# Syntax and Big Data 

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#### Abstract

The main goal of this paper is to analyze 638 KCI (Korea Citation Index) papers from 1980 to 2022. First, this paper provides information on published papers, their proportion, and their cumulative proportion. A point to note is that topic 8 was the most preferred one for authors, followed by topic 9 , topic 5 , and topic 1 , in that order. A further point to note is that the word Syntax was the most used one in syntax papers, followed by the word study, the word paper, and the word analysis. With respect to the frequency of words occurred in 638 KCI papers, it is worth noting that the word syntax was the most frequently used one, followed by the word space, the word study, the word analysis, and the word structure. Finally, this paper provides the visualization of which words are neighboring ones with syntax. Simply put, the words way, paper, fact, theory, information, study, and language are linked to the word syntax.


Keywords:syntax, big data, biblio data collector, NetMiner, visualization, keyword, topic

## I. Introduction

The ultimate goal of this paper is to analyze 638 KCI papers in connection with the word syntax from 1980 to 2022. First, we look into the frequency of published articles, their proportion, and their cumulative proportion. Second, we examine 9 topics in which each topic is formed by five keywords. It must be noted that the so-called keyword analysis provides us with the information of which topic is mainly used in 638 KCI papers and that it provides us with the information of which topic is the preferred one. Third, a topic analysis shows us the information of which topic frequently occurs. Fourth, we are concerned with the term degree which refers to the frequency of documents.Fifth, we inquire into the frequency of words occurred with the word syntax. We examine the frequency of 88 words that were much used in syntax papers. Finally, we provide main words neighboring with the word syntax, which shows us the picture of which words co-occur with the word syntax. The organization of this paper is as follows.In section 3.1, we provide information on published papers, their proportion, and their cumulative proportion. In section 3.2, we provide 9 topics that are formed by 5 keywords. We argue that topic 8 was the most preferred one for authors, followed by topic 9 , topic 5 , and topic 1, in that order. In section 3.3, we further argue that the word Syntax was the most used one in syntax papers, followed by the word study, the word paper, and the word analysis. In section 3.5, we provide the visualization of which words are neighboring ones with syntax.

## II. Methods

The main purpose of this paper is to analyze 638 KCI papers from 1980 to 2022. We used the biblio data collector and the software package NetMiner to analyze them. In this paper, we aim to answer the following questions: Can we provide information on papers published from 1980 to 2022 including their proportion and their cumulative proportion? Can we provide the keywords and topics of 638 KCI articles? Can we provide the frequency of documents in which words occur? Can we provide main words which were much used in 638 KCI articles? Finally, can we provide the information of which words are linked to the word syntax?

## III. Results

### 3.1. Published papers

The goal of this section is to provide information on published papers, their proportion, and their cumulative proportion. Table 1 shows the published time of 638 KCI papers, their proportion, and their cumulative proportion:

Table 1 Information on published papers

| Value | Frequency | Proportion | Cumulative Proportion |
| :---: | :---: | :---: | :---: |
| 1985.04 | 1 | 0.002 | 0.002 |
| 1985.11 | 1 | 0.002 | 0.003 |
| 1995.12 | 1 | 0.002 | 0.005 |
| 1998.06 | 1 | 0.002 | 0.006 |
| 1999.11 | 1 | 0.002 | 0.008 |
| 2001.06 | 1 | 0.002 | 0.009 |
| 2001.09 | 1 | 0.002 | 0.011 |
| 2001.12 | 2 | 0.003 | 0.014 |
| 2002.03 | 1 | 0.002 | 0.016 |
| 2002.06 | 1 | 0.002 | 0.017 |
| 2002.07 | 1 | 0.002 | 0.019 |
| 2002.08 | 1 | 0.002 | 0.02 |
| 2002.09 | 4 | 0.006 | 0.027 |
| 2002.10 | 1 | 0.002 | 0.028 |
| 2002.11 | 3 | 0.005 | 0.033 |
| 2002.12 | 3 | 0.005 | 0.038 |
| 2003.03 | 1 | 0.002 | 0.039 |
| 2003.05 | 2 | 0.003 | 0.042 |
| 2003.06 | 9 | 0.014 | 0.056 |
| 2003.08 | 4 | 0.006 | 0.063 |
| 2003.09 | 1 | 0.002 | 0.064 |
| 2003.10 | 1 | 0.002 | 0.066 |
| 2003.11 | 2 | 0.003 | 0.069 |
| 2003.12 | 4 | 0.006 | 0.075 |
| 2004.02 | 2 | 0.003 | 0.078 |
| 2004.03 | 2 | 0.003 | 0.082 |
| 2004.06 | 5 | 0.008 | 0.089 |
| 2004.07 | 1 | 0.002 | 0.091 |
| 2004.08 | 3 | 0.005 | 0.096 |


| 2004.09 | 3 | 0.005 | 0.1 |
| :---: | :---: | :---: | :---: |
| 2004.10 | 1 | 0.002 | 0.102 |
| 2004.11 | 2 | 0.003 | 0.105 |
| 2004.12 | 4 | 0.006 | 0.111 |
| 2005.02 | 2 | 0.003 | 0.114 |
| 2005.03 | 2 | 0.003 | 0.118 |
| 2005.04 | 5 | 0.008 | 0.125 |
| 2005.05 | 1 | 0.002 | 0.127 |
| 2005.06 | 7 | 0.011 | 0.138 |
| 2005.07 | 2 | 0.003 | 0.141 |
| 2005.08 | 2 | 0.003 | 0.144 |
| 2005.09 | 1 | 0.002 | 0.146 |
| 2005.10 | 1 | 0.002 | 0.147 |
| 2005.12 | 4 | 0.006 | 0.154 |
| 2006.02 | 1 | 0.002 | 0.155 |
| 2006.03 | 3 | 0.005 | 0.16 |
| 2006.06 | 3 | 0.005 | 0.165 |
| 2006.07 | 1 | 0.002 | 0.166 |
| 2006.08 | 2 | 0.003 | 0.169 |
| 2006.10 | 1 | 0.002 | 0.171 |
| 2006.12 | 8 | 0.013 | 0.183 |
| 2007.02 | 2 | 0.003 | 0.187 |
| 2007.05 | 2 | 0.003 | 0.19 |
| 2007.06 | 9 | 0.014 | 0.204 |
| 2007.08 | 3 | 0.005 | 0.208 |
| 2007.09 | 2 | 0.003 | 0.212 |
| 2007.10 | 2 | 0.003 | 0.215 |
| 2007.11 | 7 | 0.011 | 0.226 |
| 2007.12 | 7 | 0.011 | 0.237 |
| 2008.01 | 1 | 0.002 | 0.238 |
| 2008.02 | 2 | 0.003 | 0.241 |


| 2008.03 | 2 | 0.003 | 0.245 |
| :---: | :---: | :---: | :---: |
| 2008.05 | 3 | 0.005 | 0.249 |
| 2008.06 | 4 | 0.006 | 0.255 |
| 2008.08 | 4 | 0.006 | 0.262 |
| 2008.09 | 5 | 0.008 | 0.27 |
| 2008.10 | 1 | 0.002 | 0.271 |
| 2008.11 | 3 | 0.005 | 0.276 |
| 2008.12 | 7 | 0.011 | 0.287 |
| 2009.02 | 1 | 0.002 | 0.288 |
| 2009.03 | 3 | 0.005 | 0.293 |
| 2009.04 | 3 | 0.005 | 0.298 |
| 2009.05 | 2 | 0.003 | 0.301 |
| 2009.06 | 4 | 0.006 | 0.307 |
| 2009.07 | 1 | 0.002 | 0.309 |
| 2009.08 | 2 | 0.003 | 0.312 |
| 2009.10 | 1 | 0.002 | 0.313 |
| 2009.11 | 4 | 0.006 | 0.32 |
| 2009.12 | 8 | 0.013 | 0.332 |
| 2010.02 | 2 | 0.003 | 0.335 |
| 2010.03 | 2 | 0.003 | 0.339 |
| 2010.04 | 2 | 0.003 | 0.342 |
| 2010.05 | 2 | 0.003 | 0.345 |
| 2010.06 | 4 | 0.006 | 0.351 |
| 2010.07 | 1 | 0.002 | 0.353 |
| 2010.08 | 2 | 0.003 | 0.356 |
| 2010.09 | 2 | 0.003 | 0.359 |
| 2010.10 | 2 | 0.003 | 0.362 |
| 2010.11 | 3 | 0.005 | 0.367 |
| 2010.12 | 3 | 0.005 | 0.371 |
| 2011.03 | 2 | 0.003 | 0.375 |
| 2011.04 | 1 | 0.002 | 0.376 |


| 2011.05 | 5 | 0.008 | 0.384 |
| :---: | :---: | :---: | :---: |
| 2011.06 | 3 | 0.005 | 0.389 |
| 2011.07 | 2 | 0.003 | 0.392 |
| 2011.08 | 5 | 0.008 | 0.4 |
| 2011.09 | 2 | 0.003 | 0.403 |
| 2011.10 | 2 | 0.003 | 0.406 |
| 2011.11 | 5 | 0.008 | 0.414 |
| 2011.12 | 5 | 0.008 | 0.422 |
| 2012.01 | 1 | 0.002 | 0.423 |
| 2012.02 | 1 | 0.002 | 0.425 |
| 2012.03 | 3 | 0.005 | 0.429 |
| 2012.04 | 2 | 0.003 | 0.433 |
| 2012.05 | 3 | 0.005 | 0.437 |
| 2012.06 | 3 | 0.005 | 0.442 |
| 2012.08 | 5 | 0.008 | 0.45 |
| 2012.09 | 2 | 0.003 | 0.453 |
| 2012.10 | 1 | 0.002 | 0.455 |
| 2012.11 | 4 | 0.006 | 0.461 |
| 2012.12 | 3 | 0.005 | 0.466 |
| 2013.01 | 1 | 0.002 | 0.467 |
| 2013.02 | 3 | 0.005 | 0.472 |
| 2013.03 | 1 | 0.002 | 0.473 |
| 2013.04 | 3 | 0.005 | 0.478 |
| 2013.05 | 3 | 0.005 | 0.483 |
| 2013.06 | 1 | 0.002 | 0.484 |
| 2013.08 | 2 | 0.003 | 0.487 |
| 2013.09 | 1 | 0.002 | 0.489 |
| 2013.10 | 3 | 0.005 | 0.494 |
| 2013.11 | 1 | 0.002 | 0.495 |
| 2013.12 | 3 | 0.005 | 0.5 |
| 2014.01 | 1 | 0.002 | 0.502 |


| 2014.02 | 6 | 0.009 | 0.511 |
| :---: | :---: | :---: | :---: |
| 2014.04 | 2 | 0.003 | 0.514 |
| 2014.05 | 1 | 0.002 | 0.516 |
| 2014.06 | 5 | 0.008 | 0.524 |
| 2014.08 | 2 | 0.003 | 0.527 |
| 2014.09 | 2 | 0.003 | 0.53 |
| 2014.10 | 1 | 0.002 | 0.531 |
| 2014.11 | 3 | 0.005 | 0.536 |
| 2014.12 | 3 | 0.005 | 0.541 |
| 2015.01 | 1 | 0.002 | 0.542 |
| 2015.02 | 1 | 0.002 | 0.544 |
| 2015.03 | 4 | 0.006 | 0.55 |
| 2015.04 | 4 | 0.006 | 0.556 |
| 2015.05 | 4 | 0.006 | 0.563 |
| 2015.06 | 3 | 0.005 | 0.567 |
| 2015.08 | 6 | 0.009 | 0.577 |
| 2015.09 | 5 | 0.008 | 0.585 |
| 2015.10 | 1 | 0.002 | 0.586 |
| 2015.11 | 2 | 0.003 | 0.589 |
| 2015.12 | 8 | 0.013 | 0.602 |
| 2016.01 | 1 | 0.002 | 0.603 |
| 2016.02 | 2 | 0.003 | 0.607 |
| 2016.03 | 6 | 0.009 | 0.616 |
| 2016.04 | 3 | 0.005 | 0.621 |
| 2016.05 | 1 | 0.002 | 0.622 |
| 2016.06 | 2 | 0.003 | 0.625 |
| 2016.08 | 4 | 0.006 | 0.632 |
| 2016.09 | 3 | 0.005 | 0.636 |
| 2016.10 | 2 | 0.003 | 0.639 |
| 2016.11 | 3 | 0.005 | 0.644 |
| 2016.12 | 6 | 0.009 | 0.654 |


| 2017.01 | 1 | 0.002 | 0.655 |
| :---: | :---: | :---: | :---: |
| 2017.02 | 1 | 0.002 | 0.657 |
| 2017.03 | 6 | 0.009 | 0.666 |
| 2017.04 | 3 | 0.005 | 0.671 |
| 2017.05 | 1 | 0.002 | 0.672 |
| 2017.06 | 2 | 0.003 | 0.676 |
| 2017.07 | 2 | 0.003 | 0.679 |
| 2017.08 | 1 | 0.002 | 0.68 |
| 2017.09 | 1 | 0.002 | 0.682 |
| 2017.11 | 2 | 0.003 | 0.685 |
| 2017.12 | 7 | 0.011 | 0.696 |
| 2018.01 | 1 | 0.002 | 0.697 |
| 2018.02 | 4 | 0.006 | 0.704 |
| 2018.03 | 8 | 0.013 | 0.716 |
| 2018.04 | 1 | 0.002 | 0.718 |
| 2018.05 | 1 | 0.002 | 0.719 |
| 2018.06 | 8 | 0.013 | 0.732 |
| 2018.07 | 2 | 0.003 | 0.735 |
| 2018.08 | 2 | 0.003 | 0.738 |
| 2018.09 | 2 | 0.003 | 0.741 |
| 2018.10 | 4 | 0.006 | 0.748 |
| 2018.11 | 5 | 0.008 | 0.755 |
| 2018.12 | 5 | 0.008 | 0.763 |
| 2019.01 | 1 | 0.002 | 0.765 |
| 2019.02 | 5 | 0.008 | 0.773 |
| 2019.03 | 4 | 0.006 | 0.779 |
| 2019.04 | 2 | 0.003 | 0.782 |
| 2019.05 | 6 | 0.009 | 0.792 |
| 2019.08 | 4 | 0.006 | 0.798 |
| 2019.09 | 3 | 0.005 | 0.803 |
| 2019.10 | 2 | 0.003 | 0.806 |


| 2019.11 | 2 | 0.003 | 0.809 |
| :---: | :---: | :---: | :---: |
| 2019.12 | 7 | 0.011 | 0.82 |
| 2020.01 | 5 | 0.008 | 0.828 |
| 2020.02 | 6 | 0.009 | 0.837 |
| 2020.03 | 7 | 0.011 | 0.848 |
| 2020.04 | 4 | 0.006 | 0.854 |
| 2020.05 | 1 | 0.002 | 0.856 |
| 2020.06 | 4 | 0.006 | 0.862 |
| 2020.08 | 3 | 0.005 | 0.867 |
| 2020.09 | 3 | 0.005 | 0.871 |
| 2020.10 | 1 | 0.002 | 0.873 |
| 2020.11 | 2 | 0.003 | 0.876 |
| 2020.12 | 7 | 0.011 | 0.887 |
| 2021.02 | 3 | 0.005 | 0.892 |
| 2021.03 | 3 | 0.005 | 0.897 |
| 2021.04 | 7 | 0.011 | 0.908 |
| 2021.05 | 4 | 0.006 | 0.914 |
| 2021.06 | 4 | 0.006 | 0.92 |
| 2021.07 | 1 | 0.002 | 0.922 |
| 2021.08 | 6 | 0.009 | 0.931 |
| 2021.09 | 6 | 0.009 | 0.94 |
| 2021.10 | 4 | 0.006 | 0.947 |
| 2021.11 | 2 | 0.003 | 0.95 |
| 2021.12 | 6 | 0.009 | 0.959 |
| 2022.01 | 1 | 0.002 | 0.961 |
| 2022.02 | 6 | 0.009 | 0.97 |
| 2022.04 | 2 | 0.003 | 0.973 |
| 2022.05 | 8 | 0.013 | 0.986 |
| 2022.06 | 2 | 0.003 | 0.989 |
| 2022.08 | 5 | 0.008 | 0.997 |
| 2022.09 | 2 | 0.003 | 1 |


| Total | 638 | 1 |  |
| ---: | ---: | ---: | :--- |

It is interesting to note that in June in 2003 and 2007, 9 papers were published, which indicates that the figure is the highest one. Quite interestingly, their proportion and cumulative proportion in June in 2007 are 0.014 and 0.204 , respectively. On the other hand, in June in 2003, their proportion and cumulative proportion are 0.014 and 0.056 , respectively. It is worth noting that there was a publication of 8 papers in 2006 (December), 2009 (December), 2015 (December), 2018 (March), 2018 (June), and 2022 (August). Their proportion is 0.013 and the figure is the second highest. It is worthwhile pointing out that many papers tended to be published in December in each year. It should be pointed out that there was a publication of 7 papers in 2005 (June), 2007 (November and December), 2008 (December), 2017 (December), 2019 (December), 2020 (March and December), and 2021 (April). The figure ranks third (the third highest) and their proportion is 0.011 . This provides confirming evidence that many papers tended to be published in December in each year. We thus conclude that there was a publication of 9 papers in June in 2007, which in turn implies that the figure is the highest. The following graph briefly shows the frequency of published papers:

Figure 1 Frequency of published papers


### 3.2. Topics and Keywords

In this section, we are concerned with 9 topics and 5 keywords. Table 2 shows information on 9 topics that are formed by 5 keywords:

Table 2 Topic information

|  | 1st <br> Keyword | 2nd <br> Keyword | 3rd <br> Keyword | 4th <br> Keyword | 5th <br> Keyword |
| :--- | ---: | ---: | ---: | ---: | ---: |
| Topic-1 | sentence | syntax | study | grammar | language |
| Topic-2 | space | Space | analysis | study | Syntax |
| Topic-3 | SS | Syntax | II | development | patient |
| Topic-4 | English | learner | language | syntax | Syntax |
| Topic-5 | construction | clause | noun | paper | syntax |
| Topic-6 | child | language | group | study | ability |
| Topic-7 | verb | syntax | meaning | structure | construction |

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| Topic-8 | paper | syntax | Korean | analysis | English |
| ---: | ---: | ---: | ---: | ---: | ---: |
| Topic-9 | Space | study | Syntax | space | analysis |

As illustrated in Table 2, there are 9 topics that are constituted by 5 keywords. These 9 topics are slightly different from one another in that 5 keywords constituting them are different. However, one thing is certain. Simply put, these topics are mainly used by authors. It is interesting to point out that topic 1 is constituted by 5 keywords sentence, syntax, study, grammar, and language. As indicated in Table 1, the $1^{\text {st }}$ keyword is the word sentence, which in turn indicates that it is the most preferred one. It should be mentioned, on the other hand, that 5 keywords space, Space, analysis, study, and Syntax consist of topic 2 . The $1^{\text {st }}$ keyword is the word spaceand it is regarded as the most preferred. When it comes to topic 4 , it is formed by 5 keywords English, learner, language, and syntax. More importantly, the word English is the $1^{\text {st }}$ keyword and it is considered to be the most preferable one among authors. It is noteworthy that 5 keywords construction, clause, noun, paper, and syntaxconsist of topic 5 . Note that the keyword construction is thought of as the most preferred. Quite interestingly, topic 7 is formed by the keywords verb, syntax, meaning, structure, and construction. This in turn suggests that the word verb was the most preferred one for authors in topic 7. Finally, 5 keywords Space, study, syntax, space, and analysisconsist of topic 9. As expected, the word Space was the most widely used one in topic 9.
Now attention is paid to the frequency of documents. In the term of NetMiner, documents refer to papers. Table 3 shows how many times each topic occurred in papers:

Table 3 Frequency of documents

|  |  |
| :--- | :--- |
|  | \# of documents |
| Topic-1 |  |
| Topic-2 |  |
| Topic-3 |  |
| Topic-4 |  |
| Topic-5 |  |
| Topic-6 |  |
| Topic-7 |  |
| Topic-8 |  |
| Topic-9 |  |

It is significant to note that topic 8 occurred in 115 papers, which is the highest. As observed earlier, topic 8 is constituted by the keywords paper, syntax, Korean, analysis, and English. This in turn implies that authors were keen on using these keywords in their papers. It is worth pointing out, on the other hand, that topic 9 occurred in 102 papers, which is the second highest. As illustrated in Table 2, the keywords Space, study, syntax, space, and analysis consist of topic 9 . Additionally, it should be noted that topic 5 appeared in 85 papers, which is the third highest. As indicated in Table 2, topic 5 is constituted by the keywords construction, clause, noun, paper, and syntax. It should be pointed out, on the other hand, that topic 1 appeared in 79 papers, which is the fourth highest. It can thus be concluded that topic 8 was the most preferred one for authors, followed by topic 9 , topic 5 , and topic 1 , in that order.

### 3.3. Frequency of words

The goal of this section is to examine the frequency of words occurred in 638 KCI papers. The so-called degree is the term of NetMiner and refers to the frequency of documents. Table 4 shows the frequency of papers in which words occurred:

Table 4 Frequency of papers

| Number | Word | Degree |
| :---: | :---: | :---: |
| 1 | Syntax | 396 |
| 2 | syntax | 350 |
| 3 | study | 300 |
| 4 | paper | 251 |
| 5 | analysis | 246 |
| 6 | result | 208 |
| 7 | structure | 197 |
| 8 | Space | 156 |
| 9 | space | 153 |
| 10 | Korean | 140 |
| 11 | language | 136 |
| 12 | Study | 127 |
| 13 | construction | 115 |
| 14 | purpose | 110 |
| 15 | type | 110 |
| 16 | method | 108 |
| 17 | characteristic | 104 |
| 18 | research | 103 |
| 19 | sentence | 103 |
| 20 | case | 92 |
| 21 | verb | 88 |
| 22 | integration | 87 |
| 23 | syntactic | 85 |
| 24 | Analysis | 84 |
| 25 | way | 84 |
| 26 | system | 83 |
| 27 | theory | 83 |
| 28 | word | 82 |
| 29 | English | 81 |
| 30 | meaning | 80 |
| 31 | order | 79 |
| 32 | term | 79 |
| 33 | relationship | 78 |
| 34 | difference | 75 |
| 35 | function | 74 |
| 36 | property | 74 |
| 37 | element | 73 |
| 38 | value | 71 |
| 39 | form | 70 |
| 40 | area | 69 |
| 41 | subject | 69 |
| 42 | time | 67 |
| 43 | datum | 65 |
| 44 | pattern | 64 |
| 45 | argument | 62 |
| 46 | kongkankwumwunlon | 62 |
| 47 | problem | 60 |
| 48 | change | 59 |
| 49 | development | 59 |
| 50 | information | 59 |


| 51 | process | 59 |
| :---: | :---: | :---: |
| 52 | semantic | 58 |
| 53 | feature | 57 |
| 54 | clause | 56 |
| 55 | fact | 56 |
| 56 | object | 55 |
| 57 | factor | 54 |
| 58 | grammar | 54 |
| 59 | category | 53 |
| 60 | position | 53 |
| 61 | approach | 52 |
| 62 | relation | 52 |
| 63 | role | 52 |
| 64 | use | 52 |
| 65 | Korea | 51 |
| 66 | Spatial | 51 |
| 67 | addition | 51 |
| 68 | Semantics | 50 |
| 69 | level | 50 |
| 70 | model | 50 |
| 71 | phrase | 50 |
| 72 | plan | 50 |
| 73 | point | 49 |
| 74 | aspect | 48 |
| 75 | phenomenon | 48 |
| 76 | effect | 47 |
| 77 | expression | 47 |
| 78 | noun | 47 |
| 79 | unit | 47 |
| 80 | person | 46 |
| 81 | Structure | 45 |
| 82 | view | 45 |
| 83 | distribution | 44 |
| 84 | predicate | 44 |
| 85 | perspective | 43 |
| 86 | accessibility | 42 |
| 87 | context | 42 |
| 88 | movement | 42 |
| 89 | configuration | 40 |
| 90 | group | 40 |
| 91 | number | 40 |
| 92 | speaker | 40 |
| 93 | city | 39 |
| 94 | condition | 39 |
| 95 | work | 39 |
| 96 | component | 38 |
| 97 | concept | 37 |
| 98 | facility | 37 |
| 99 | learner | 37 |

It is important to note that the word Syntax were the most frequently used one. More specifically, it occurred in 396 papers. This in turn suggests that the word Syntax was the most preferable one among authors. It
is worthwhile noting that the word syntax is the second highest. To be more specific, it appeared in 350 papers. We take this fact as suggesting that the word Syntax is followed by the word syntax. It should be mentioned, on the other hand, that the word study ranks third. It occurred in 300 papers. It seems thus reasonable to assume that the word syntax is followed by the word study. Additionally, it is noteworthy that the word paper ranks fourth. More specifically, it occurred in 251 papers. Additionally, it is worth noting that the word analysis occurred in 246 papers. It seems thus reasonable to conclude that the word Syntax was the most preferable one for authors, followed by the word study, the word paper, and the word analysis, in that order. The following graph briefly shows the frequency of keywords:

Figure 2 Frequency of keywords

## Degree



### 3.4. Frequency of words related to syntax

In this section, we consider the overall frequency of words occurred in 638 KCI papers.
Table 5 Frequency of words occurred in 638 KCI papers

| Number | Word | Part of <br> Speech(POS) | Frequency | Word <br> length |
| :--- | :--- | :--- | ---: | ---: |
| $\mathbf{1}$ | syntax | Common Noun | 816 | 4 |
| $\mathbf{2}$ | space | Common Noun | 758 | 7 |
| $\mathbf{3}$ | study | Common Noun | 653 | 8 |
| $\mathbf{4}$ | Syntax | Proper Noun | 643 | 8 |
| $\mathbf{5}$ | analysis | Common Noun | 477 | 3 |
| $\mathbf{6}$ | structure | Common Noun | 430 | 14 |
| $\mathbf{7}$ | Space | Proper Noun | 393 | 12 |
| $\mathbf{8}$ | paper | Common Noun | 374 | 4 |
| $\mathbf{9}$ | sentence | Common Noun | 355 | 5 |
| $\mathbf{1 0}$ | construction | Common Noun | 346 | 6 |
| $\mathbf{1 1}$ | language | Common Noun | 317 | 4 |
| $\mathbf{1 2}$ | verb | Common Noun | 310 | 9 |
| $\mathbf{1 3}$ | result | Common Noun | 287 | 6 |
| $\mathbf{1 4}$ | Korean | Proper Noun | 259 | 5 |
| $\mathbf{1 5}$ | type | Common Noun | 231 | 5 |
| $\mathbf{1 6}$ | integration | Common Noun | 205 | 9 |
| $\mathbf{1 7}$ | meaning | Common Noun | 195 | 10 |
| $\mathbf{1 8}$ | English | Proper Noun | 192 | 4 |
| $\mathbf{1 9}$ | clause | Common Noun | 187 | 6 |
| $\mathbf{2 0}$ | research | Common Noun | 179 | 7 |


| 21 | method | Common Noun | 173 | 11 |
| :---: | :---: | :---: | :---: | :---: |
| 22 | characteristic | Common Noun | 169 | 4 |
| 23 | word | Common Noun | 168 | 7 |
| 24 | case | Common Noun | 159 | 4 |
| 25 | area | Common Noun | 159 | 5 |
| 26 | grammar | Common Noun | 152 | 7 |
| 27 | theory | Common Noun | 145 | 13 |
| 28 | noun | Common Noun | 145 | 5 |
| 29 | system | Common Noun | 141 | 8 |
| 30 | value | Common Noun | 135 | 5 |
| 31 | object | Common Noun | 135 | 5 |
| 32 | Study | Proper Noun | 133 | 4 |
| 33 | subject | Common Noun | 129 | 6 |
| 34 | phrase | Common Noun | 129 | 5 |
| 35 | difference | Common Noun | 129 | 9 |
| 36 | purpose | Common Noun | 125 | 6 |
| 37 | function | Common Noun | 123 | 8 |
| 38 | element | Common Noun | 119 | 8 |
| 39 | change | Common Noun | 114 | 6 |
| 40 | syntactic | Common Noun | 113 | 8 |
| 41 | plan | Common Noun | 113 | 8 |
| 42 | argument | Common Noun | 113 | 3 |
| 43 | model | Common Noun | 111 | 6 |
| 44 | form | Common Noun | 111 | 7 |
| 45 | relationship | Common Noun | 110 | 10 |
| 46 | factor | Common Noun | 110 | 12 |
| 47 | way | Common Noun | 107 | 5 |
| 48 | term | Common Noun | 106 | 8 |
| 49 | pattern | Common Noun | 106 | 8 |
| 50 | feature | Common Noun | 106 | 8 |
| 51 | unit | Common Noun | 103 | 9 |
| 52 | property | Common Noun | 103 | 7 |
| 53 | order | Common Noun | 103 | 6 |
| 54 | Analysis | Common Noun | 103 | 4 |
| 55 | information | Common Noun | 102 | 7 |
| 56 | time | Common Noun | 97 | 6 |
| 57 | development | Common Noun | 97 | 5 |
| 58 | person | Common Noun | 96 | 5 |
| 59 | expression | Common Noun | 94 | 6 |
| 60 | accessibility | Common Noun | 94 | 5 |
| 61 | predicate | Common Noun | 92 | 7 |
| 62 | position | Common Noun | 90 | 11 |
| 63 | category | Common Noun | 90 | 4 |
| 64 | datum | Common Noun | 88 | 7 |
| 65 | problem | Common Noun | 84 | 8 |
| 66 | aspect | Common Noun | 83 | 4 |
| 67 | approach | Common Noun | 82 | 4 |
| 68 | semantic | Common Noun | 81 | 10 |
| 69 | process | Common Noun | 78 | 4 |
| 70 | Korea | Proper Noun | 75 | 8 |
| 71 | relation | Common Noun | 74 | 4 |
| 72 | movement | Common Noun | 73 | 7 |


| $\mathbf{7 3}$ | level | Common Noun | 72 | 6 |
| :--- | :--- | :--- | ---: | ---: |
| $\mathbf{7 4}$ | effect | Common Noun | 71 | 8 |
| $\mathbf{7 5}$ | view | Common Noun | 69 | 6 |
| $\mathbf{7 6}$ | role | Common Noun | 69 | 12 |
| $\mathbf{7 7}$ | Spatial | Proper Noun | 67 | 6 |
| $\mathbf{7 8}$ | use | Common Noun | 66 | 7 |
| $\mathbf{7 9}$ | phenomenon | Common Noun | 66 | 7 |
| $\mathbf{8 0}$ | fact | Common Noun | 63 | 8 |
| $\mathbf{8 1}$ | distribution | Common Noun | 63 | 5 |
| $\mathbf{8 2}$ | kongkankwumwunlon | Proper Noun | 62 | 8 |
| $\mathbf{8 3}$ | point | Common Noun | 58 | 11 |
| $\mathbf{8 4}$ | Structure | Proper Noun | 57 | 6 |
| $\mathbf{8 5}$ | addition | Common Noun | 57 | 4 |
| $\mathbf{8 6}$ | Semantics | Proper Noun | 55 | 11 |
| $\mathbf{8 7}$ | context | Common Noun | 53 | 9 |
| $\mathbf{8 8}$ | perspective | Common Noun | 48 | 6 |

It is significant to note that the overall frequency of the word syntax is 816 tokens and that the word length including it is 4 . As illustrated in Table 5, the word syntax ranks first, which in turn indicates that it was the most preferred by KCI authors. It is worth observing that the overall frequency of the word spaceis 758 tokens and that it ranks second ( 758 tokens). This in turn imply that KCI authors were keen on using this word in their papers. It should be pointed out, on the other hand, that the word study ranks third. More specifically, the overall frequency of it is 653 tokens and the word length including it is 8 . Quite interestingly, the word Syntax ranks fourth and the word length containing it is 8 . This indicates that the word Syntax was the fourth most frequently used one. It should be noted that the frequency of the word analysis is 477 tokens and the word length containing it is 3 . As indicated in Table 5, the word analysis ranks fifth, which may imply that KCI authors liked using this word. Noteworthy is that the overall frequency of the word structure is 430 tokens and that it ranks sixth. From all of this, it is clear that the word syntax was the most preferred by KCI authors, followed by the word space, the word study, the word Syntax, the word analysis, and the word structure, in that order. Additionally, the overall frequency of the word research is 179 tokens (the twentieth highest) and the word length including it is 7 . Finally, it should be mentioned that the overall frequency of the word theory is 145 tokens and that it ranks twenty seventh. We thus conclude that the word syntax was the most preferred one for KCI authors. Figure 3 briefly shows the frequency of 29 words occurred in 638 KCI papers:

Figure 3 Frequency of 29 words


### 3.5 Visualization of words neighboring with syntax

The goal of this section is to provide the picture of which words are linked to the word syntax. Figure 4 shows the visualization of words neighboring with syntax:

Figure 4 Visualization of words neighboring with syntax


Most interestingly, the words order, person, problem, distribution, system, case, Semantics, process, role, etc. are linked to the word Syntax. Such words are the main words neighboring with Syntax. Most importantly, the words way, paper, fact, theory, information, study, and languageare also linked to the word syntax. These words are closely related to the word syntax. To sum up, Figure 4 provides the visualization of which words are neighboring ones with syntax. For the visualization of synonyms, see Kang (2022a, 2022b, 2022c, 2022d).

## IV. Conclusion

To sum up, we have analyzed 638 KCI papers in connection with the word syntax from 1980 to 2022. In section 3.1, we have provided information on published papers, their proportion, and their cumulative proportion. In section 3.2, we have provided 9 topics that are formed by 5 keywords. We have also shown that topic 8 was the most preferred one for authors, followed by topic 9 , topic 5 , and topic 1 , in that order. In section 3.3, we have argued that the word Syntax was the most widely usedone in syntax papers, followed by the word syntax, the wordstudy, the word paper, and the word analysis. In section 3.4, we have further argued that that the word syntax was the most preferred by KCI authors, followed by the word space, the word study, the word Syntax, the word analysis, and the word structure. In section 3.5, we have provided the visualization of which words are main ones neighboring with syntax. More specifically, the words way, paper, fact, theory, information, study, and language are linked to the word syntax.

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