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A data-driven approach for discovery of the latest research trends in higher education for business by leveraging advanced technology and big data

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ABSTRACT

This study aims to examine the latest research trends in higher education for business by grasping the key trends, topics, and interrelationship of each subject. For this study, 304 research articles from four international “top-tier” journals were collected in the field of business education for two years 2018~2019 and analyzed through semantic network analysis. The results show case-centered research for students’ learning and career, performance/results-oriented research, creating programs that emphasize teamwork and leadership are emerging as the main agendas with “student-led or centered.” It helps business educators in higher education have an incredible power to be proactive by reshaping the program or curriculum of business for a future trend-based quality education using advanced technology and big data.

KEYWORDS



Business education; data-driven approach; higher education; research trends; semantic network analysis

Introduction

Everything is going fast. In a rapidly changing world, living in anticipation of the future has become very difficult. Nevertheless, to deal with the uncertain future more clearly, we must be careful to predict future trends, particularly under a crisis such as a coronavirus pandemic (Levine, 2019; Kim & SNU Consumer Trend Analysis Center, 2019). Although there is an error in the prediction or forecast, the best-educated guessing would be better than random guessing or nothing. Predicting the future is an exercise, and through this exercise, we can reduce prediction errors even more (Levine, 2019; Park, 2019). Therefore, we need to apply this view to the field of education by reflecting the rapidly changing educational environment (Yun & Park, 2018).

As an area of learning, business education has continually been developed. Mainly, American and German business education, these two schools have contributed significantly to building and educating new business administration (Dias & Shah, 2008). At the same time, business education has grown quantitatively and qualitatively by expanding not only academic foundations but also various areas of business

education through continuous research in higher education. However, it is faced with multiple challenges in terms of quality education, given the rapidly changing trends and many factors such as dynamic environmental issues with much pressure from a variety of stakeholders surrounding education (Nomuoja, 2010). Based on this background, previous studies have focused on measuring the achievement of curriculum reform in business education or measuring the outcomes of the level of business education to meet the highest standards (American Assembly of Collegiate Schools of Business (AACSB), 1996; Angelo & Cross, 1993; Banta et al., 1996; Edwards & Brannen, 1990). Besides, many scholars have studied the latest trends and factors in the global external environments that influence the development and management of business education. Looking at the latest trends of how business education research has been conducted has a significant meaning in reflecting on the present through the past and seeking directions for the development of business education and research in the future (Choi, 2017; Executive Core, 2015; Foster, 2019; Kim, 2015; Maxwell, 2019; Nikitina & Lapina, 2017; Nomuoja, 2010; OECD, 2019). Accordingly, many researchers have shown vast and multifarious

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studies related to this agenda with diversified perspectives. However, most of these studies were analyzed based on somewhat specific contexts or particular educational situations individually rather than approaching business education with a holistic view. Besides, most studies used qualitative research methods such as case study, comparative analysis based on scientific publications reviews or business school's core course reviews, or interviews and online surveys. Despite the enormous implications for understanding the actual educational situations, it should be taken into account that subjective interpretations or biased opinions may be followed depending on the individual research setting situation (Executive Core, 2015; Nikitina & Lapina, 2017; Nomuoja, 2010). They are confined to individual studies independently rather than covering the totality of business education with a holistic view to keep up with the latest trends in higher education.

Under these limitations of existing studies, this study is designed to examine the latest research trends and direction of business education quantitatively and systematically in a more objective sense. Through this work, a large amount of unstructured text in big data is effectively utilized using Semantic Network Analysis, a kind of data (text) mining techniques. Then, it will lead to generating more diverse and succeeding knowledge that can bring about reshape of the business education program by reflecting major trends entirely (Atteveldt, 2008; Doerfel, 1998; Kharlamov, Gradoselskaya, & Dokuka, 2017; Steyvers & Tenenbaum, 2005). Furthermore, it can help educators, researchers, and even academic leaders in higher education are more innovative and proactive by recognizing the trends since they have a magical and marvelous power to acquire the game or rule-changing insights into the uncertain future education.

Literature review

Researches on business education in higher education

Many scholars have conducted various investigations covering the realm of higher education. These studies are generally divided into three scopes according to the main topics although there are somewhat areas that are not distinguishable: first, teaching & learning domain in higher education (Biggs, 2001; Pitan & Muller, 2019; Price & Kirkwood, 2014; Shen & Ho 2020; Yilmaz & Keser, 2016; Zainuddin & Halili, 2016), second, a research area in higher education (Choi, 2017; Executive Core, 2015; Foster, 2019; Kim, 2015; Maxwell, 2019;

Nomuoja, 2010; OECD 2019), then, lastly, the territory of administration, management and leadership in higher education institutions (Bauer & Henkel, 1997; CABS, 2019; Marginson & Considine, 2000; OECD, 2014; World Bank, 2002). Among them, a large number of studies have mainly concentrated on the numerous factors or trends affecting business education development and management (Foster, 2019; Kim, 2015; Maxwell, 2019; Nikitina & Lapina, 2017; Nomuoja, 2010). For instance, Nikitina & Lapina, (2017) argued that modern trends of business education could be grouped into three categories: partnership and networking, a curriculum that meets the needs of society and business, and a flexible and modern teaching method through their research. Nomuoja (2010) also studied the current trends in business education emerging in eight business schools of higher education institutions. As a result, career awareness, risk management and strategic management, people-oriented strategy, and skills-based curriculum, etc. were discussed. Moreover, there were interviews of the global top 5 MBA Schools released annually by Financial Times. The researcher discovered the top 3 MBA Trends, such as the job market, the role of an MBA, and location & mobility (Maxwell, 2019). Furthermore, essay-formatted articles on significant trends in business education were introduced through the MBA Journals with the issues of "rise of double degrees" and "growth of online, technology-based and blended programs," etc. (Iniguez, 2015; Foster, 2019).

Semantic network analysis using big data of the unstructured text

Text mining is a methodology for analyzing unstructured text data written by humans for reading (Lambert, 2017; Wright, 2018). As a text mining technique, semantic network analysis has been developed in a variety of ways by an indefinitely large number of scholars since Rice & Danowski (1991) created a framework for network analysis (Doerfel, 1998; Monge & Eisenberg, 1987; Rice & Danowski, 1991; Stohl, 1993). A semantic network analysis generally refers to a network in which words extracted through morphological analysis from the unstructured text are constructed according to the degree of adjacency. Thus, it is possible to understand the relationship between words or to combine words to see their association for multitudinous interpretations in a given text (Cyram NetMiner, 2019; Nulty, 2017; Rice & Danowski, 1991). With the development of technology, natural language processing is integrated into data mining programs, which can directly input unstructured text data, extract words (nodes) in morphological units,

and generate network data composed of words. It extends the horizon of network analysis with rich unstructured text data (Cyram NetMiner, 2019; Kim, Choi, & Youm, 2017).

The purpose of analyzing text is varied from understanding the main concepts and subtopics included in documents and reading the main trends or shifts through their temporal changes, to identifying the word associations between documents and the similarity of ideas between authors. It is also used as a way to visualize the relationship between objects or people in text and topic modeling (Kharlamov et al., 2017; Nulty, 2017). Through this work, a large amount of information can be efficiently analyzed to generate more comprehensive and subsequent knowledge, which is the ultimate purpose of text analysis (Cyram NetMiner, 2019). Moreover, semantic network analysis is used as a way to visualize the text to illustrate the visual characteristics or to promote knowledge building, analytical investigation, and reasoning, even explorative study (Drieger, 2013). With the advantages of this approach, many scholars have discussed a wide range of topics using big data, including a variety of unstructured text, such as bibliographic information, social media data like Twitter, Facebook, Instagram, and others or online news, speeches, etc. (Doerfel, 1998; Drieger, 2013; Kharlamov et al., 2017; Kim et al., 2017; Nulty, 2017; Park, 2019; Shen & Ho, 2020; Yun & Park, 2018). Besides, several scholars (Lee, Choi, & Kim, 2010; Rice, 2005; Wasserman & Faust, 1994) have found noteworthy, tremendous potentials of semantic network analysis with identifying centrality indicators and sub-network structures between words. Many of these studies show the immense possibilities of continuous development of semantic network analysis as a powerful research method emerging with the big data era.

The proposed framework of this study

This study is data-driven research that does not use theoretical hypotheses or theoretical frameworks. A data-driven approach is a growing and potential area with the advent of big data. Massive and enormous information stored in electronic and digital forms on the internet provides tremendous opportunities and impacts remarkably for knowledge discovery, information extraction, and analytical reasoning in the diverse fields using large-scale human-machine generated data (Doerfel, 1998; Monge & Eisenberg, 1987; Wright, 2018; Zaki & Meira, 2014). Big data can be collected through various sources such as news media channels, social media, search engines, financial reports, etc. (Park, 2019). In this study, abstracts of journals on business education were collected for research and analysis through search engines. Figure 1 shows the proposed framework of this study in a holistic view.

This study attempts to identify the latest research trends of the world's leading business education journals in 2018 and 2019 using semantic network analysis based on the previous reviews discussed above. As the global trend is changing very rapidly, this study focuses on the most recent trends and agendas of business education in the last two years. For this purpose, the following specific research questions were established.

Research Questions 1.

What are the main research keywords and topics of global business education in the last two years?

Research Question 2.

What are the significant characteristics of global business education?

Research Question 3.

How are the specific subdomains of business education in the world categorized, furthermore,

What are the implications of modeling these topics?

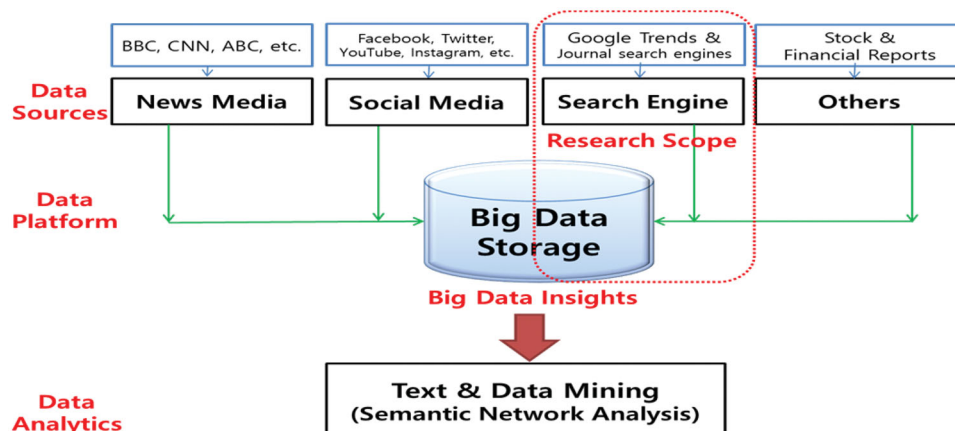


Figure 1. The proposed framework of this study.

Table 3. Top 20-word network.

| Rank | Source | Target | TF-IDF (weight) | # of Sentences/ Paragraphs/Documents | Gini coefficient |
|------|------------|----------------|-----------------|---|------------------|
| 1 | Business | School | 100 | 55 | 0.97 |
| 2 | Management | Education | 51 | 41 | 0.97 |
| 3 | Business | Student | 41 | 33 | 0.9 |
| 4 | Business | Education | 24 | 19 | 0.9 |
| 5 | Student | Business | 19 | 18 | 0.9 |
| 6 | Case | Study | 29 | 18 | 1 |
| 7 | Business | Course | 17 | 14 | 1 |
| 8 | Student | Learning | 17 | 14 | 1 |
| 9 | Management | Course | 14 | 13 | 1 |
| 10 | Student | Performance | 16 | 13 | 1 |
| 11 | Business | Management | 13 | 12 | 1 |
| 12 | Student | Experience | 14 | 12 | 1 |
| 13 | Student | Engagement | 18 | 11 | 1 |
| 14 | Business | Administration | 15 | 11 | 1 |
| 15 | Management | Student | 13 | 11 | 1 |
| 16 | Business | Program | 14 | 11 | 1 |
| 17 | Study | Student | 11 | 11 | 1 |
| 18 | Teaching | Learning | 13 | 11 | 1 |
| 19 | Student | Course | 10 | 10 | 1 |
| 20 | Student | Perception | 13 | 9 | 1 |

the layout algorithm. A layout algorithm is a method of calculating where to place nodes to visualize network data. Based on this layout, the top 20-word network was selected as follows (Table 3).

In the program, a 1-mode network can be generated by using word-to-word distance information. In this study, the closeness of two words was calculated and, based on this, used a method of generating links between words located close together. The two linked words are displayed as Source and Target, respectively. Weight or TF-IDF (Term Frequency-Inverse Document Frequency) is the link frequency of generated word pairs, meaning that the words of “business” and “school” weight 100, and the word pair appears 100 times in the entire text with a weight of 51 and # of documents of 41. Gini Coefficient is an indicator of how concentrated the word pair is intensely in a few sentences, paragraphs, and documents, and how evenly it appears in multiple sentences, paragraphs, and documents. A value closer to 1 indicates that the more focused it is on a few sentences, paragraphs, and documents, the more important the word pair is. In this case, the criterion for sentences, paragraphs, and documents is a co-occurrence unit selected when creating a 1-mode network.

Lastly, the method of LDA (Latent Dirichlet Allocation, hereafter LDA), which is a machine learning algorithm, was used to extract subtopics embedded in the text (Blei, Ng, & Jordan, 2003; Steyvers & Griffiths, 2007). LDA is the most popular and influential topic model, which is a method for the discovery of hidden phrase patterns in a broad set of unstructured documents (Table 4).

Using the method of LDA, we can see that the more similar the values of the response variables are, the

more likely they are to contain the same subjects. In contrast, the higher the differences between variables, the more likely they are to include different themes. The results of the top 3 topics combining related five keywords can be interpreted as follows. The main issue of topic 1 can be converted as the case-centered research for students’ learning and career. In the case of topic 2, performance/results-oriented research articles are emerging as the main direction. In topic 3, it can be rephrased that business schools are creating programs that emphasize teamwork and leadership.

Implication and conclusion

This study focused on analyzing the latest research trends through the keywords of influential journals related to business education. It contributed greatly to extracting topics that discover remarkable and noticeable future research trends. Based on that, business educators, researchers, and even academic leaders can be inspired by trends-based research, teaching, and learning as well in Higher education. In this regard, the implications of this study can be summarized as follows.

First, traditionally, “teacher-led” business education was the central theme of higher education in the past. However, in this study, it can be seen that “student-oriented” or “student-centered” learning in business education is promising by considering student’s careers beyond just learning itself. This study objectively proved the current paradigm and educational direction of higher education through quantitative research. Also, case study-oriented business learning, team-based learning and leadership training, and

Table 4. Topic modeling using LDA (Latent Dirichlet Allocation model).

| | 1st Keyword | 2nd Keyword | 3rd Keyword | 4th Keyword | 5th Keyword | # of documents |
|----------|-------------|-------------|-------------|-------------|---------------|----------------|
| Topic-1 | Study | Student | Case | Career | Factor | 156 |
| Topic-2 | Result | Performance | Way | Article | Research | 159 |
| Topic-3 | Business | School | Team | Leadership | Program | 186 |
| Topic-4 | Education | Management | Practice | Implication | Student | 198 |
| Topic-5 | Research | Program | Study | Article | Challenge | 143 |
| Topic-6 | Student | Author | University | Time | Class | 136 |
| Topic-7 | Datum | Analysis | Project | Value | Author | 146 |
| Topic-8 | Course | Skill | Student | Knowledge | Communication | 177 |
| Topic-9 | Learning | Student | Experience | Teaching | Strategy | 186 |
| Topic-10 | Development | Theory | Student | Group | Satisfaction | 168 |

performance-based learning, which train students to make decisions about real-world situations rather than traditional text-based learning, are enterprising as pivotal issues of business education. This study shows that these subjects are still valid and exert tremendous power in business education. Those significant trends will play an essential role in reshaping critical perspectives on future business education. Second, the world is changing speedier than ever, but most institutions in higher education are not adapting as quickly.

Moreover, most of them don't have their world-class trends master at keeping them up-to-date in the double loop, not a single circuit. Given that the latest trends are changing very rapidly, this study used big data over a short period rather than 10 or 20 years of the long-term panel. Then, it shows meaningful results as it is in line with the opinions of experts studying trends. Finally, the method of the machine learning algorithm through semantic network analysis shows that it is a handy and powerful tool for finding the recognizable trends and subjects to be studied together. Those outcomes of educational issues with advanced technology and big data can help us to discover data-driven insights lurking in data to make predictions or proactive decisions without being explicitly processed or configured. Furthermore, it can also allow us to conduct a secondary and tertiary in-depth analysis of quality future trend-based education. Therefore, this study has contributed dramatically to showing those various potential possibilities.

On the other hand, despite abundant and significant implications were found, there are some limitations of this study as follows. It will be addressed in future research. First, the limit of the data can be mentioned. In this study, Although this study was intended to see only recent data, however, it is still true that studies using a lot of data improve the research results in general, including the validity and reliability of the study despite the error problem of large data samples. Therefore, future research is needed to aggregate the vastly larger research data by increasing the number of related research papers.

Next, comparing the research trends in various education fields such as engineering or computer science, law, or any other studies as well as business education in higher education is worth trying for future research with holistic perspectives. Lastly, traditional network analysis has simply analyzed physical world relationships based on direction, strength, distance, etc. However, recent network analysis continues to expand as large as 1: N relationships for real-time online. Therefore, it should be recognized that recent network analysis is very complicated based on the vast amount of data flowing. Accordingly, it is necessary to extract and analyze sub-networks to reflect those characteristics of the extensive network into various sectors.

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References

- American Assembly of Collegiate Schools of Business (AACSB). (1996). *Achieving quality and continuous improvement through self-evaluation and peer review. Accreditation Handbook of the American Assembly of Collegiate Schools of Business*. St Louis, MO: AACSB.
- Angelo, T. A., & Cross, K. P. (1993). *Classroom assessment techniques: A Handbook for College Teachers* (2nd ed.). San Francisco, CA: Jossey-Bass.
- Atteveldt, W. V. (2008). *Semantic network analysis: Techniques for extracting, representing, and querying media content*. Charleston SC: BookSurge Publishers.
- Banta, T., Land, J., Black, K., & Olander, F. (1996). *Assessment in practice: Putting principles to work on college campuses*. San Francisco, CA: Jossey-Bass.
- Bauer, M., & Henkel, M. (1997). Responses of academe to quality reforms in higher education: A comparative study of England and Sweden. *Tertiary Education and Management*, 3(3), 211–228. doi:10.1080/13583883.1997.9966924
- Biggs, J. (2001). The reflective institution: Assuring and enhancing the quality of teaching and learning. *Higher Education*, 41(3), 221–238.
- Blei, D. M., Ng, A. Y., & Jordan, M. I. (2003). Latent Dirichlet allocation. *Journal of Machine Learning Research*, 3(2003), 993–1022.

- CABS. (2019, March). The changing shape of business education provision. Chartered Association of Business Schools, Carringtoncrisp. Retrieved from <https://chartereddabs.org/publications/the-changing-shape-of-business-education-provision/>.
- Choi, W. S. (2017). A study on the research trend of western music theory and analysis in the Korean Journal of Musicology, 2006–2015. *Music Theory Forum*, 24(2), 159–205. doi:10.15571/MTF.2017.24.2.159.
- Cyram NetMiner. (2019). *NetMiner semantic network analysis manual*. Cyram. Retrieved from <https://www.NetMiner.Com>.
- Dias, L., & Shah, A. (2008). *Introduction to business*. *Career Education* (1st ed., January 25, 2008).
- Doerfel, M. L. (1998). What constitutes semantic network analysis? A comparison of research and methodologies. *Connections*, 21(2), 16–26.
- Drieger, P. (2013). Semantic network analysis as a method for visual text analytics. 9th Conference on Applications of Social Network Analysis (ASNA). *Procedia – Social and Behavioral Sciences*, 79(2013), 4–17. doi:10.1016/j.sbspro.2013.05.053
- Edwards, D. E., & Brannen, D. E. (1990). Current status of outcomes assessment at the MBA level. *Journal of Education for Business*, 65(5), 206–212. doi:10.1080/08832323.1990.10117428.
- Executive Core. (2015, Summer). Future trends in business education. Executive Core, LLC. Retrieved from https://www.uniconexed.org/wp-content/uploads/2017/01/Future_Trends-Revised_Final_Report_Executive_Core-August-Jan.12.2016-v2.pdf.
- Foster, J. (2019). *Key trends influencing graduate business education in 2019*. Retrieved from <https://www.mba.com/article-and-announcements/articles/why-business-school/key-trends-influencing-graduate-business-education-in>.
- Iniguez, S. (2015). Major trends in business education. *MBA Journal*, 12, 16. Retrieved from <https://www.mba-journal.de/major-trends-in-business-education>.
- Kharlamov, A., Gradoselskaya, G., & Dokuka, S. (2017). Dynamic semantic network analysis of unstructured text corpora. *International Conference on Analysis of Images, Social Networks and Texts* (AIST 2017, pp. 392–403).
- Kim, H. M. (2015). Analysis of research trends of South Korean music education through semantic network analysis. *Korean Journal of Research in Music Education*, 44(4), 49–68. http://210.101.116.28/W_files/kiss5/24400648_pv.pdf.
- Kim, N. D., & SNU Consumer Trend Analysis Center. (2019). *Trends Korea 2020*. Seoul, Korea: Futuristic window (Milaeui Chang).
- Kim, M., Choi, M., & Youm, Y. (2017). Semantic network analysis of online news and social media text related to comprehensive nursing care service. *Journal of Korean Academy of Nursing*, 47(6), 806–816. doi:10.4040/jkan.2017.47.6.806.
- Lambert, N. J. (2017). *Text mining tutorial*. *Group Processes (Part of the Computational Social Sciences book series (CSS))*, (pp. 93–117). doi:10.1007/978-3-319-48941-4_5.
- Lee, S., Choi, J. H., & Kim, H.W. (2010). Semantic network analysis on the MIS research keywords: APJIS and MIS Quarterly 2005–2009. *Asian Pacific Journal of Information System*, 20(4), 25–51.
- Levine, D. (2019). *Trends in technology: How we work, live and consume*. USA Trends Day Keynote. Retrieved from <https://www.daniellelevine.com/>.
- Marginson, S., & Considine, M. (2000). *The enterprise university: Power, governance and reinvention in Australia*. Cambridge: Cambridge University Press.
- Maxwell, S. (2019). *Top 3 MBA trends in 2019*. Hiperpool. Retrieved from <https://hiperpool.com/blog/top-3-mba-trends>.
- Monge, P. R., & Eisenberg, E. M. (1987). *Emergent communication networks. Handbook of organizational communication*, Newbury Park, CA: Sage.
- Nikitina, T., & Lapina, I. (2017). *Overview of trends and developments in business education*. The 21st World Multi-Conference on Systemics, Cybernetics and Informatics: WMSCI 2017, Vol.2, USA, Orlando.
- Nomuoja, J. O. (2010). *Current trends in business education in higher institutions*. Retrieved from <http://www.globalacademicgroup.com/journals/the%20nigerian%20academic%20forum/Jude%20O%20Nomuoja%204.pdf>.
- Nulty, P. (2017). *Semantic network analysis of contested political concepts*. International Conference on Computational Semantics (IWCS 2017). Retrieved from <http://www.aclweb.org/anthology/W/W17/#6800>.
- OECD. (2019). *Trends shaping education 2019 spotlight 18 Play!* Paris: OECD Publishing.
- Park, Y. E., Management Department, College of Business Administration, Prince Sultan University. (2019). Data empowered insights for sustainability of Korean MNEs. *The Journal of Asian Finance, Economics and Business*, 6(3), 173–183.
- Pitan, O.S., & Muller, C. (2019). University reputation and undergraduates' self-perceived employability: Mediating influence of experiential learning activities. *Higher Education Research & Development*, 38(6), 1269–1284. doi:10.1080/07294360.2019.1634678.
- Price, L., & Kirkwood, A. (2014). Using technology for teaching and learning in higher education: A critical review of the role of evidence in informing practice. *Higher Education Research & Development*, 33(3), 549–564. doi:10.1080/07294360.2013.841643.
- Rice, R. E. (2005). New media/internet research topics of the association of Internet research. *The Information Society*, 21(4), 285–299. doi:10.1080/01972240500189232.
- Rice, R. E., & Danowski, J. A. (1991). Comparing comments and semantic networks about voicemail. *Proceedings of the American Society for Information Science*, 28, 134–138.
- Shen, C. W., & Ho, J. T. (2020). Technology-enhanced learning in higher education: A bibliometric analysis with latent semantic approach. *Computers in Human Behavior*, 104, 106177. doi:10.1016/j.chb.2019.106177.
- Steyvers, M., & Griffiths, T. (2007). Probabilistic topic models. In T. K. Landauer, D. S. McNamara, S. Dennis, & W. Kintsch (Eds.), *Handbook of latent semantic analysis* (pp. 427–448). Lawrence Erlbaum Associates Publishers.
- Steyvers, M., & Tenenbaum, J.B. (2005). The large-scale structure of semantic networks: Statistical analyses and a model of semantic growth. *Cognitive Science*, 29(1), 41–78. doi:10.1207/s15516709cog2901_3.
- Stohl, C. (1993). European managers' interpretations of participation: A semantic network analysis. *Human*

- Communication Research*, 20(1), 97–117. doi:10.1111/j.1468-2958.1993.tb00317.x.
- Wasserman, S., & Faust, K. (1994). *Social network analysis: Methods and applications*. Cambridge, UK: Cambridge University Press.
- World Bank. (2002). *Constructing knowledge societies: New challenges for tertiary education*. Washington D.C.: The World Bank.
- Wright, J. (2018). *Methodology review, Part2: Text mining, and semantic network analysis*. Retrieved from <https://jar-edmwr.wordpress.com/2018/03/13/methodology-review-part-2-text-mining-and-semantic-network-analysis/>.
- Yilmaz, F. G. K., & Keser, H. (2016). The impact of reflective thinking activities in e-learning: A critical review of the empirical research. *Computers & Education*, 95, 163–173. 10.1016/j.compedu.2016.01.006.
- Yun, E., & Park, Y. (2018). Extraction of scientific semantic networks from science textbooks and comparison with science teachers' spoken language by text network analysis. *International Journal of Science Education*, 40(17), 2118–2136. 10.1080/09500693.2018.1521536.
- Zainuddin, Z., & Halili, S. H. (2016). Flipped classroom research and trends from different fields of study. *International Review of Research in Open and Distance Learning*, 17(3), 313–340. 10.19173/irrodl.v17i3.2274.
- Zaki, M. J., & Meira, W. (2014). *Data Mining and Analysis: Fundamental Concepts and Algorithms*. London, LD: Cambridge University Press.