Trends in Ceramic education using Big Data Analysis

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Abstract—This study used the Art full text DB to provide a variety of apprenticeship 333 kinds of education journals to identify research trends in ceramic education. From 1983 to 2014 after gathering the keywords of the 2,711 papers published in international journals in the field of education ceramics, using KH Coder degree centrality, betweenness centrality, eigenvector centrality, etc. centrality analysis was performed. Thus, by knowing the relationship between the specific research themes of the papers of apprenticeship education and keywords, I tried to present the direction of research for interdisciplinary research and fusion. In addition, we discussed the research trend of ceramics education by combining the study of the results and the quadrant keyword of multidimensional scaling of Qin (1999). A combination of the KH Coder and multidimensional scaling quadrant, was derive the following conclusion. First, the mainstream of the research can be to proceed with the study of the eigenvector centrality keyword and 1 quadrant of the keyword is that there is a high value of research. Secondly, in the depth of research, it is possible to proceed with the study of the degree centrality keywords and 2 quadrant of the keyword is that there is a high value of research. Thirdly, the fusion research can be advanced research betweenness centrality keyword and 3 quadrants of the keyword and more valuable research. Fourth, the next generation of research can be advanced new study appeared in mainstream keywords and 4 quadrants of keywords in recent 1-2 years and a high value of research. The result of such analysis, first analyzes the research trends of ceramics education, it can be that there is a learning significance that presented a future research directions of ceramics education.

Keyword : Ceramic Education, Big data, Keyword Analysis, KH Coder, Multidimensional Scaling

I. INTRODUCTION

Research Background and Purpose

In the information age, large quantities of information are produced and managed, and the analysis and value of information are emphasized as important factors. The importance of this newly emerged "Big Data" is highlighted, and it is used as an effective strategy for creating value by understanding and analyzing it.

Big Data is a large data volume, a variety of data types, and the ability\(^1\) to solve data processing and analysis in a timely manner. And as a result, it was necessary to be able to create new value. Big Data has sector specific characteristics, and can be used in various ways, and its utilization value is beyond imagination. Therefore, it is necessary to utilize big data in ceramic research field where researches related to experiment, application, and work are mainstream, to examine research trends and to create new research value. The purpose of this study is to elicit the degree centrality, betweenness centrality, eigenvector centrality of the keywords using the foreign journal and the KH Coder based on keywords searched by 'ceramic education' and is to propose future research direction.

II. THEORETICAL BACKGROUND

A. Keyword Analysis

Using research paper, reports, and other keywords bibliometrics has been used as method to analyze research trends in academic studies. Traditional methods of bibliometrics include papers, co-authors, citation analysis, and simultaneous word analysis.\(^2\) In this method, as the computer technology is rapidly developed, it is possible to map the information, and the information analyzed quantitatively is constructed as a network represented by a node and a link as shown in <Fig. 1>. It becomes possible to grasp the semantic relation structure for the object.

![Keyword network model structure](image)

**Figure 1.** Keyword network model structure

![Keyword analysis](image)

**Figure 2.**

Analysis methods using this network include subnetwork analysis, structural satellite analysis, and centrality analysis. In this study, centrality analysis was conducted. Centralism is often interpreted as the concept of influence and is one of the most commonly used analytical techniques. The types of centrality are subdivided into Degree centrality, Betweenness centrality, and Eigenvector centrality as shown in TABLE 1.

<table>
<thead>
<tr>
<th>Centrality</th>
<th>Concept</th>
<th>Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree Centrality</td>
<td>The number of other nodes to which a node (keyword) is directly connected.</td>
<td>Depth study</td>
</tr>
<tr>
<td>Betweenness Centrality</td>
<td>The degree to which a node is located between other nodes in the network</td>
<td>Fusion research</td>
</tr>
</tbody>
</table>

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\(^1\) O'Reilly, (2013), How to use Big Data, Pub.

\(^2\) Kim, Hye-Jin (2007), References.
Degree centrality is a measure of the degree of connectivity of nodes on a network. In other words, the number of other nodes directly connected to one node means the sum of connected nodes in the network (Kim, Yong-Hak, 2011). This is the concept of measuring the position of the central node in the network because it only measures the relationship with the directly connected node. For example, a node with the highest connection with other nodes can be considered to have a high connection center, which means a node acting as a hub in the network.

And betweenness centrality is the measure of the degree to which one node is "between" other nodes in the network. In other words, a node with a large betweenness centrality has a great influence on information because it is the node that the other nodes are most frequently visited on the network. This means that nodes that act as mediators on the network, regardless of the frequency of connectivity.

Eigenvector centrality is called the prestige index or eigenvector, which is the degree to which one node is connected to another node in a critical location on the whole network. This means that only one connection with a node, a significant status and role in the network can increase its influence if it has a relationship with several other nodes. In interpreting the results of centrality analysis, it can be used to study the degree centrality with an attention to the research subject. The betweenness centrality can be used when the subject to be studied is to be fused with another research topic and the eigenvector centrality is closely related to the selection of research topics.

In this context, this study constructed a keyword network model for the ceramic research field and analyzed critical keyword and research flow on the global level in the ceramic research field by carrying out the centrality analysis.

B. Preliminary Research on Keyword Analysis

Since Khun introduced the concept of paradigm, a methodology has been studied to observe the paradigm of his research domain in various disciplines and to understand their changes.3

Recently, as the bibliographic search engine is improved and the text mining technique is developed, it becomes easier to extract critical keywords mentioned in the paper, and the relationship between the extracted keywords is analyzed. It became possible to grasp the growth pattern of related research field precisely.

In related research, Kim Yong-Bum et al. (2015) derived leisure activity trend through keyword analysis of Google trend. Kim Byung-Sun et al. (2015) analyzed the trend of geospatial information research with NodeXL through WOS search. Chung Hye-Young et al. (2015) studied the change and characteristic flow of early childhood education research through KCI search and UCINET6 analysis. Jang Se-Eun et al. (2014) analyzed the world cruise industry with NetMiner 4.0 through Springer e-journal search, and Ko Jae-Chang et al. (2013) analyzed technology contest with NodeXL after collecting data through 10 journals. Lee Joo-yeon et al. (2013) analyzed the research trends by analyzing jurisprudential studies through journals with NetMiner, and Jeong Dae-hyun et al. (2012) identified trends in research-oriented keywords and key keywords for each year through keyword analysis of green technology information.

Seo Bong-Eun et al. (2011) analyzed diaspora studies in Korea through DBpia and KISS search and analyzed through EXCEL and SPSS. In this way, we can confirm that research trends related to related fields are grasped and data linkage structure is derived by using appropriate data searcher and analysis tool for various fields of study.

In the field of ceramic research related to this study, it is differentiated from previous studies by the first keyword analysis. For this purpose, Art full text which provides DB of 243 kinds of journals of various art fields was used and KH Coder was used as an analysis tool.

There have been no previous studies analyzing the trends of papers related to ceramic education in domestic journals. Therefore, it is the academic significance of this paper to examine the research trends of ceramic education for the first time.

III. Research Design

A. Research Questions

The questions of this study are as follows. What are trends in research related to ceramic education through keyword network analysis?

1. What is the status of the keyword network data shown in research related to ceramic education?

2. What is the result of the keyword network analysis (degree centrality, betweenness centrality, and eigenvector centrality) in research related to ceramic education?

B. Research methods and procedures

1) Keyword network analysis process

This study aims to analyze using the keyword data of overseas journals related to ceramic research. The keyword network analysis process is divided into three stages as data collection, keyword network analysis, and multidimensional scaling application shown in <Fig. 2>.

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2) Data collection

The purpose of this study is to examine the research trends in the field of ceramic education through the keyword network structure of the thesis. To this end, a total of 243 arts and scholarly papers were searched from 1983 to 2014 through the search term `ceramic education' in Art full text, which provides 333 kinds of journals of various art fields among the world's academic databases including Korea. KH Coder was used as the analysis tool. KH Coder is a program developed by Japanese scholar Koichi Higuchi. It is used for quantitative content analysis and text mining.\(^4\)

C. Keyword Network Analysis

In the full text of the art field, we conducted a network analysis of keywords from 243 art and scholarly articles, which were searched through the term 'ceramic education' from 1983 to 2014. First, the KH Coder Frequency List is used to find keywords with high connection centrality. Degree centrality is the most frequently used index in the searched papers, and is an indicator that neighboring nodes can identify many words.

![Degree centrality](image)

Next, through the co-occurrence analysis of the Tools tab, we found the keywords with the high betweenness centrality and eigenvector centrality. Betweenness centrality means the most frequently used word through intermediation when a link is made between words and words. In other words, it is an indicator of the actual value of a specific word through how it is related to other vocabulary, not just the frequency of appearance. As a result of the analysis, the keyword 'Convention' has the highest betweenness centrality through the Centrality of co-occurrence analysis.< Fig. 4.>

![Betweenness centrality](image)

And the eigenvector centrality is the degree of connection with the influential nodes. As a result of the analysis, the keyword 'art-school' was found to has the highest eigenvector centrality through Eigenvector betweenness of co-occurrence analysis.<Fig. 5.>

The data obtained by the above method are arranged on a two-dimensional graph using a multi-dimensional scale method<Fig. 6.>. The quadrant was divided by the origin of each axis, and the graph analysis was in accordance with the interpretation standard proposed by Qin (1999).<Fig. 6.> shows the result of the multidimensional scaling.

![Keyword Multidimensional Scaling](image)

According to Qin (1999) in Fig. 7, the first quadrant is the centered and mature study, the mainstream research field, and the second quadrant is the center but the immature field is an area that needs to be studied in depth. The third quadrant is the periphery but mature, and the last four quadrants are the mainstream keywords that have recently emerged in the near and immature fields, that is, the next generation research fields, in the last one to two years.

![Qin, H. (1999)](image)

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\(^4\) Seo, Jung-Min (2014), References.

\(^5\) Qin, H. (1999), Knowledge discovery through co-word analysis. Library Trends.
The results of analyzing the research trends of ceramic education using KH Coder and multidimensional scaling (MDS) technique are as follows:

### TABLE 2. Direction of comprehensive research

<table>
<thead>
<tr>
<th>Category</th>
<th>KH/MDS</th>
<th>Keyword</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mainstream research</td>
<td>Quadrant 1: &quot;Center - maturation - mainstream' research field /eigenvector centrality</td>
<td>art school, directory, list/toledo potter, tabletop exhibition, university of washington, words in art exhibition, art students exhibition, pottery craft study, aesthetics</td>
</tr>
<tr>
<td>Depth study</td>
<td>Quadrant 2: &quot;Center of keyword - Immature - interest' Research field /degree centrality</td>
<td>teaching, illustration, organization, pottery study, conference, pottery exhibition, art study/alfred university, africa pottery, students financial support, american art 21st century exhibition, pottery 21st century exhibition, art teachers education, apprentice, art school great Britain, art teacher education in service, ceramic industries history, art criticism philosophy</td>
</tr>
<tr>
<td>Fusion research</td>
<td>Quadrant 3: &quot;Neighborhoo d - Maturity - Unique' Research Field /betweenness centrality</td>
<td>convention, vacational guidance, pottery technique/ceramics industries economic aspect, pottery study, human figure in art exhibition, american ceramic sculpture exhibition, ceramic sculpture exhibition, people with disabilities, college of ceramic, workshops in art, exchange evaluation, art therapy</td>
</tr>
<tr>
<td>Next Generation Research</td>
<td>Quadrant 4: &quot;Around the keyword - Immature - Next-generation' research field /Mainstream keywords</td>
<td>illustration, brit, organization, council/baltimore clayworks exhibition, fine art, modern art, art school, manual tag, pottery congress, pottery festival, art middle atlantic states exhibition, houston center for contemporary craft, british ceramic sculpture exhibition, art theory, art history methodology, design history, art teachers training</td>
</tr>
</tbody>
</table>

### IV. CONCLUSION

The results of the network analysis of the Ceramic Education Research were as follows.

1. In mainstream research, it is worth to study the keyword with high eigenvector centrality and the first quadrant keyword. Keywords include: art school, tableware exhibition, art exhibition word, art major student exhibition, pottery research, aesthetics.

2. In depth research, it is worth to study the keywords with high degree centrality and the second quadrant keyword. Keywords include: teaching, illustration, organization, pottery study, conference, pottery exhibition, art study, apprentice, art School great Britain, art teacher education in service, ceramic industries history, art criticism philosophy.

3. In fusion research, it is worth to study the keywords with high betweenness centrality and the third quadrant keyword. Keywords include: convention, vocational guidance, pottery technique / Arts and sculpture exhibition, ceramic sculpture exhibition, people with disabilities, college of ceramic, workshops in art, exchange evaluation, art therapy.

4. Researchers who want to do next-generation researches can be said to have a high research value in researching forth quadrant keywords and mainstream keywords newly appeared in the last 1 ~ 2 years. Keywords include: pottery festival, art methodology, Baltimore clay works exhibition, fine art, Pottery congress, art middle Atlantic state exhibition, Houston center for contemporary craft, British ceramic sculpture exhibition, art theory, design history, art teachers training.

This study analyzed the keywords of the articles published in journal related to ceramics education from the viewpoint of network. It is an academic significance that the research trend of ceramic education was first analyzed and presented trends and future research directions. However, a definite interpretation of all papers in the related research field is necessary for further research.

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**REFERENCES**


[14] Cha Hwa-Suk (2010). Meta - analysis on the purpose and type of ceramic research, Korean Ceramics Study. Volume 7 Issue 1