INFORMATION SYSTEMS EDUCATION JOURNAL

Volume 23, No. 4
July 2025
ISSN: 1545-679X

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ISEDJ is published online (https://isedj.org). Our sister publication, the Proceedings of the ISCAP Conference (https://iscap.us/proceedings) features all papers, abstracts, panels, workshops, and presentations from the conference.

The journal acceptance review process involves a minimum of three double-blind peer reviews, where both the reviewer is not aware of the identities of the authors and the authors are not aware of the identities of the reviewers. The initial reviews happen before the ISCAP conference. All papers, whether award-winners or not, are invited to resubmit for journal consideration after applying feedback from the Conference presentation. Award winning papers are assured of a publication slot; however, all re-submitted papers including award winners are subjected to a second round of three blind peer reviews to improve quality and make final accept/reject decisions. Those papers that are deemed of sufficient quality are accepted for publication in the ISEDJ journal. Currently the target acceptance rate for the journal is under 35%.

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Visualizing the Eras of IS Education: A Co-occurrence Analysis of the Information Systems Education Journal

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Abstract

The *Information Systems Education Journal* has published uninterrupted since 2003. Over its publication history, it has covered myriad topics related to information systems education including model curriculum, outcomes assessment, online learning, capstone courses, service learning, data analytics, and cybersecurity, just to name a few. This, first of its kind, study conducts a co-occurrence analysis using article keywords on the corpus of the journal for the years 2003 through 2024. The results are presented in terms of five eras and present frequency counts, clusters, and term maps of the key topics. This paper presents a worthwhile endeavor of examining the past and looking forward to the future. While the future of information systems education is unknown, the *Information Systems Education Journal* provides a consistent outlet to keep information systems educators and researchers abreast of the latest trends and developments.

Keywords: Co-occurrence analysis, cluster analysis, bibliometric review, term map, *ISEDJ*.

Recommended Citation: Sharp, J., Anderson, J., Lang, G. (2025). Visualizing the Eras of IS Education: A Co-occurrence Analysis of the Information Systems Education Journal*. Information Systems Education Journal,* v23, n4, pp.4-21. https://doi.org/10.62273/FYDF2042.

Visualizing the Eras of IS Education: A Co-occurrence Analysis of the Information Systems Education Journal

Jason H. Sharp, John E. Anderson and Guido Lang

1. INTRODUCTION

The study of individual journals or groups of journals is well established and quite common across various disciplines, information systems (IS) notwithstanding (e.g., Krauskopf, 2018; Flis & van Eck, 2018; Liu & Myers, 2011; Merigo, Pedrycz, Weber, & de la Sotta, 2018; Mustafee, 2011; Oskos & Gencer, 2017). Often, one or more techniques under the umbrella of bibliometrics or bibliometric analysis are employed to gain insight into impact, authorship, citations, publications, themes, trends, and patterns (Broadus, 1987; Pritchard, 1969). In that tradition, the purpose of this paper is to conduct a co-occurrence analysis of articles published in the *Information Systems Education Journal (ISEDJ)* from 2003-2024 to identify topics over the course of time as well as look forward to the future of IS education.

ISEDJ published its first volume on September 8, 2003, and has published uninterrupted through its current Volume #22 (2024). As a double-blind peer-reviewed academic journal focused on information systems (IS) education, it covers a wide-array of topics including, but not limited to, model curriculum, outcomes assessment, online and distance education, capstone and service-learning projects, networking, data analytics, and cybersecurity (About, n.d.). *ISEDJ* is listed in Cabells and indexed in ERIC Institute of Education Services. As a publication of the Information Systems and Computing Professionals (ISCAP), the submission process for *ISEDJ* is integrated as a part of the ISCAP Conference and reports a 36% acceptance rate. Per ERIC, 17,800 articles from *ISEDJ* were downloaded in 2022 (Impact, n.d.). Since its inception, five individuals have served as chief editor(s): Donald Colton, Emeritus (2003-2010), Wendy Ceccucci (2011-2012), Nita Brooks (2013-2015), Jeffry Babb, Emeritus (2016-2021), and Paul Witman (2021-present).

2. BACKGROUND

When a journal celebrates a notable anniversary, researchers often conduct a bibliometric-based study to commemorate this important event. This was the case for both the *European Journal of Marketing* and *Information Sciences* when each reached 50 years of publications, respectively (Martinez-Lopez, Merigo, Valenzuela-Fernandez, & Nicolas, 2018; Merigo, Pedrycz, Weber, & de la Sotta, 2018). In each of these studies, various bibliometric techniques were employed including publication counts, bibliographic coupling, citation and co-citation analysis, and co-occurrence analysis of keywords.

Large-scale discipline-specific studies commonly necessitate bibliometric studies as well. For example, Flis and van Eck (2018) conducted a co-occurrence analysis of psychology literature between the years ranging from 1950 to 1999, representing 676,393 articles, while White and McCain (1998), conducted an author co-citation analysis of the information science discipline from the period of 1972 to 1995. Smaller scale studies often examine a specific field, such as Ozkose and Gencer (2017) who analyzed the field of management information systems using bibliographic mapping.

Other well-established approaches include analyzing a single journal such as the case of the *Journal of Infection and Public Health* (Krauskopf, 2019), comparing two journals such as the *European Journal of Information Systems* and *Management Information Systems Quarterly* (Mustafee, 2011), or examining a group or "basket" of journals. For example, the Association for Information Systems (AIS) basket of journals (Bernroider, Pilkington, & Cordoba, 2013; Liu & Myers, 2011). These types of studies are not limited only to journals, as others have analyzed various conference proceedings as well (Olbrich, 2009). Finally, researchers may examine a specific research topic or area such as cybersecurity (Mandani & Ramirez, 2019), ethics and corporate social responsibility (Weiss, 2017), or gender (Zhou & Loiacono, 2023).

3. METHOD

For our study we employed co-occurrence analysis. Co-occurrence networks are defined as the interconnectedness of terms based on their joint presence within a specific text unit. These networks are formed by linking pairs of terms according to criteria that define co-occurrence. For instance, terms A and B are considered to "co-occur" if they both appear in the same article. Or

in our case, in the author-supplied keywords. Another article might include terms B and C. By connecting A to B and B to C, a co-occurrence network of these three terms is created. The criteria for defining co-occurrence within a text corpus can be adjusted as needed. For example, a stricter criterion might require that the terms appear in the same sentence or in the author supplied keywords. Co-occurrence networks are particularly useful for analyzing large text datasets and big data, such as identifying main themes and topics in numerous social media posts, uncovering biases in text like news coverage, or mapping the entirety of a field of research (Segev, 2022). We applied co-occurrence analysis to the author-produced keywords of the corpus of *ISEDJ*.

For this paper, we looked at all of the articles published in *ISEDJ* from 2003 to 2024, a total of 1076 articles. We then focused on the author produced key words (the key words submitted with each article) as our primary data, in addition to year. We then chose to group the years into units of five years to make it more digestible, as shown in Table 1.

Grouping Years	Number of Articles
2003-2007	288
2008-2012	332
2013-2017	222
2018-2022	174
2023-2024	60

Table 1: Grouping by Years

We defined the importance of a key word based on simple frequency counts and link strength. A connection between two items is called a link. The strength of a link is represented by a numerical value, such as the number of articles in which two keywords occur together. A visualization of the importance of the key words (called a term map) was then created. A term map shows the relatedness of terms as a function of the distance between them. The more co-occurrences of two terms, the smaller the distance between them. The more articles in which a term occurs, the more prominently the term is displayed in the term map, such as with a larger font size and larger sphere. The terms are also grouped into clusters.

Six term maps were created to get a glimpse into topics academics published in *ISEDJ*. We constructed term maps based on four five-year groupings (2003-2007, 2008-2012, 2013-2017, 2018-2022) and one for the new unfinished group (2023-2024), and one for the entire data. We hoped the groups would yield a picture of the evolution of topics published in *ISEDJ*. The term maps were created using the VOSviewer software (van Eck & Waltman, 2010, 2014). Part of the term map construction was choosing the minimum number of key word term co-occurrence frequency that would be considered "interesting enough" to use. We choose a minimum number of occurrences as three for the evolutionary term maps, and five for the term map of the full data.

Based on the co-occurrence frequency counts VOSviewer constructed term maps where distance between term indicated relatedness, and color was used to cluster the terms into topic areas. VOSviewer uses both a mapping technique (to determine the layout of terms in the term map) and a clustering technique (which assigns frequently co-occurring terms to the same cluster). The mapping technique is called VOS and is related to multidimensional scaling (Borg & Groenen 2005; van Eck, Waltman, Dekker, & van den Berg 2010). The clustering technique used by VOSviewer is related to modularity-based clustering (Newman, 2004; Newman & Girvan, 2004; Waltman et al. 2010).

4. RESULTS

The results of the co-occurrence analysis are presented below for each of the year range groupings including the frequency counts, clusters, and term maps. The colors assigned in the term maps for each era were randomly generated by the VOSviewer software. Unfortunately, we did not have the ability to alter these assigned colors to use the same color for the same topics across eras. We did, however, attempt to match the color in the associated tables for frequency count and clusters.

2003-2007: IS Education

We used the rule that the keyword must occur a minimum of three times to be "interesting" (of 989 keywords, twenty-six met the threshold). Of the twenty-six keywords, 14 (54%) are "education" words such as variants of curriculum, assessment, and pedagogy. See Appendix A, Table 2 for frequency counts. The clusters are made up of the terms that are closest to each other, yet also farther away from other terms. Nine clusters were found as shown in Appendix A, Table 3. The term map is provided in Appendix B, Figure 1.

2008-2012: Pedagogy and Student Issues

We used the rule that the keyword must occur a minimum of three times to be "interesting" (of

1117 keywords, 101 met the threshold). The thirty-five keywords with a total link strength of 10 or greater are shown in the table below. Looking at the top thirteen for the 2003-2007 vs 2008-2012 we see a movement from plain vanilla curriculum and assessment issues to broader pedagogy and student issues such as mentoring, retention, scholarships, women, and minorities. See Appendix A, Table 4 for frequency counts. The clusters are made up of the terms that are closest to each other, yet also farther away from other terms. Twelve clusters were found as shown in Appendix A, Table 5. The term map is provided in Appendix B, Figure 2.

2013-2017: Cybersecurity-Big Data-Analytic
We used the rule that the keyword must occur a minimum of three times to be "interesting" (of 735 keywords, sixty-five met the threshold). There were thirty-nine keywords with a total link strength of 5 or greater. The clusters are made up of the terms that are closest to each other, yet also farther away from other terms. See frequency counts in Appendix A, Table 6. Seven clusters were found as shown in Appendix A, Table 7. The term map is provided in Appendix B, Figure 3.

2018-2022: COVID Impact on IS Education
We used the rule that the keyword must occur a minimum of three times to be "interesting" (of 543 keywords, fifty-six met the threshold). The thirty keywords with a total link strength of 5 or greater are shown in Appendix A, Table 8. The clusters are made up of the terms that are closest to each other, yet also farther away from other terms. Eight main clusters were found, in addition to five smaller clusters as shown in Appendix A, Table 9. We combined the smaller clusters with the larger cluster. Some of the fifty-six keywords in the network were not connected to each other. The largest set of connected items consists of thirty-eight items. The fracturing (or less cohesiveness) is interesting. This may be due to the impact of the COVID-19 pandemic. The term map is provided in Appendix B, Figure 4.

2023-2024: Artificial Intelligence
We used the rule that the keyword must occur a minimum of three times to be "interesting" (of 215 keywords, eighteen met the threshold). All eighteen keywords are shown in Appendix A, Table 10. The clusters are made up of the terms that are closest to each other, yet also farther away from other terms. Three clusters were found as provided in Appendix A, Table 11. The term map is presented in Appendix B, Figure 5.

2003-2024: Full Network
We used the rule that the keyword must occur a minimum of five times to be "interesting" (of 2827 keywords, 115 met the threshold). The fifty keywords with a total link strength of 16 or higher are shown in Appendix A, Table 12. The clusters are made up of the terms that are closest to each other, yet also farther away from other terms. Nine clusters were found as shown in Appendix A, Table 13. The term map is presented in Appendix B, Figure 6. Appendix B, Figure 7 shows the time overlay for the full network.

5. DISCUSSION

For the purpose of discussion each grouping of years is defined as an era. An examination of the topics and factors affecting the choice of topics during each era is then presented.

Era 1: 2003-2007
The first era of *ISEDJ* is characterized by topics associated with IS education. Topics such as curriculum, assessment, and information systems, accreditation, ethics, and pedagogy round out the top three occurrences of keywords. As mentioned previously, these topics represent "education" words. Ethics may be considered a bit of an outlier, however; it is hoped that ethics underlies all aspects of IS education. Also interesting was the separation of curriculum assessment and accreditation as seen in the term map. As a young discipline in this era there was greater interest in solidifying the curriculum, with accreditation just starting to be an important issue. It might be noted that in these early years of the journal, all articles were included in a single volume, without the use of individual issue numbers. Perhaps this was due to a more heterogenous set of topics and less diversity of topics at the time.

Era 2: 2008-2012
The evolution from Era 1 to Era 2 experienced several changes. First, security curriculum development dropped out of the topics. Perhaps, this area matured to the point that educators felt they had gained a good grasp of security curricula. Not surprisingly, retention, social networking, and outsourcing appeared in this era. With the 2008 financial crisis, it is quite possible that the current emphasis on retention began. It is common sense that when students have financial difficulties they often must drop out of school to take care of their responsibilities. The 2010s saw the growth of numerous social networking platforms including Facebook, LinkedIn, Snapchat, and Twitter. Consequently, the use of these platforms in higher education and

in IS education research saw subsequent growth. Interestingly, from Era 1 to Era 2, ethics grew into own cluster. Traditional topics such as programming, assessment, accreditation, and IS curriculum continued into this era. In the term map we see the merging of assessment and accreditation with the emergence of terms such as learning outcomes and program assessment. Perhaps this era shows the focus shift from curriculum assessment to program assessment and accreditation. Also in this era, Volume 11 - 2009, was the beginning of creating separate issue numbers rather than publishing all articles in a single volume.

Era 3: 2013-2017

The evolution from Era 2 to Era 3 saw the loss of social networking, retention, outsourcing, and ethics. Perhaps the ubiquitous nature of social networking led to its absence in this area. It had simply become a normal part of life and education. The tumultuous times created by the 2008 financial crisis were subsiding and students were returning to continue their education lessening the overall emphasis on retention. After two eras, ethics fell out of the topics. It is hard to say ethic was no longer important, but again, perhaps it had become ingrained in the context of IS education. Era 3 saw the reemergence of cybersecurity into its own cluster. The continued growth of the Internet and the Web and numerous data leaks and security breaches throughout the era contributed to the growth and popularity of cybersecurity. Pedagogy and big data/analytics also saw the formation of their own clusters. Along with cybersecurity, this era saw the growth and popularity of big data/analytics. In fact, a common movement at the time was for IS programs to rebrand as Business Analytic programs. As in previous eras, programming, assessment, IS curriculum, and online learning continued to be common topics. Interestingly when looking at the term map we see a refocus of assessment from program assessment back to curriculum assessment, especially the assessment of experiential learning.

Era 4: 2018-2022

The evolution from Era 3 to Era 4 experienced a notable shift. The long-standing topics of programming and assessment were absent. While a direct connection may not be possible, it is interesting to note that a significant change in the *IS 2010 Curriculum Guidelines for Undergraduate Degree Programs in Information Systems* (Topi et al., 2010) was the removal of application development (IS 2002.5 Programming, Data, File, and Object Structures) from the previous curriculum guidelines. A clear explanation for the loss of assessment is a bit more difficult to identify. New developments include the splitting of analytics into two clusters: business analytics and data analytics. This split certainly reflects the growth and popularity of this area. It also saw the movement of business analytics as primarily housed within the College of Business and data analytics housed in various places such as Business, Mathematics, Statistics, and Engineering. This era also saw the appearance of topics related to the COVID-19 pandemic. In particular the growth of topics related to attendance and attentiveness might have been a direct result. While the capstone course was a regular topic in previous eras, it became its own cluster in Era 4. Cybersecurity, pedagogy, online learning, and IS curriculum remained consistent in this era. Assessment fell out of importance except as a part of cybersecurity, which makes sense as the need to assess and solidify the new cybersecurity curriculum was important.

Era 5: 2023-2024

The evolution from Era 4 to Era 5 saw the loss of several long-standing topics including cybersecurity, online learning, assessment, attendance, attentiveness, IS Curriculum, and capstone course. The number of clusters moved from 8 to 3 (Pedagogy, Analytics, and AI). This may be due simply to natural attrition. That is, these topics are so much a normal part of IS education that the novelty has worn off a bit and so they fall out of favor as research topics. It should be noted, in regard to cybersecurity in particular, that ISCAP introduced the *Cybersecurity Pedagogy and Practice Journal (CPPJ)* in 2022 as a publication outlet associated with the ISCAP Conferences. This may account for the absence of cybersecurity-related topics in *ISEDJ*. With the release of ChatGPT in 2022 and numerous other Generative Artificial Intelligence platforms to follow since, it is not a surprise that artificial intelligence appeared. Analytics and pedagogy continued their inclusion.
It should be noted that Era 5 only presents two years.

Looking at the movement or ranking changes of themes through the eras we see that Assessment/Accreditation went from 1 to 5 to 3 to 5 to null (went from first to middle ranking). Pedagogy went from 4 to 1, to 1 to 1 to 2 (highest overall ranking). Programming went from 5 to 9 to 6 to partial 3 to null (lower-middle ranking). Cybersecurity really started in Era 3 and was ranked 4 then 5 then null (middle ranking). Analytics really started in Era 2 and was ranked 7 then 5 and 7 then 6 then 1 (moved from middle to first). Student Issues came to the foreground

in Eras 2 and 4 ranked 3 and 4 (Era 2 blossoming concern for students, COVID-19 era concern for students). See Appendix A, Table 14 for the rank changes from Eras 1 to 5.

From the viewpoint of the number of clusters each term map shows for each era we see that era 1 had 9 clusters, era 2 had 12, era 3 had 7, era 4 had 8, and finally era 5 had just 3. It would appear that era 2 from 2008-2012 was the richest and most diverse era of IS education scholarship. Also, although era 5 is only half-way completed, it would appear that the diversity of IS education has shrunk.

Lastly, the Full Network Term Map (Figure 6) shows the wonderful growth and diversity of IS Education scholarship produced in that past 22 years. We are struck by the continuous central focus of work produced in the areas of pedagogy and curriculum, which are at the heart of student success. It is in a way a painting of the IS Educator landscape, a landscape probably vastly different from that of the IS Researcher producing work in the Basket of Eight.

6. CONCLUSION

This is the first known study to examine the full corpus of *ISEDJ* available at the time it was conducted. To see how IS education has changed as well as has stayed the same over the years is quite interesting and serves to honor the past as well as inform the future.

Limitations

The study is not without its limitations. The most obvious is that the co-occurrence analysis relies solely on author-supplied keywords. Inherent in this methodology is a potential bias toward the terms and buzzwords of any given era. Another potential limitation is the publishing of special issues of *ISEDJ* such as teaching cases which may serve to artificially inflate the occurrence of a term(s) in a particular era. Because of the potential limitation resulting from the sole use of author-supplied keywords, future research might include the addition of title and abstract to the co-occurrence analysis to increase the likelihood of otherwise unforeseen or obvious topics.

Future Directions

For over two decades *ISEDJ* has kept up with the dynamic nature of IS education as shown by the evolutionary nature of the topics contained in each era of its 1,076 articles published between 2003-2024. In this particular study, the authors chose to establish predefined five-year groupings for analysis and determination of "eras". In future research, the authors plan to implement a more organic approach, by allowing the data itself to establish "eras" of topicality. Furthermore, with the continued growth and popularity of artificial intelligence, in general, and generative artificial intelligence, specifically, continued co-occurrence analysis of ISEDJ may reveal a preponderance of research in this area in the future.

7. REFERENCES

About. (n.d.). Information Systems Education Journal. https://isedj.org/about.html

Bernroider, E. W. N., Pilkington, A., & Cordoba, J. (2013). Research in information systems: A study of diversity and inter-disciplinary discourse in the AIS basket journals between 1995 and 2011. *Journal of Information Technology*, 28, 74-89. https://doi.org/10.1057/jit.2013.5

Borg, I., & Groenen, P. J. F. (2005). *Modern multidimensional scaling: Theory and applications* (2nd ed.) Springer Science + Business Media. https://doi.org/10.1007/0-387-28981-X

Broadus, R. N. (1987). Toward a definition of "bibliometrics". *Scientometrics*, 12, 373-379. https://doi.org/10.1007/BF02016680

Flis, I., & van Eck, N. J. (2018). Framing Psychology as a discipline (1950-1999): A large-scale term co-occurrence analysis of scientific literature in Psychology. *History of Psychology*, 21(4), 334-362. https://doi.org/10.1037/hop0000067

Impact. (n.d.). Information Systems Education Journal. https://isedj.org/impact.html

Krauskopf, E. (2018). A bibliometric analysis of the Journal of Infection and Public Health. *Journal of Infection and Public Health*, 11, 224-229. https://doi.org/10.1016/j.jiph.2017.12.011

Liu, F., & Myers, M. D. (2011). An analysis of the AIS basket of top journals. *Journal of Systems and Information Technology*, 13(1), 5-24. https://doi.org/10.1108/13287261111118322

Mandani, A., & Ramirez, R. (2019). Cybersecurity: Current state of governance literature. *Proceedings of the Twenty-fifth Americas Conference on Information Systems*, 16, 1-5.

Martinez-Lopez, F. J., Merigo, J. M., Valenzuela-Fernandez, L., & Nicolas, C. (2018). Fifty

years of the European Journal of Marketing: A bibliometric analysis. *European Journal of Marketing*, 52(1/2), 439-468. https://doi.org/10.1108/EJM-11-2017-0853

Merigo, J. M., Pedrycz, W., Weber, R., & de la Sotta, C. (2018). Fifty years of Information Sciences: A bibliometric overview. *Information Sciences*, 432, 245-268. https://doi.org/10.1016/j.ins.2017.11.054

Mustafee, N. (2011). Evolution of IS research based on literature published in two leading IS journals – EJIS and MISQ. *Proceedings of the Nineteenth European Conference on Information Systems*, 228.

Newman, M. E. J. (2004). Fast algorithm for detecting community structure in networks. *Physical Review E*, 69(6). https://doi.org/10.1103/PhysRevE.69.066133

Newman, M. E. J., & Girvan, M. (2004). Finding and evaluating community structure in networks. *Physical Review E*, 69(2). https://doi.org/10.1103/PhysRevE.69.026113

Olbrich, S. (2009). Reflecting the past decades of ICIS, ECIS, and AMCIS proceedings – a Design Science perspective. *Proceedings of the Thirtieth International Conference On Information Systems*, 116, 1-8.

Özköse, H., & Gencer, C. (2017). Bibliometric analysis and mapping of Management Information Systems field. *Gazi University Journal of Science*, 30(4), 356-371.

Pritchard, A. (1969). Statistical bibliography or bibliometrics. *Journal of Documentation*, 25(4), 348-349.

Segev, E. (Ed.). (2021). Semantic Network Analysis in Social Sciences. Routledge.

Topi, H., Valacich, J. S., Wright, R. T., Kaiser, K. M., Nunamaker, Jr., J. F., Sipior, J. C., & de Vreede, G. J. (2010). IS 2010: Curriculum guidelines for undergraduate degree programs in Information Systems. *Communications of the Association for Information Systems*, 26(18), 359-428. https://doi.org/10.17705/1CAIS.02618

van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, 84(2), 523-538. https://doi.org/10.1007/s11192-009-0146-3

van Eck, N. J., & Waltman, L. (2014). Visualizing bibliometric networks. In Y. Ding, R. Rousseau, & D. Wolfram (Eds.), *Measuring scholarly impact: Methods and practice* (pp. 285-320). Springer. https://doi.org/10.1007/978-3-319-10377-8_13

van Eck, N. J., Waltman, L., Dekker, R., & van den Berg, J. (2010). A comparison of two techniques for bibliometric mapping: Multidimensional scaling and VOS. *Journal of the American Society for Information Science and Technology*, 61(12), 2405-2416. https://doi.org/10.1002/asi.21421

Waltman, L., van Eck, N. J., & Noyons, E. C. M. (2010). A unified approach to mapping and clustering of bibliometric networks. *Journal of Informetrics*, 4(4), 629-635. https://doi.org/10.1016/j.joi.2010.07.002

Weiss, J. W. (2017). Ethics and CSR research in top ranked IS journals, 1980-2013: A developing trend or anomaly? *Proceedings of the Fiftieth Hawaii International Conference on System Sciences*, 5758-5762.

White, H. D., & McCain, K. W. (1998). Visualizing a discipline: An author co-citation analysis of Information Science, 1972-1955. *Journal of the American Society for Information Science*, 49(4), 327-355. https://doi.org/10.1002/(SICI)1097-4571(19980401)49:43.0.CO;2-4

Zhou, S., & Loiacono, E. (2023). A review of gender research in Information Systems: From bibliometric analysis to future research directions. *Proceedings of the Twenty-fifth Southern Association for Information Systems Conference*, 56.

APPENDIX A
Frequency Count and Cluster Tables

Keyword	Occurrences	Total link strength	Keyword	Occurrences	Total link strength
curriculum	21	19	electronic commerce	6	4
assessment	15	15	is curriculum	8	4
information systems	12	14	model curriculum	5	4
accreditation	5	11	curriculum development	8	3
ethics	10	10	distance education	6	3
pedagogy	9	9	service learning	7	3
database	8	8	computer information systems	5	2
education	8	8	distance learning	11	2
information technology	8	8	e-commerce	6	2
computer literacy	5	5	project management	8	2
is education	8	5	technology	5	2
systems analysis and design	7	5	information systems curriculum	5	1
course design	5	4	programming	6	1

Table 2: 2003-2007 Frequency Counts

Curricula	Programming	Assessment	e-learning/ e-commerce	IS Core	Systems Analysis & Design	IST Computer Literacy	Security Curriculum Development	Accreditation
case study	.net	assessment	collaborative learning	curriculum design	capstone course	capstone	curriculum development	accreditation
cis	abet	certification	distance learning	gis	course design	computer literacy	information security	
computer information systems	application development	computer	e-business	is curriculum	methodology	higher education	is model curriculum	
distance education	cobol	curriculum	e-commerce	is education	project management	information systems	pedagogy	
information systems curriculum	database	education	electronic commerce	open source software	service learning	information technology		
information systems education	grading	innovation	ethics	sdlc	significant learning	usability		
is 2002 model curriculum	is accreditation	model curriculum	internet	software engineering	systems analysis and design			
is curricula	java	security	privacy	systems analysis				
it curriculum	programming	technology	small college	web design				
it education	software tools	testing						
mis	systems development							
online education								
outsourcing								

Table 3: 2003-2007 Clusters

Keyword	Occurrences	Total link strength	Keyword	Occurrences	Total link strength
pedagogy	25	43	abet	8	14
information systems	15	33	accreditation	9	14
information systems education	15	24	management information systems	8	14
mentoring	5	22	assessment	10	13
retention	6	22	is curriculum	12	13
scholarships	4	21	is education	8	13
women	5	21	learning	9	13
computer science	6	20	database	7	12
education	11	20	distance education	10	12
web 2.0	10	20	enterprise systems	6	12
minorities	4	19	ethics	12	12
computer literacy	12	18	outsourcing	7	12
graduates	3	18	social networking	4	11
curriculum	17	17	business intelligence	6	10
higher education	7	17	curriculum design	7	10
information technology	9	17	information systems curriculum	5	10
software engineering	5	16	systems analysis and design	7	10
mathematics	4	15			

Table 4: 2008-2012 Frequency Counts

Computer-mediated learning	IS Curriculum	Data (base) (analytics)	Retention	Social Networking	Systems Analysis & Design	IST Education	Assess/Accred	Programming	Outsourcing	Pedagogy	Ethics
blackboard	capstone experience	business intelligence	framework	collaborative learning	active learning	case studies	abet	alice prog lang	is 2002	is research toward educators	copyright
capstone	curriculum design	computer literacy	gestalt	is pedagogy	capstone course	distance learning	accreditation	intro prog	it workers	is undergrad curriculum	ethics
cloud computing	curriculum dev	data mining	graduates	instant messaging	cis	is education	assessment	java	offshoring	pedagogy	
computer science	design	data modeling	mathematics	internet	curriculum	information technology	assurance of learning	programming	outsourcing		
computers	erp	database	mentoring	mobile computing	is 2002	motivation	information literacy	prog lang	skills		
distance ed	enterprise systems	database design	minorities	outcomes assessment	project management	online education	learning outcomes	security			
education	faculty	feedback	retention	privacy	service learning	soft skills		security educ			
elearning	higher ed	knowledge management	scholarships	social networking	systems analysis & design						
entrepreneurship	information systems	laboratory-based learning	tutoring	twitter							
is curr	is curriculum	mis	women								
learning	model curriculum	normalization									
learning management system	sap										
online learning	software engineering										
service-oriented architecture											
technology											
web 2.0											
web services											

Table 5: 2008-2012 Clusters

Keyword	Occurrences	Total link strength	Keyword	Occurrences	Total link strength
active learning	14	26	assessment	7	7
is curriculum	11	18	curriculum	7	7
pedagogy	11	15	e-learning	3	7
online learning	9	14	engagement	4	7
experiential learning	8	13	java	4	7
information systems education	6	13	problem solving	3	7
cyberbullying	4	12	security	4	7
privacy	6	12	social media	7	7
programming	9	12	business analytics	5	6
social networking	5	12	business intelligence	5	
analytics	6	11	information technology	4	6
big data	8	11	learning styles	3	6
flipped classroom	6	11	online education	3	6
cybersecurity	6	10	abet	3	5
it strategy	5	10	accreditation	3	5
inverted classroom	3	9	course design	3	5
systems analysis and design	7	9	data science	3	5
cyberharassment	3	8	teaching	3	5
distance education	4	8	team-based learning	3	5
higher education	4	8			

Table 6: 2013-2017 Frequency Counts

Cybersecurity	Programming	Online Learning	Big Data	Pedagogy	IS Curriculum??	Assessment
classroom innovation	collaborative learning	course design	big data	active learning	analytics	abet
curriculum development	curriculum	distance education	business analytics	cloud computing	database design	accreditation
cyberbullying	it strategy	e-learning	business intelligence	flipped classroom	engagement	assessment
cyberharassment	java	erp	community engagement	information systems education	entrepreneurship	database
cybersecurity	music	learning styles	data science	inverted classroom	information systems	experiential learning
education	programming	online classes	information systems curriculum	is curriculum	problem solving	is education
higher education	project management	online education	is2002 model curriculum	pedagogy	social media	
information technology	python	online learning	privacy	student engagement	systems analysis and design	
instructional design	team-based learning	teaching	teaching case			
security						
social networking						

Table 7: 2013-2017 Clusters

Keyword	Occurrences	Total link strength	Keyword	Occurrences	Total link strength
pedagogy	22	32	scrum project	3	12
online learning	7	26	student performance	3	12
pandemic	6	26	learned helplessness	5	10
covid 19	5	25	procrastination	6	10
faculty	5	25	data analytics	12	10
grading impact	5	25	apprenticeship	3	9
remote learning	5	25	assessment	4	6
capstone course	4	13	education	4	6
scrum	4	13	information systems	6	6
asp.net mvc	3	12	work-based learning	3	6
attendance	3	12	business analytics	7	5
attentiveness	3	12	certification	3	5
cybersecurity	12	12	coding bootcamps	3	5
distraction	3	12	content analysis	3	5
participation	3	12	data science	3	5

Table 8: 2018-2022 Frequency Counts

Cybersecurity	Pedagogy	Business Analytics	Online Learning	Data Analytics	Attendance-Attentiveness	IS Curriculum	Capstone Course
apprenticeship	active learning	business analytics	covid 19	data analytics	attendance	competency	agile
assessment	certification	coding bootcamps	faculty	data science	attentiveness	curriculum	asp.net mvc
cybersecurity	computing education	content analysis	grading impact	education	distraction	information systems	capstone course
digital badge	covid-19	education in data analytics	online learning	retention	participation	information systems curriculum	scrum
digital literacy	pedagogy	is curriculum	pandemic	stem	student performance	project management	scrum project
learning outcomes	raspberry pi	programming	remote learning	teaching strategies		higher education	
online education	systems analysis and design	student satisfaction			learning		
work-based learning					self-regulated learning		
	learned helplessness				disabilities		
	procrastination						

Table 9: 2018-2022 Clusters

Keyword	Occurrences	Total link strength	Keyword	Occurrences	Total link strength
experiential learning	7	21	data literacy	3	8
data analytics	7	19	tableau	3	8
pedagogy	8	18	artificial intelligence	6	6
curriculum development	4	16	information systems	4	5
interdisciplinary	3	15	business education	3	3
practicum	3	15	curriculum	3	3
analytics	4	11	chatgpt	3	2
data visualization	6	9	cybersecurity	4	2
excel	3	9	machine learning	4	2

Table 10: 2023-2024 Frequency Counts

Analytics/Data Viz	Pedagogy	AI
analytics	curriculum development	artificial intelligence
business education	data analytics	chatgpt
curriculum	experiential learning	cybersecurity
data literacy	interdisciplinary	information systems
data visualization	pedagogy	machine learning
excel	practicum	
tableau		

Table 11: 2023-2024 Clusters

Keyword	Occurrences	Total link strength	Keyword	Occurrences	Total link strength
pedagogy	75	106	business intelligence	14	24
curriculum	51	63	is education	21	23
information systems	45	62	distance education	20	22
online learning	26	51	abet	14	21
assessment	37	44	computer literacy	18	21
information systems education	25	44	online education	15	21
information technology	23	42	security	15	21
is curriculum	37	42	social networking	9	20
education	27	39	information systems curriculum	17	19
faculty	10	39	retention	11	19
accreditation	19	37	service learning	15	19
active learning	26	37	student perceptions	9	19
data analytics	20	35	analytics	11	18
pandemic	8	32	curriculum design	14	18
privacy	16	32	cybersecurity	22	18
ethics	25	31	internet	8	18
experiential learning	19	31	learning	15	18
covid 19	6	30	software engineering	12	18
grading impact	6	30	web 2.0	13	18
remote learning	6	30	business analytics	14	17
systems analysis and design	24	29	capstone course	14	17
computer science	11	28	cyberbullying	6	17
higher education	19	26	entrepreneurship	11	17
curriculum development	19	25	big data	10	16
database	19	25	certification	10	16
programming	24	25	distance learning	17	16

Table 12: Full Network Keyword Frequency and Total Link Strength (sorted by Total Link Strength)

Ethics/Privacy Social Net	Curriculum Assessment	Analytics	Pedagogy	Distance Ed Learning	MIS Ed Issues	IS Topics	COVID impact on Online Learning	Programming
capstone	abet	analytics	active learning	computer literacy	computer science	enterprise systems	covid 19	intro programming
cloud computing	accreditation	artificial intelligence	agile	course design	design	higher education	faculty	java
collaborative learning	assessment	big data	capstone course	distance education	education	information systems	grading impact	programming
cyberbullying	case study	business analytics	covid-19	distance learning	enrollment	information systems curriculum	online learning	programming language
e-commerce	certification	business intelligence	curriculum development	e-learning	is curricula	information technology	pandemic	python
electronic commerce	computer information systems	critical thinking	experiential learning	erp	management information systems	instructional design	remote learning	
entrepreneurship	curriculum	curriculum design	is curriculum	flipped classroom	mentoring	learning outcomes	erp	
ethics	database	cybersecurity	is education	framework	outsourcing	simulation	information systems curriculum	
information systems curriculum	database design	data analytics	it strategy	information systems education	retention	software engineering		
innovation	is 2002 model curriculum	data mining	motivation	learning	scholarships			
internet	is model curriculum	data science	online teaching	learning styles	skills			
mobile computing	it curriculum	data visualization	pedagogy	online education	women			
privacy	it education	information security	procrastination	teaching				
social networking	normalization	machine learning	project management					
technology	project based learning	social media	service learning					
web 2.0	security	student perceptions	student engagement					
web development	soft skills							
web services	systems analysis and design							

Table 13: Full Network Clusters

Rank	Era 1	Era 2	Era 3	Era 4	Era 5
1	curriculum, assessment, accreditation, model curriculum	pedagogy	pedagogy	pedagogy, Covid 19	analytics, data viz
2	ist computer literacy	IS curriculum	online learning	online learning, pandemic, faculty, grading impact, remote learning	pedagogy
3	ethics, e-learning, e-commerce	Student Issues: mentoring, retention, scholarships, women, minorities	assessment, experiential learning	capstone course, scrum, asp.net mvc, scrum project	AI
4	pedagogy, curriculum development	online education	cybersecurity, cyberbullying, social networking	attendance, attentiveness, distraction, participation, student performance	
5	programming, database	accreditation, assessment	analytics, privacy	cybersecurity, apprenticeship, assessment	
6	IS core	IS education	programming	data analytics, education, data science	
7	SAD, course design, service learning, project management	Database, data analytics	analytics, engagement, problem solving, social media	business analytics, coding bootcamps, content analysis	
8	Curriculum variations	Ethics			
9		Programming			

Table 14: Rank Changes from Eras 1 to 5

APPENDIX B
Term Maps

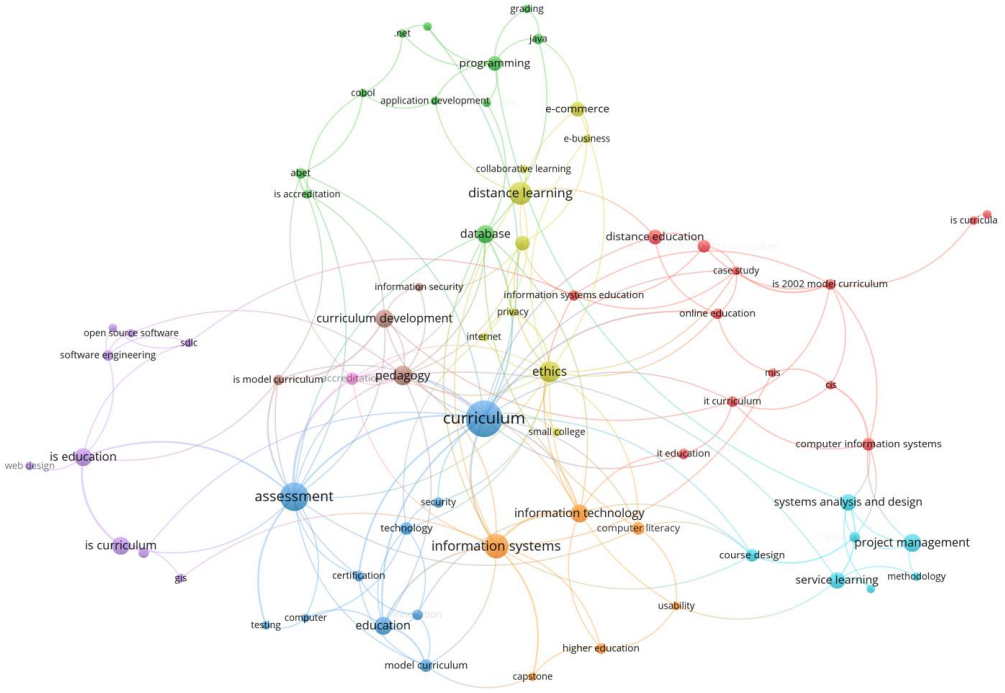


Figure 1: 2003-2007 Term Map

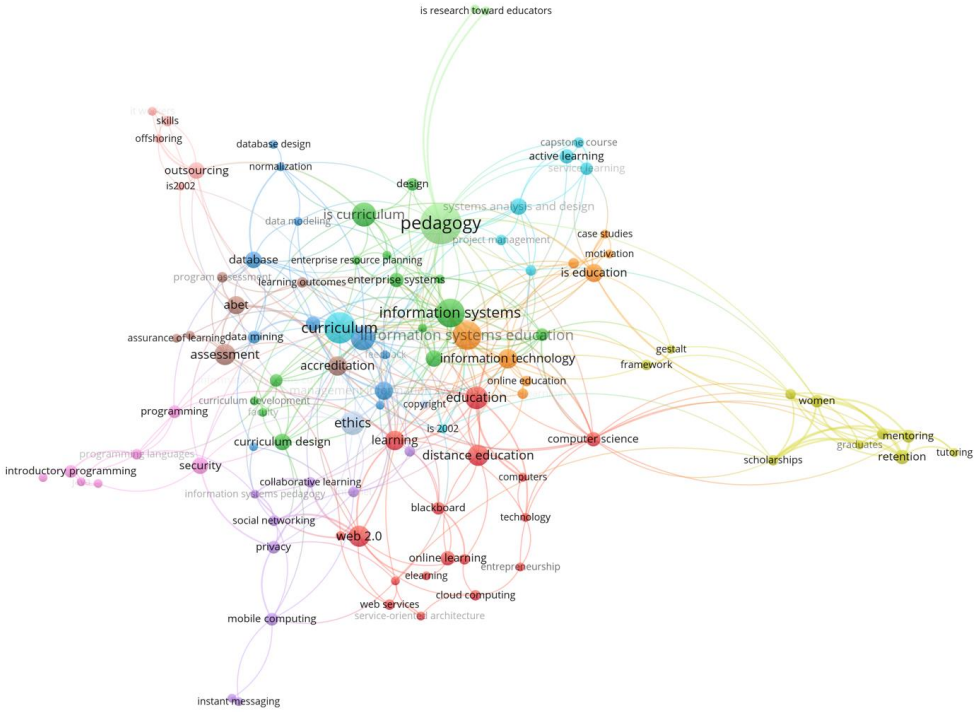


Figure 2: 2008-2012 Term Map

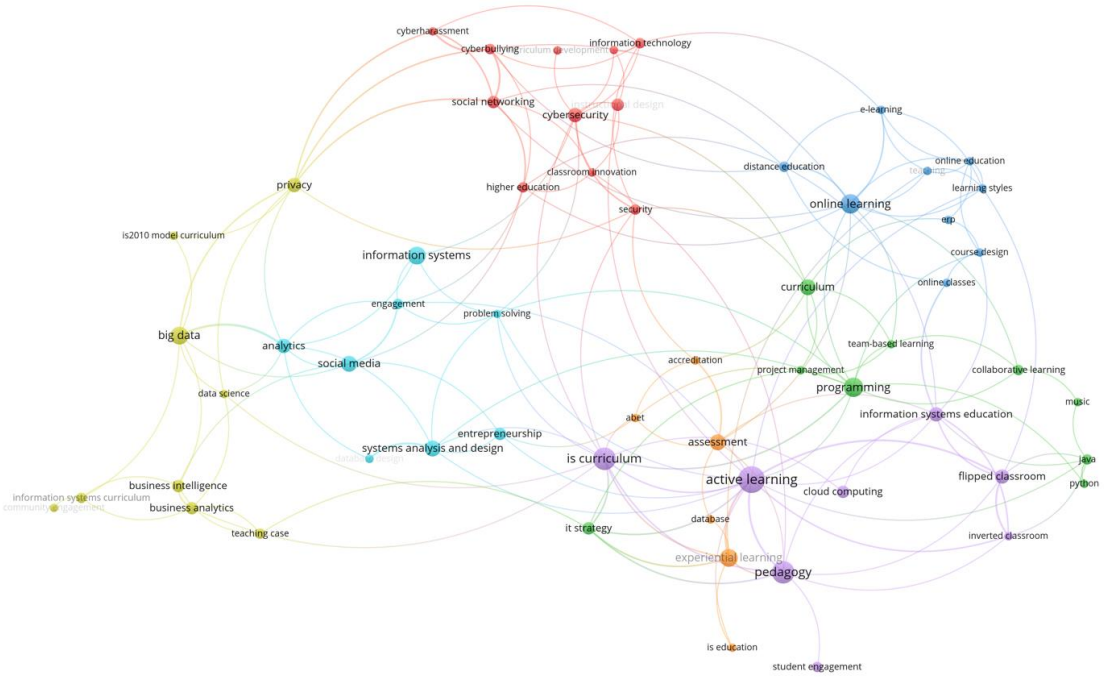


Figure 3: 2013-2017 Term Map

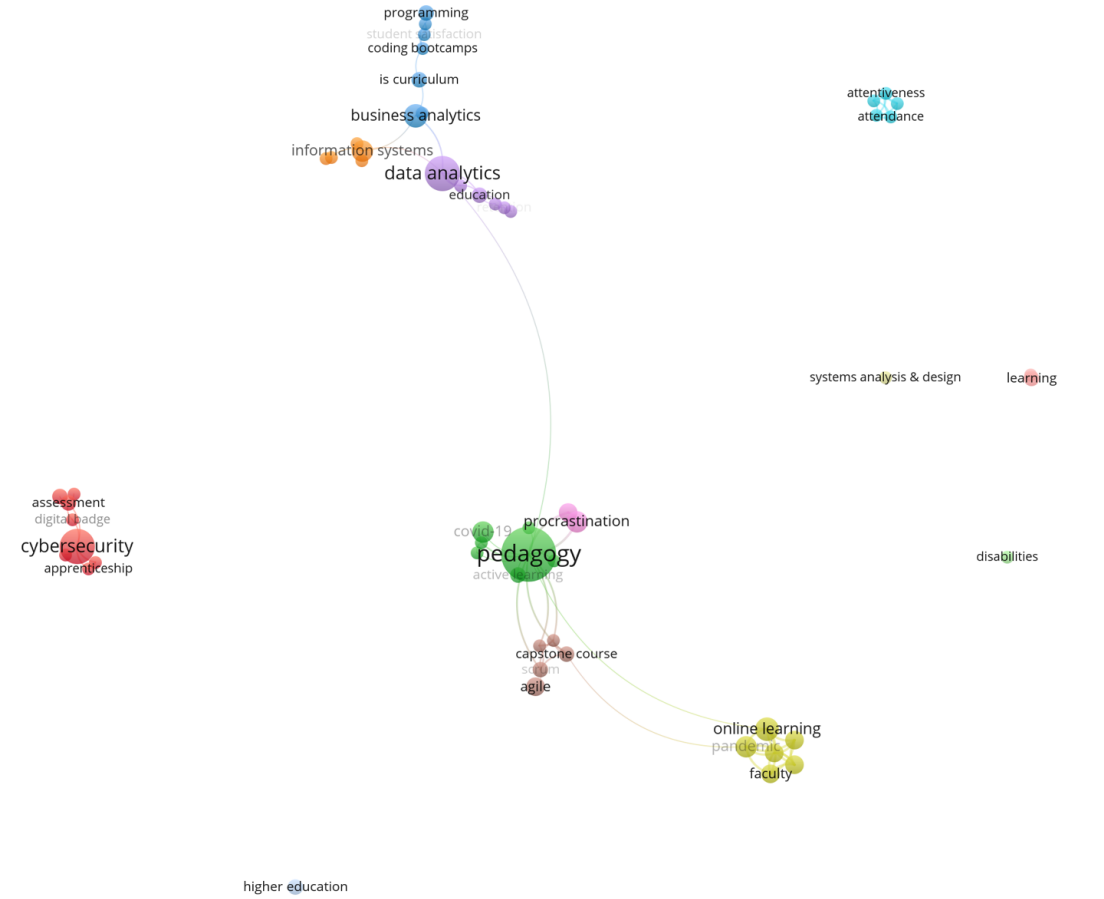


Figure 4: 2018-2022 Term Map

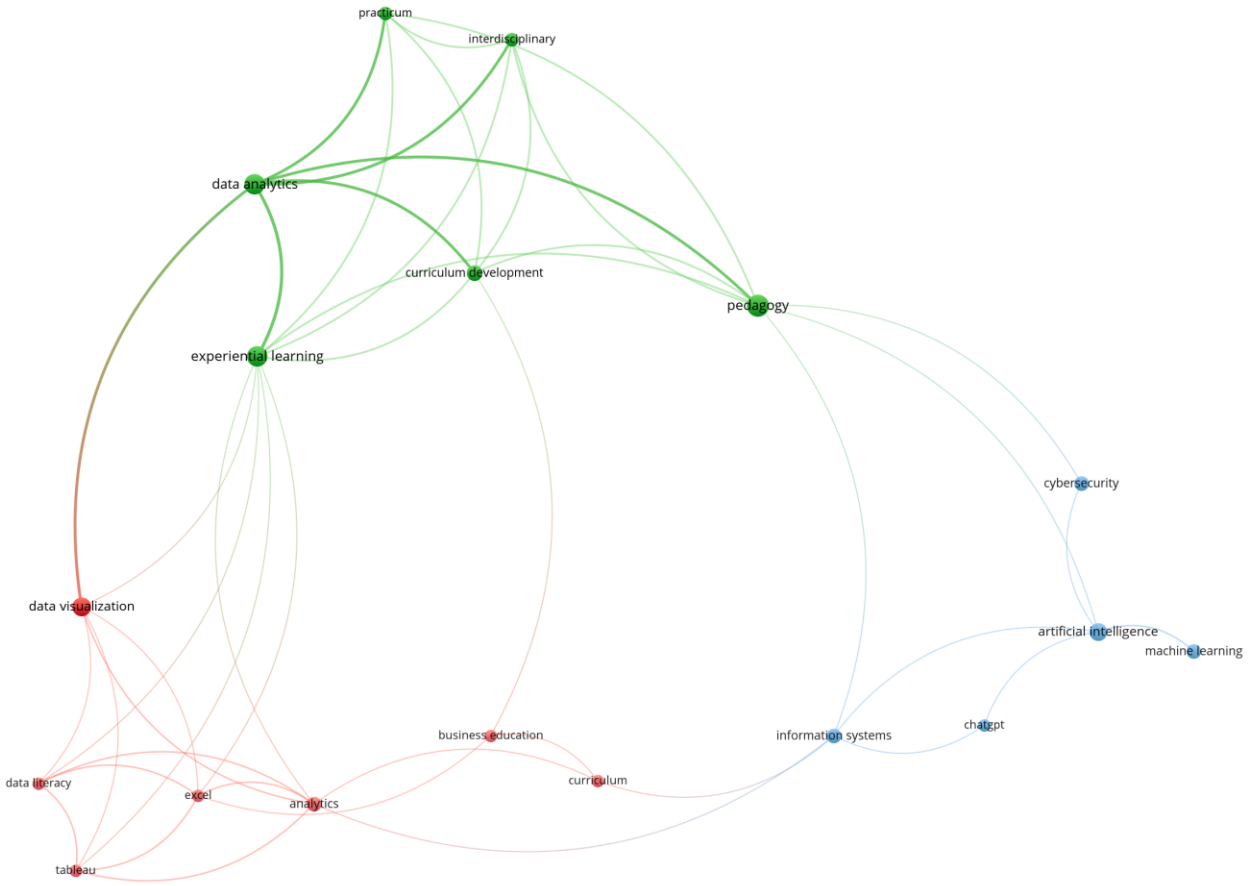


Figure 5: 2023-2024 Term Map

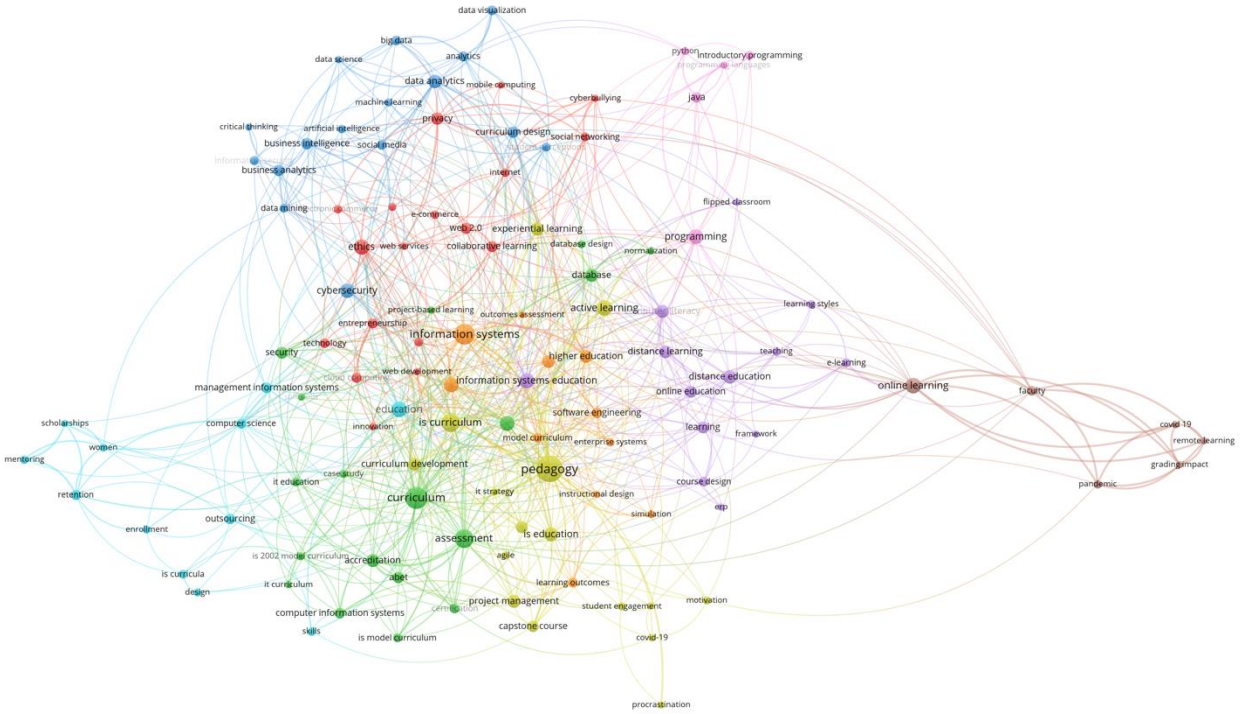


Figure 6: Full Network Term Map

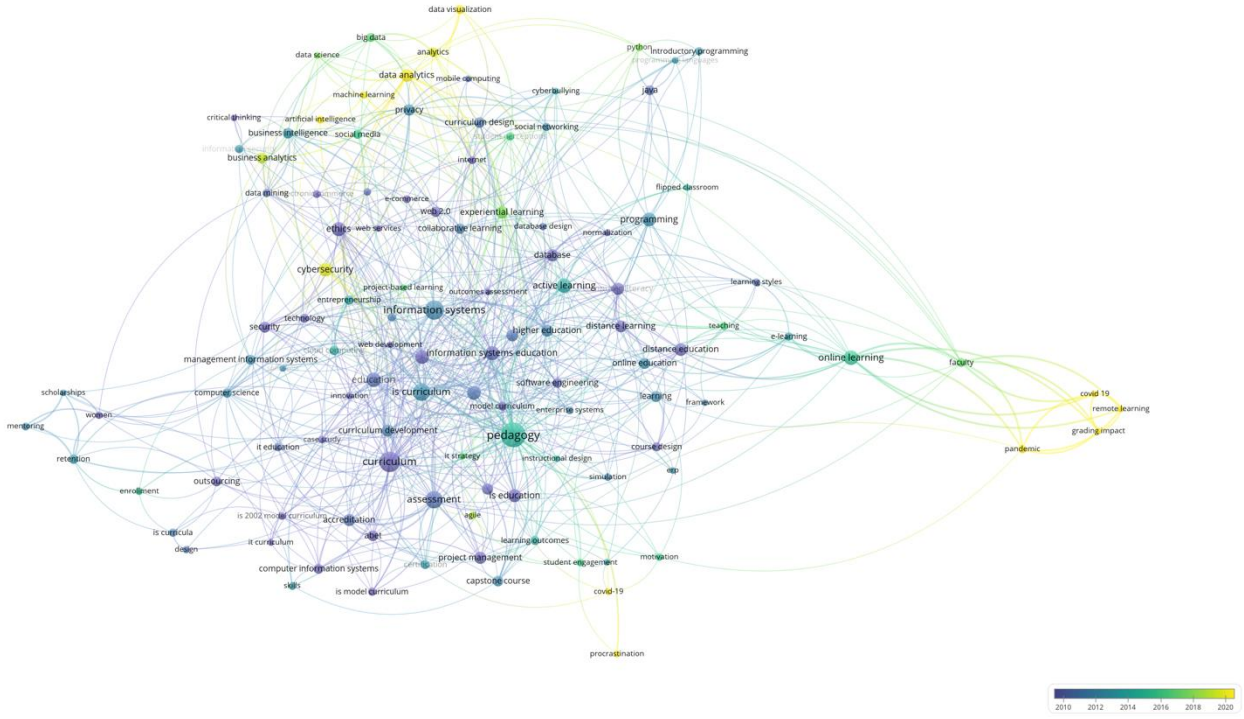


Figure 7: Full Network Time Overlay