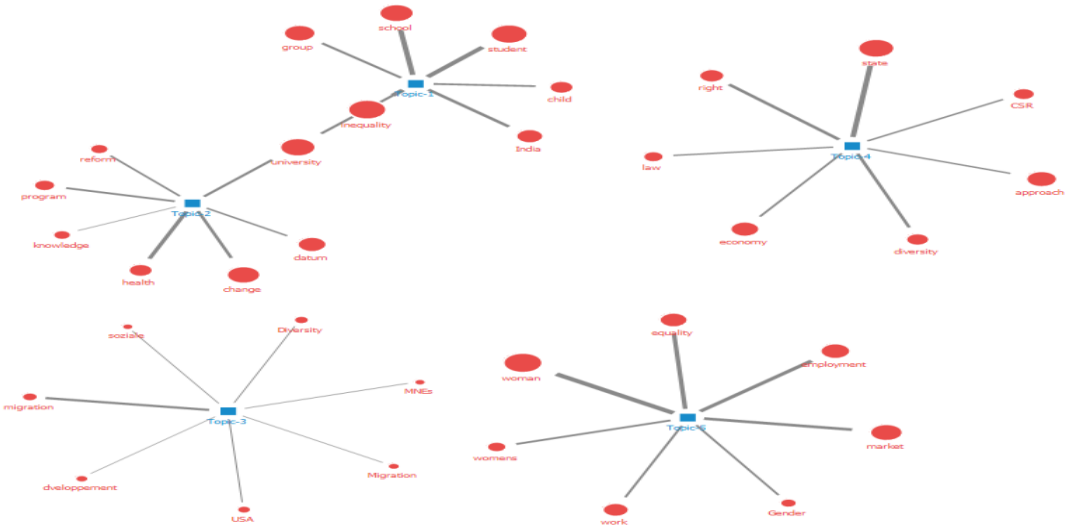

Figure 4 The five extracted topics

Figure 4 makes it possible to review the words of the five extracted topics. We can see that To pic 1 is made up of *group*, *school*, *student*, *child*, *India* and *inequality*. Topic 2 is made up of *university*, *datum*, *change*, *health*, *knowledge*, *program* and *reform*. Topic 3 consists of *diversity*, *MNEs*, *migration*, *USA*, *development* and *soziale*, and Topic 4 consists of *state*, *CSR*, *approach*, *diversity*, *economy*, *law* and *right*. Finally, Topic 5 consists of *woman*, *equality*, *employment*, *mar ket*, *gender* and *work*.

By performing degree centrality analysis on only the words included here, a degree centrality net work can be derived, as shown in Figure 5. In order to understand the characteristics of the five topics analysed here more clearly, we analysed them again using the multi-dimensional scale me thod, and the results are as shown in Figure 5.

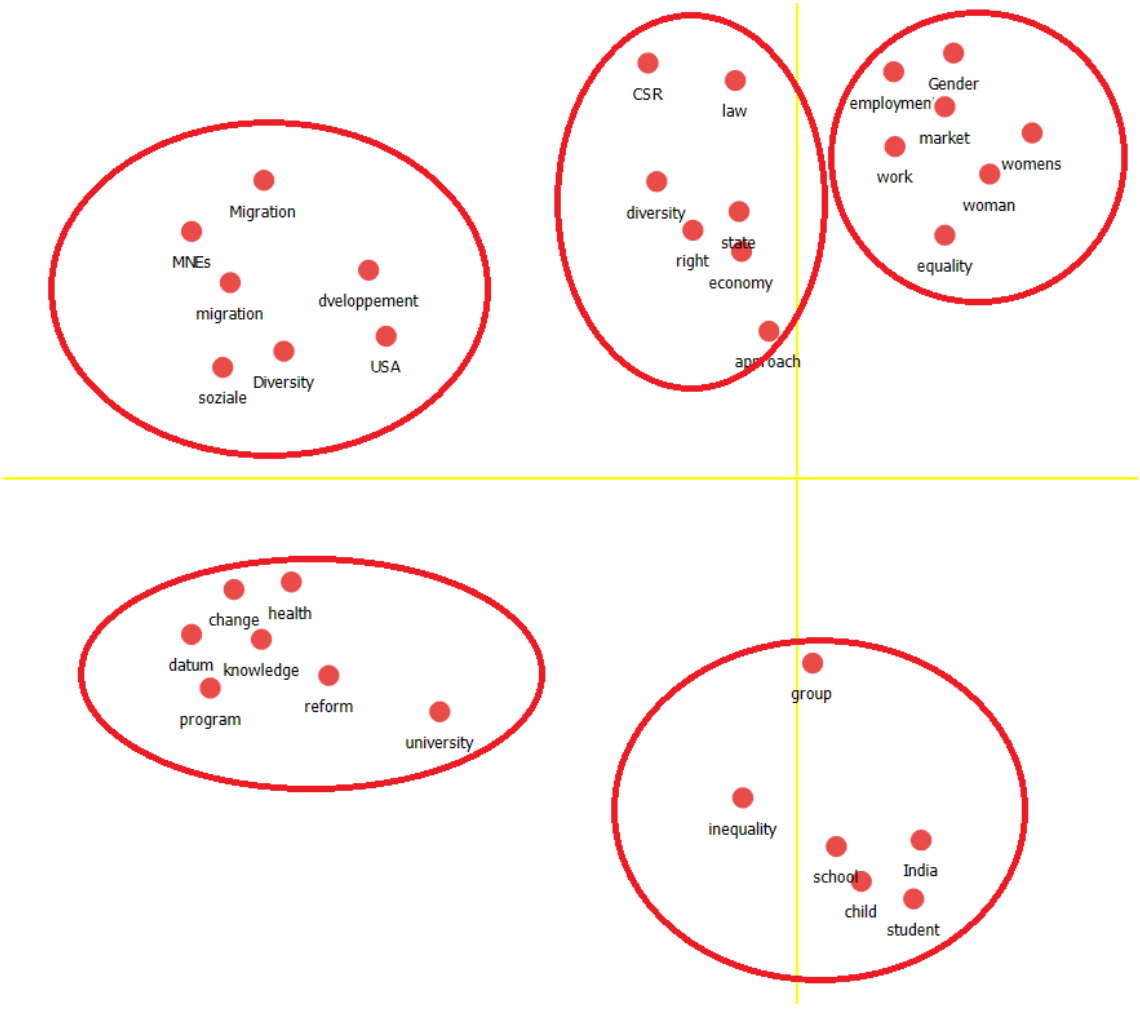

Figure 5 Multi-dimensional scaling analysis: results

The analysis results of applying the topic analysis and multi-dimensional scale method can be su mmarized as follows. In the case of OECD countries, if the policy agenda relating to educational inequality is combined with topic analysis and derived, Topic 1 can be named the problem of i nequality in schools. In particular, the problem of inequality can be aggravated from children's s chool lives, and this inequality is reflected in students' school lives. This suggests that, in order to address these problems, specific guidelines for resolving or alleviating inequality in school life should be constructed.

Topic 2 relates to the active implementation of programmes for reform in universities. Examples include the establishment of a scholarship system for university students from low-income backgr

ounds so as to resolve educational inequality, and exemptions from tuition. Topic 3 suggests the introduction of a policy system that reflects the social diversity of migrants. This appears to be particularly necessary in the USA. It realistically accepts diversity such as cultural diversity and r acial diversity, and suggests the need for the development of educational policies based on such diversity. Topic 4 suggests that corrective measures for educational inequality should be legally g uaranteed and legislated for so that this becomes a single right.

In other words, on a national level, it may be said that the law should guarantee benefits given to people suffering from educational inequality, thereby emphasizing the solution to the problem of educational inequality. Topic 5 relates to the need for benefits for women in the labour marke t. This relates particularly to job opportunities for women, and raises the need for a separate ben efit for women in employment.

5. Conclusion

Educational inequality is a phenomenon whereby inequality in educational outcomes occurs becau se students receive education in conditions that are relatively inferior in regional, socio-economic and other terms. As such, it occurs when the fairness enshrined in the principles and standards a pplied in the distribution of educational opportunities, and in the educational process itself, is we akened. The 'education gap' problem is a phenomenon experienced by all countries, whether dev eloped or underdeveloped. The problem is that such educational inequality either leads to a harde ning of the barriers between classes, or shows a tendency to intensify over time.

Furthermore, it is expected that such educational inequality is likely to intensify owing to the Co vid-19 pandemic that the world has been experiencing recently. Recognizing this problem, this st udy attempted to examine the policy issues faced by OECD countries in dealing with educational inequality. The analysis results were obtained using the text mining analysis method. As a result of the analysis, various policy issues faced by OECD countries were classified into five categori es. These five policy topics can be summarized as: inequality in primary schools; reform of supp ort programmes for university students; measures to recognize the diversity of migrants; legislatio n regarding educational inequality measures; and promotion of protection for women in the labou r market.

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