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ZOLTÁN DÖRNYEI'S IMPACT ON LANGUAGE ACQUISITION AND EDUCATION STUDIES: A SCOPUS-BASED BIBLIOMETRIC STUDY (1991-2023)

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Abstract
Previous literature reviews and bibliometric studies have paid much attention to the scientific outputs of Zoltán Dörnyei, a leading figure in the field of second language acquisition and education. However, little attention has been paid to his scholarly impact. This study aims to analyze all publications citing his 87 works in Scopus. Bibliometrix, a comprehensive bibliometric tool, was run to analyze 7,621 documents published in 1,970 sources by 9,226 authors of 2,652 institutions across 99 countries between 1991 and 2023. The analyses include the publication trend, research contributors, including authors, document elements including keywords, collaboration networks of research contributors, shared references, and frequently used keywords. Although most documents were written in English in the fields of social sciences as well as arts and humanities, his impact could be observed across other subject areas and languages. Further discussion elaborated on four major themes of the publications, including motivation, L2 motivational self-system, language learning, and positive psychology. This study could provide researchers and educators with valuable insights into understanding and improving language acquisition processes based on Dörnyei's incalculable intellectual contribution. As this study focused on quantitative citation analysis, future research on how Dörnyei's works were cited could provide deeper insights into his impact.

Keywords: motivation language theory, publication and citation pattern, science mapping, scientometric portrait, Zoltán Dörnyei

Introduction
The passing away of Zoltán Dörnyei (ZD) in Nottingham, England, on June 10, 2022, after his "struggling with cancer in the last couple of months" (Dewaele, 2023, p. x), was a significant loss. During his lifetime, the professor of applied linguistics has contributed immeasurably to the big enterprise of second language acquisition (SLA) research, including research methodology, individual differences, and, specifically, language learning motivation theory. Born in Budapest, Hungary, on March 11, 1960, ZD was one of the leading figures in applied linguistics (de Bot, 2015) because of being "a bridge from other fields to

SLA" (Oxford, 2022, p. xx). Described as "a man of boundless energy, amazing erudition, unwavering focus, blazing self-confidence, and profound kindness" (Dewaele, 2023, p. x), his passing undoubtedly leaves a significant void in the field.

In the 1980s, ZD began his career as a language teacher at the International House in Budapest, Hungary. Subsequently, from 1985 to 1988, he pursued his PhD in Psycholinguistics under the supervision of Professor Csaba Pléh at Eötvös Loránd University, focusing on some psycholinguistic factors in foreign language learning (Dörnyei, 2016). Later, he embarked on his teaching journey as an English language teacher at the School of English and American Studies at Eötvös Loránd University in Budapest. After ten years, ZD relocated to the United Kingdom and was initially employed at Thames Valley University in London. Eventually, in 2000, he became a part of the School of English at the University of Nottingham. In 2003, ZD successfully obtained a Doctor of Science (DSc) degree—a postdoctoral degree program granted to an individual who has made substantial contributions to the realm of Linguistics from the Hungarian Academy of Sciences. In 2004, his dedication and expertise in the field of Psycholinguistics led to his promotion as a Professor at the University of Nottingham.

Moreover, in 2017, he successfully completed another remarkable achievement by obtaining a second PhD in Theology from Durham University, England. His commitment to academic and religious endeavors was evident in his dissertation, which explored the challenges faced by humanity in the Bible under the title "Progressive Creation and the Struggles of Humankind: An Experiment in Canonical Narrative Interpretation". Due to his immeasurable contributions and his erudition, ZD has been honored with numerous prestigious awards between the 1990s and the 2010s. Some of the accolades include the Distinguished Research Award of the American TESOL Organization in 1998, the Kenneth W. Mildenberger Prize of the Modern Language Association in 1999, the International Language Testing Association (ILTA) Best Paper Award in 2006, the Ben Warren International House Trust Prize in 2010, the Henry Fairfield Osborn Award of Cornerstone University in 2011, and the Duke of Edinburgh English Language Book Awards in 2014 (Al-Hoorie & Hiver, 2022; Hajar & Karakus, 2023).

Because of his impressive outputs, impact, and awards, unsurprisingly, ZD has been the subject of many studies, especially since his passing away. Al-Hoorie and Hiver (2022), for instance, acknowledged how ZD's contributions to SLA, motivation, research methodology, the Open Science movement, and his theological interpretation of language learning had left a lasting impact on the fields. In their collective tributes, Pease, Lepp-Kaethler, and Wong (2022) painted a rich and comprehensive picture of ZD's legacy, revealing his profound influence on colleagues, students, and the field.

Unfortunately, many posthumous tributes summarized "personal and professional life journey without any analysis" (Serenko, Marrone, & Dumay, 2022, p. 4829). The two narrative descriptions of ZD were undoubtedly not "without analysis". However, the authors' reliance on manual content and thematic analyses might result in interpretation bias (Donthu, Kumar, Mukherjee, Pandey, & Lim, 2021), emphasizing the need for a more objective, comprehensive, and replicable analysis of ZD's output.

This gap was then filled by Hajar and Karakus (2023). They adopted science mapping analyses of bibliometric studies (Donthu et al., 2021), such as citation

analysis of ZD's works from keyword to country levels. In doing so, they systematically analyzed ZD's 84 publications indexed in Scopus. Additionally, they mapped ZD's collaboration network with 52 authors from 15 countries between 1991 and 2023. They could also shed light on the breadth and depth of ZD's key research themes. The themes ranged from individual differences in SLA and multilingualism through research methodology to religious interpretation. Briefly stated, their bibliometric mapping excellently represented ZD's invaluable intellectual output. Nevertheless, a full-length portrait of ZD could have been taken if they had paid enough attention to ZD's impact, as cited in publications that cited ZD's works. It is posited that an examination of the impact of ZD's works could provide a more holistic portrait of ZD within the academic community. To address the perceived limitation in Hajar and Karakus' (2023) work, this study explored the impact of ZD's contributions as evidenced by the broader scholarly landscape that has cited ZD's publications.

In this study, we aim to portray ZD through the angle of his impact. Following Chen (2018), who reviewed Eugene Garfield's impact, we captured ZD's portrait through a set of publications that cited ZD's works (hereafter, ZI). The citing literature represents ZD's impact. This study then dealt with the two types of bibliometric analyses. First, performance analysis was used to identify the most productive authors, institutions, sources, and countries, and it mostly used cited references and keywords. The citation patterns were not observed, as the focus of this study was only on the publication patterns of ZI. Second, science mapping analysis was used to examine author, institution, and country collaborations to identify the social impact of ZI, co-citation analysis of cited references to reveal the intellectual impact of ZI, and co-word analysis of authors' keywords to uncover the central themes of ZI.

The two bibliometric analyses of ZI could help academic and practitioner communities understand better the global impact and dissemination of ZD's contributions across subject areas. Additionally, findings such as the dynamics of uncovered key themes provide a foundation for enhancing educational practices and developing innovative strategies in language acquisition and education based on ZD's impact on the field. More specifically, in the EFL context, our findings focused on how ZD's works can be practically applied to enhance language teaching methods, boost learner engagement, and improve academic performance. This study aims to serve as a bridge between theoretical knowledge and practical classroom implementation by identifying trends in ZD's impact on second/foreign language education and providing EFL researchers and educators with practical techniques to create a dynamic learning environment.

Method

This study did not involve human or animal subjects, and therefore, no ethical approval was required. To align this study with the findability, accessibility, interoperability, and reusability (FAIR) principles (Wilkinson et al., 2016), including its reliability and validity (Glänzel, 1996), we adopted the Preferred Reporting Items for Bibliometric Analysis (PRIBA) proposed by Koo and Lin (2023). PRIBA was chosen because it specifically addresses key aspects of bibliometric analysis. Other guidelines, such as the Preferred Reporting Items for

Systematic Reviews and Meta-Analyses (PRISMA) 2020 (Page et al., 2021), the PRIBA's foundational framework, are not tailored for bibliometric studies.

Data source

Regarding the data source, Scopus was accessed. As a prominent selective bibliographic database, Scopus recorded over 85 million documents by 17 million researchers (Elsevier, 2023) of 27 major subject areas consisting of over 300 minor subject areas (Scopus, 2023a). The last search was conducted on December 10, 2023.

Eligibility criteria and search strategy

As described by Chen (2018), the inclusion criteria encompassed all publications citing ZD's works, including ZD's self-citations. No exclusion criteria were applied in relation to languages, article types, or coverage years. At the initial stage of the research, the "Author" search tab in Scopus was used by entering "Dornyei" in the last name box and "Z" in the first name box. The search returned four variants of ZD's name in Scopus: "Dörnyei, Zoltán", "DÖrnyei, ZoltÁn", "Dörnyei, Z." and "Dornyei, Zoltán". All these variants were associated with the University of Nottingham (United Kingdom). ZD recorded 87 publications with an h-index of 52, demonstrating that at least 52 of 87 documents have each been cited no less than 52 times. The results were examined in a search result format, leading to the identification of ZD's 87 publications. By clicking "View cited by", ZI was found. The complete query string is available as supplemental online material.

Bibliometric indicators

Regarding the objectives of this study, some indicators of bibliometric performance and science mapping were used. The performance indicators included the general publication trend, annual publications, subject areas, languages, publication venues, cited references, trend topics, and authorship, including authors, affiliations, and countries. Not only the connectedness among keywords, references, and sources but also the connectedness among authors, institutions, and countries were examined. In addition, the science mapping indicators involved the author, institution, and country collaborations along with the co-occurrence network of authors' keywords and the co-citation network of cited references. Combining the performance and science mapping indicators provides a detailed bibliometric mapping of ZD's scholarly impact within the academic domain.

Data wrangling and analytical software

To enhance data accuracy, the downloaded data set of ZI underwent refinement using OpenRefine (Delpeuch et al., 2023). The software was used to identify and merge some different values that could potentially signify the same things. For instance, variations in the spelling, such as "DORNYEI Z" (1 record) and "DÖRNYEI Z" (63 records), were merged with "DÖRNYEI Z". Not only authors' names but also other variables, including institutions and keywords were refined and merged.

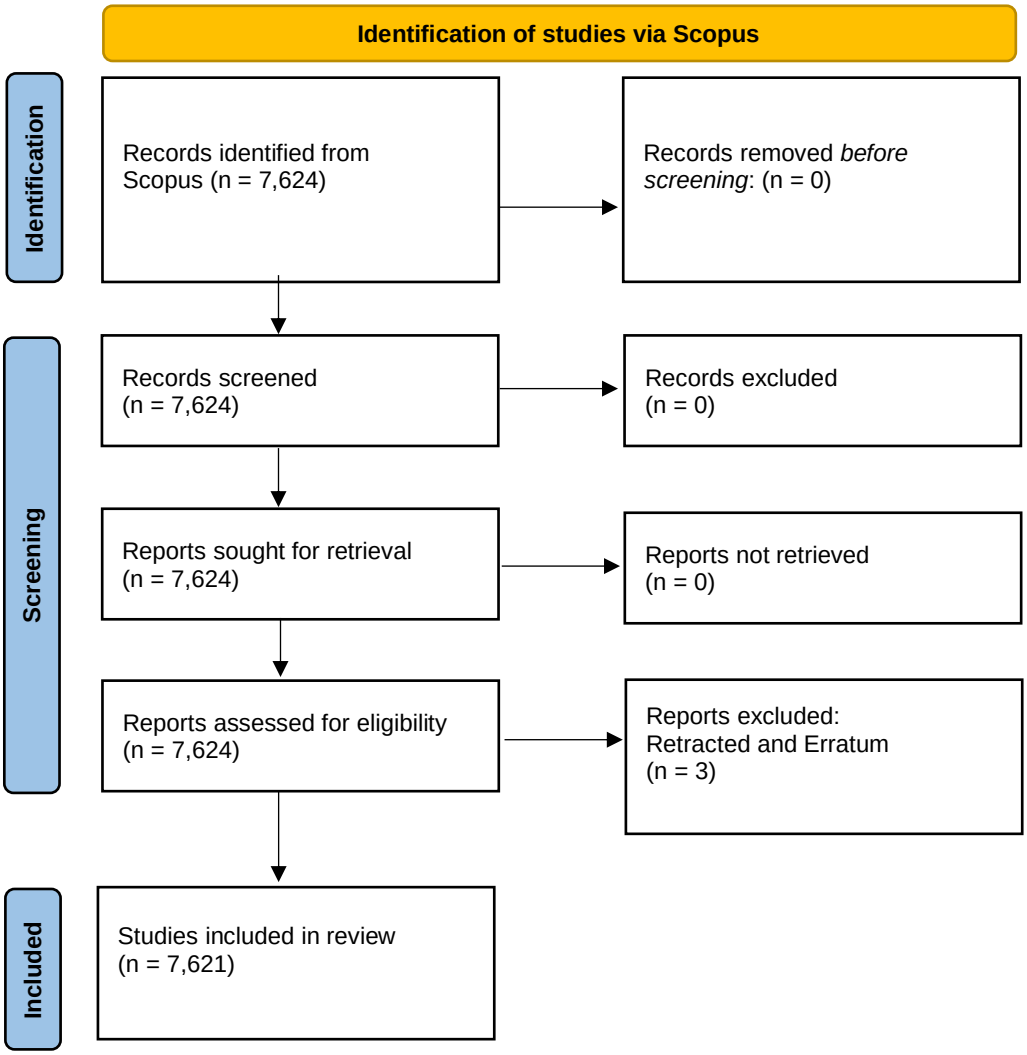
Afterward, the refined data were submitted to Bibliometrix through its web-based interface, Biblioshiny (Aria & Cuccurullo, 2017). The software was used because of its capacity to conduct both performance and science mapping

bibliometric analyses and its coverage of major citation databases such as Scopus (Linnenluecke, Marrone, & Singh, 2020; Moral-Muñoz et al., 2020). Unless something different is clearly mentioned, Bibliometrix was utilized with its default settings and configurations.

Findings and discussion

Search results

Figure 1 illustrates the systematic process of identifying, screening, excluding, and including ZI-related documents in our research study. After scrutinizing 7,624 records, we excluded three records of Retracted and Erratum document types. Therefore, the final data set included 7,621 documents. The query string and dataset for this study are openly available in Figshare at https://doi.org/10.6084/m9.figshare.24878832.



Note. From "The PRISMA 2020 statement: an updated guideline for reporting systematic reviews," by M. J. Page, J. E. McKenzie, P. M. Bossuyt, I. Boutron, T. C. Hoffmann, C. D. Mulrow, …, and D Moher, 2021, BMJ, n71, p. 5. (https://doi.org/10.1136/bmj.n71). CC BY

Figure 1. Selection process for ZI-related literature

The process shown in Figure 1 can eliminate any potentially flawed documents that could skew the results. Our comprehensive and accurate dataset can provide reliable insights and conclusions. In this view, our study aligns with the findability, accessibility, interoperability, and reusability (FAIR) principles (Wilkinson et al., 2016), ensuring that our data is reliable and valid (Glänzel, 1996).

Performance analysis

Overview of ZI. Table 1 outlines the trends in ZI from 1991 to 2023. ZI spanned 7,621 documents by 9,226 authors in 1,970 sources, with articles being the most prevalent document type. The average citation per document indicates a substantial and lasting influence. As 3,140 of the total documents (approximately 40%) were single-authored documents, collaborative efforts were evident, with each document typically involving slightly more than two authors. A notable degree of international co-authorship suggests a positive engagement with the global research community. The contents of ZI showcased a rich diversity of keywords and references, reflecting the breadth of ZI. The negative annual growth rate of -2.08% could be explained by the presence of one early access document accessible to readers and Scopus in 2023 but assigned to a journal issue in 2024.

Table 1. Overview of ZI

Description	Results
Main information about data	
Annual Growth Rate %	-2.08
Document Average Age	5.75
Average citations per document	20.55
References	335,159
Document contents	
Scopus-generated keywords	2,482
Author's keywords	11,416
Authorship	
Authors of single-authored documents	2,096
Single-authored documents	3,140
Co-Authors per documents	2.02
International co-authorships %	15.92
Document types	
Article	5,500
Article in press	1
Book	349
Book chapter	1,226
Conference paper	175
Data paper	2
Editorial	46
Note	10
Review	308
Short survey	4

Publications of ZI. Figure 2 provides a chronological overview of the number of ZI published each year. The pattern suggests a generally positive trend in both publication output, particularly in the mid-2000s. The decrease in the number of publications in the more recent years could indeed be influenced by an ongoing process. Regarding the date of data retrieval, the publications in 2023 possibly have not yet reached their full potential.

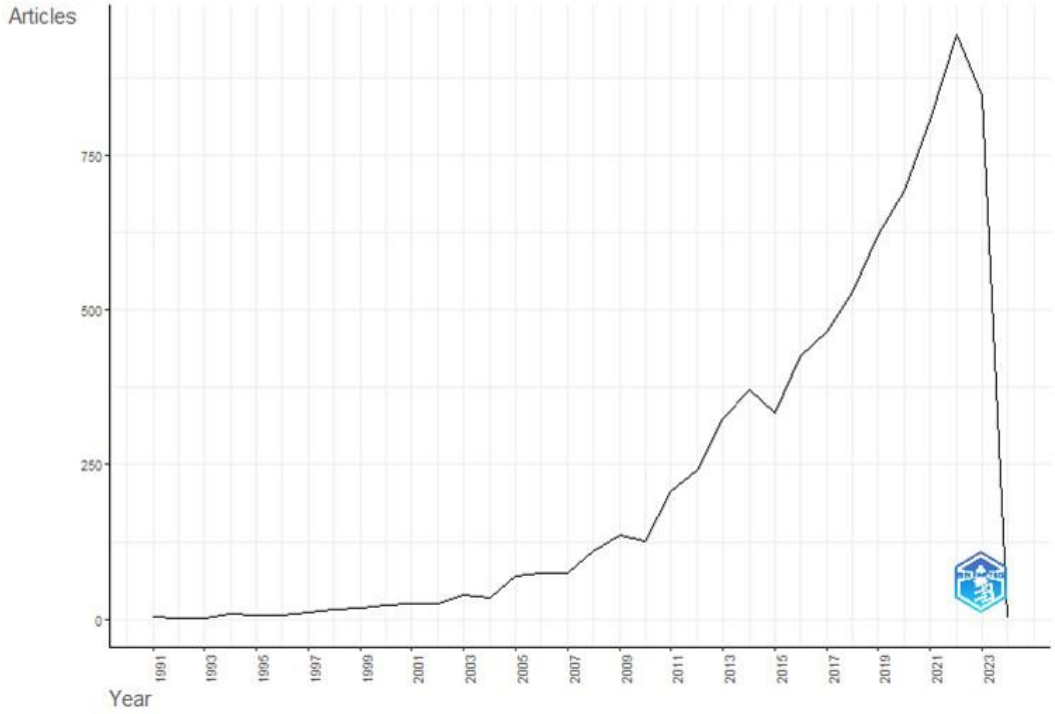


Figure 2. Annual publication of ZI

As displayed in Figure 2, the first four documents of ZI were published in 1991. They cited one of ZD's first articles indexed in Scopus. In the article published in 1990 (according to Hajar and Karakus [2023], in 1991), exploring motivation in the Hungarian foreign-language learning context, ZD revealed four dimensions of a motivational construct, namely "Instrumental Motivational Subsystems", "Integrative Motivational Subsystems", "Need for Achievement", and "Attributions about Past Failures" (Dörnyei, 1990). The article, cited one year after its publication, garnered attention from prominent scholars in the field of language learning and teaching. The four dimensions could explain further the complexities of motivations in second/foreign language learning, as can be seen in its references, based on the five publications by Robert C. Gardner, one of the most prominent pioneers of the language motivation theory (Flynn & Harris, 2016). Contrary to Gardner's external locus of language motivation in the forms of role models and reference groups, ZD took an internal locus in terms of the learners' self-concept (Claro, 2019). A new mainstream of language motivation theory was then born, making ZD one of the leading figures in language learning and teaching.

Subject areas and languages of ZI. Scopus indicated the impact of ZD across 26 subject areas. Table 2 highlights a substantial impact on social sciences

(49%) along with arts and humanities (35%). About 11% of ZI were observed in three other areas, such as psychology (6%). ZD's impact could also be found in 21 other subject areas, ranging from engineering (0.79%) to chemical engineering (0.01%). The wide range of subject areas demonstrates a broader impact beyond academic disciplines in which ZD was actively involved.

Table 2. Distribution of ZI across subject areas

Subject Area	Documents
Social sciences	3,733
Arts and humanities	2,638
Psychology	485
Computer science	277
Business, management, and accounting	91
21 other subject areas, such as engineering	397

Hajar and Karakus (2023) mentioned that ZD's works were mostly distributed across social sciences as well as arts and humanities. Since other subjects were not mentioned, we searched Scopus and found two additional areas, namely psychology and neuroscience. ZD's works were then distributed in four subject areas. While the four subject areas suggest that ZD acted as "a bridge from other fields to SLA" (Oxford, 2022, p. xx), the 26 subject areas of ZI indicate that ZD also serves as a bridge *from SLA to other fields*. Our study underscores how ZD's works have connected SLA with a broad spectrum of academic disciplines.

In terms of language, nearly 98% of ZI were in English. This is expected as English has been the dominant language in academic and research communication since the late 1960s (Gordin, 2015). The presence of 26 other languages, including Spanish (92 documents), French (35), German (17), Estonian (12), and Persian (10), indicates that ZD's works reached diverse linguistic and cultural contexts. Our study thus reflects ZD's significance across various academic and cultural spheres.

Sources of ZI. Regarding the sources, Table 3 displays the top 10 out of 1,970 sources that published ZI. The top 10 sources accounted for approximately 19% (1,458) of the total 7,621 documents of ZI. The distribution of ZI across these sources suggests a broad engagement in various fields related to language learning and teaching, psychology, and multilingual development.

Four of the top 10 sources in Table 3 (#1, #3, #5, #9) also appear in the most prominent venues of ZD's works, as found by Hajar and Karakus (2023). It indicates that both ZD and ZI were frequently published in the same venues, suggesting a shared academic interest and relevance. Interestingly, eight of the top 10 sources of ZI belonged to Quartile 1 in Scopus (2023b). This demonstrated high-quality citations, confirming both the impact and prestige of ZD's works within internationally reputable venues.

Table 3. The top 10 sources of ZI

Sources	Total Publications
System	354
Frontiers in Psychology	203
Language Teaching Research	151
Journal of Multilingual and Multicultural Development	126

Sources	Total Publications
Modern Language Journal	124
Language Learning Journal	118
Second Language Learning and Teaching	103
Foreign Language Annals	101
Language Learning	99
Innovation in Language Learning and Teaching	79

In their study, Hajar and Karakus (2023) ran VOSviewer (van Eck & Waltman, 2010), a bibliometric science mapping tool focusing on the interconnection among research constituents such as journals and document elements such as keywords (Moral-Muñoz et al., 2020). They carried out a bibliographic coupling analysis of "the most prominent venues of publication preferred by Zoltán and his co-authors" (2023, p. 6). In fact, since the 1960s, bibliographic coupling has been used to identify two publications addressing shared topics based on the same third work in their references (Kessler, 1963). With journals as the unit of analysis, bibliographic coupling is primarily used to identify shared references between different journals (Aria & Cuccurullo, 2017). For the analysis of publication venues, we chose a descriptive frequency analysis in Bibliometrix because it offers a straightforward approach.

References of ZI. Table 4 presents the top 10 out of 335,159 references cited in ZI (see Table 1). Expectedly, seven of them were authored by ZD. These seven works, including the updated versions published between the 2000s and 2010s, collectively accentuate the breadth and depth of ZD's impact on the understanding and application of motivation in language learning and teaching.

Table 4. The top 10 references cited in ZI

Cited References	Citations
Dörnyei, Z. (2005). *The psychology of the language learner: Individual differences in second language acquisition*. Lawrence Erlbaum.	1,301
Gardner, R. C. (1985). *Social psychology and second language learning: The role of attitudes and motivation*. Edward Arnold.	847
Dörnyei, Z. (2009). The L2 motivational self system. In Z. Dörnyei & E. Ushioda, (Eds.), *Motivation, language identity, and the L2 self* (pp. 9–42). Multilingual Matters.	828
Dörnyei, Z., & Ryan, S. (2015). *The psychology of the language learner revisited*. Routledge.	607
Dörnyei, Z., & Ushioda, E. (2021). *Teaching and researching motivation*. Routledge.	462
Dörnyei, Z. (2001). *Teaching and researching motivation*. Longman.	384

Cited References	Citations
Dörnyei, Z., & Ushioda, E. (2009). *Motivation, language identity and the L2 self*. Multilingual Matters.	361
Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. Plenum.	345
Gardner, R. C., & Lambert, W. E. (1972). *Attitudes and motivation in second-language learning*. Newbury House Publishers.	345
Dörnyei, Z. (2001). *Motivational strategies in the language classroom*. Cambridge University Press.	336

Interestingly, two classic works by the two pioneers in the language motivation theory, Robert C. Gardner and Wallace E. Lambert (Dörnyei, 2020), were also highly cited in ZI. Emphasizing the role of social psychology, attitudes, and motivation in second-language learning (Gardner, 1985; Gardner & Lambert, 1972), the seminal works still feature prominently and attest to the lasting significance of foundational research in the field. In addition, the inclusion of Deci and Ryan's (1985) influential work on intrinsic motivation underscores the interdisciplinary nature of motivation research in language education. In conclusion, Table 4 not only highlights the extensive impact of ZD's scholarship but also underscores the enduring relevance of classic works in shaping the landscape of language motivation research.

Trend topics based on authors' keywords. Between 1991 and 2023, the 7,621 documents of ZI contained 11,416 keywords (see Table 2). Figure 3 shows trend topics of 42 keywords based on a minimum keyword frequency of 10 and an annual keyword count of five. ZD's extensive body of work appears to illuminate dynamic trends in language research.

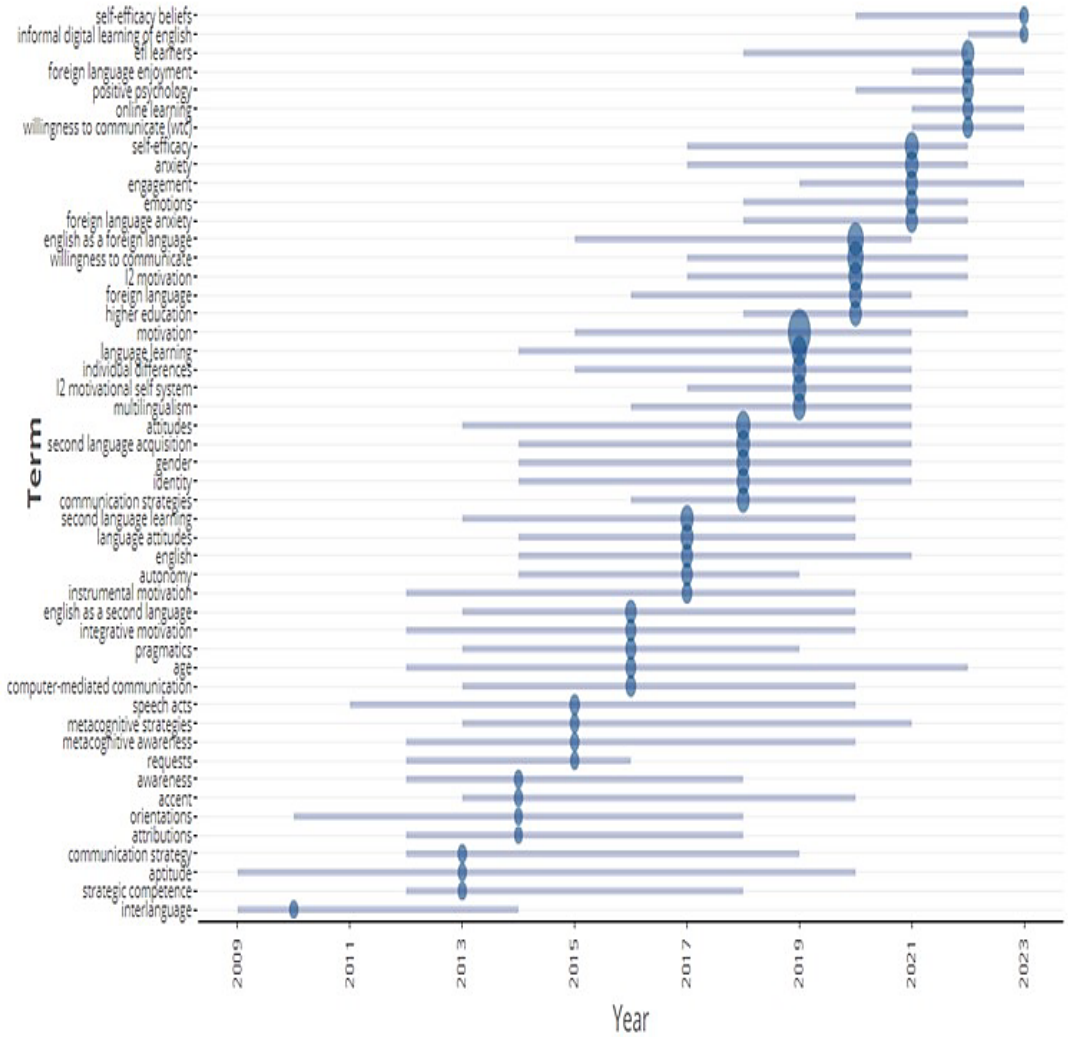


Figure 3. Trend topic of ZI

Three-field plot of keywords, references, and sources. Figure 4 compares how ZD and ZI were related in terms of the main items of cited references (CR), authors' keywords (DE), and sources (SO). The Sankey diagram was generated by setting up the number of each item to 10. The analysis established which references were mostly cited (see Table 4) and keywords were mostly used by authors (see Figure 3) in the most preferred publication venues of ZI (see Table 3).

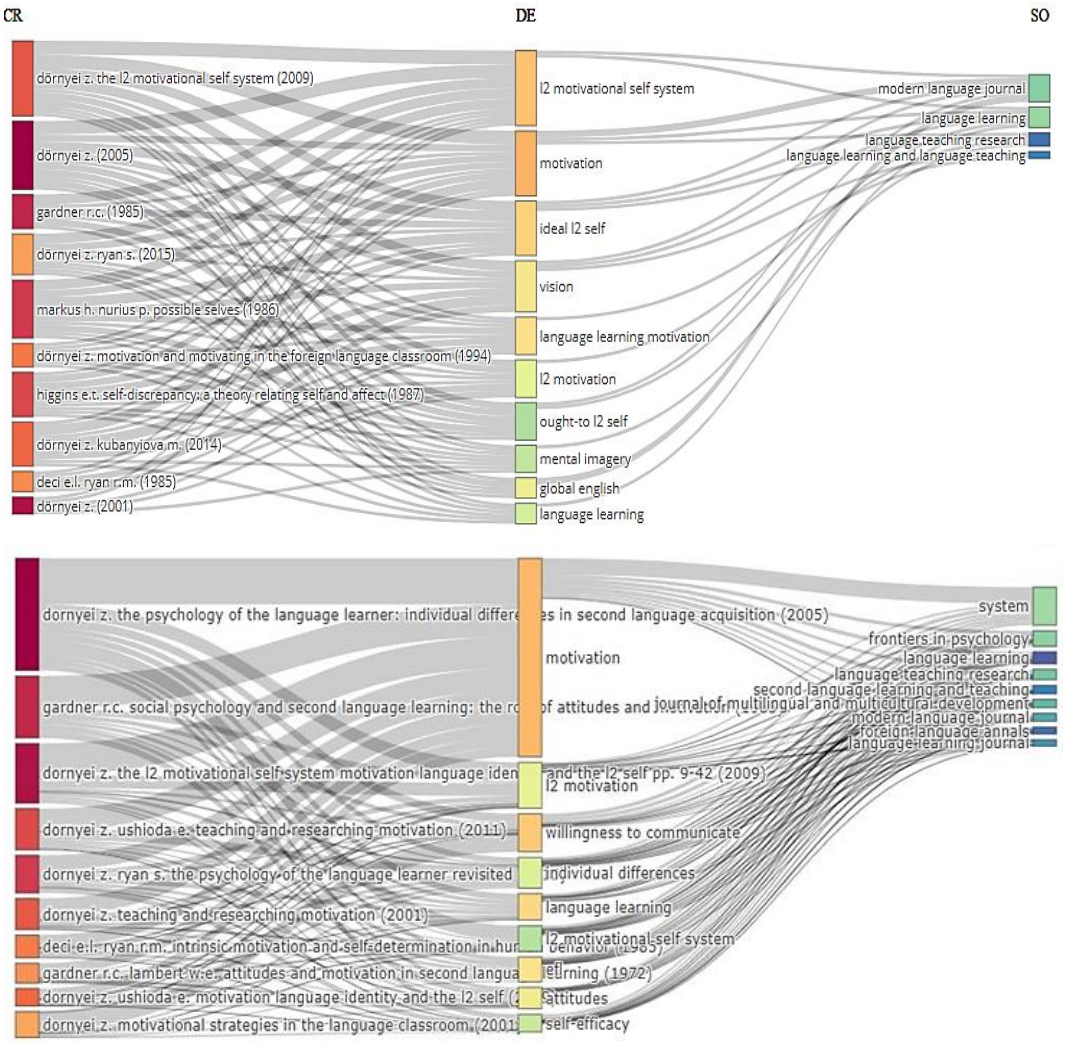


Figure 4. Connectedness of references, authors' keywords, and sources of ZD (upper) and ZI (lower)

While the comparison of the top sources has been presented in sources of ZI (Table 3), focusing on the comparison of keywords in the most preferred sources provides valuable insights. It is important to note that Hajar and Karakus (2023) did not show the keywords in relation to the most preferred journals. ZD's keywords, such as "L2 motivational self-system", focus on nuanced motivational constructs and broader sociocultural contexts. In contrast, ZI expands on these foundational concepts by incorporating a broader array of keywords, including "willingness to communicate". This expansion suggests a deeper exploration into additional psychological factors influencing motivation and learning in diverse contexts.

Authorship of ZI. Table 5 highlights the interconnectedness of authors, organizations, and countries in actively citing ZD's influential body of research. The top 10 out of 9,226 authors of ZI demonstrate a notable engagement, with ZD himself and "Pawlak M" leading in the number of publications. The top 10 authors contributed only 6.10% to the total of 7,621 publications.

Table 5. The top 10 contributors to ZI

Authors	TP*	Affiliations	TP*	Country	TP*	SCP*	MCP*
Dörnyei Z	64	Islamic Azad University	142	China	681	538	143
Pawlak M	64	University of Nottingham	100	USA	516	441	75
MacIntyre PD	51	Universiti Sains Malaysia	90	Iran	417	360	57
Dewaele J-M	49	Adam Mickiewicz University	85	United Kingdom	349	268	81
Henry A	47	University of Isfahan	83	Japan	269	243	26
Csizér K	44	The Education University of Hong Kong	78	Korea	189	156	33
Hiver P	37	Ferdowsi University of Mashhad	74	Spain	182	170	12
Mercer S	37	University of Bojnord	64	Hong Kong	179	124	55
Kim T-Y	36	University of Macau	58	Australia	146	121	25
Kormos J	36	The Hong Kong Polytechnic University	55	Canada	146	120	26

Note. TP = Total Publications, SCP = Single Country Publications, MCP = Multi Country Publications

Additionally, the top 10 out of 2,652 affiliations of 9,226 authors showcase the prolific organizations publishing ZI, such as four Iranian universities (#1, #5, #7, and #8). ZD and Pawlak M's affiliations, as expected, are listed in the top 10 affiliations. Furthermore, Table 5 outlines the top 10 out of 99 countries contributing to the dissemination of ZD's ideas. The number of contributing countries across five continents emphasizes the global impact of ZD's research.

As presented in the Methods, Scopus recorded ZD's 87 documents. Table 5 shows 64 documents authored or co-authored by ZD. It appears that ZD had a significant portion of documents citing his own works, approximately 74%. Based on Pandita and Singh's (2017) investigation, ZD's self-citations were relatively higher than the percentage of self-citations in Social Sciences (43.21%) along with Arts and Humanities (42.89%), two subject areas to which ZD actively contributed from the 1990s to 2020s. Moreover, in many studies, self-citation has been negatively perceived due to its potential use for one's self-promotion or increasing one's impact factor (Szomszor, Pendlebury, & Adams, 2020). Nevertheless, this is not the case for ZD.

ZD's self-citation was certainly necessary for refining his works, which pioneered a new mainstream of language motivation theory (Claro, 2019). In this view, ZD incorporated his earlier works into his more recent research (Sugimoto & Larivière, 2018). In other words, ZD's self-citation was needed to bridge between

his more recent intellectual motives, such as theology and his earlier ones, including psycholinguistics (Oxford, 2022). ZD's judicious use of self-citation, therefore, not only contributed to the refinement of his works but also characterized a strategic integration of his intellectual evolution across diverse topics.

In addition to the co-authorship highlighted by Hajar and Karakus (2023), it is noteworthy that the top three of ZD's co-authors, "Csizér K", "Henry A", and "MacIntyre PD", joined the top 10 authors of ZI (see Table 5) with their ZI counts were comparatively higher. This suggests that they not only consistently referenced and built upon ZD's works but also maintained active publication activities in their individual research pursuits.

The three-field plot of authors, institutions, and countries. Figure 5 shows how the main items of authors (AU), along with their affiliations (AU_UN) and countries (AU_CO), were related. The Sankey diagram was generated by setting up the number of each item to 10. The analysis could shed light on the interrelationships among the three research constituents (see Table 5), offering valuable insights into the productivity within ZI.

Understanding the interrelationships among authors, affiliations, and countries, as illustrated by Figure 5, has significant implications for ZI. It can facilitate strategic collaborations by helping researchers identify potential partners who are leaders in interpreting or continuing ZD's works. It also highlights institutions that provide strong support for ZD-related research. In addition, institutions can use this analysis to allocate resources more effectively, supporting prolific researchers and fostering environments that encourage high productivity. For policymakers, insights into which countries and institutions are leading in ZD-related research can inform decisions on funding, support, and international cooperation initiatives.

Science mapping analysis

Social structure of ZI

Author collaboration network. Figure 6 offers a detailed perspective on the co-authorship in publishing ZI. Note that the size of the dot corresponds to the number of publications by an author (see Table 5). The collaborations of 45 authors were categorized into five clusters. Each cluster is followed by its respective color to facilitate understanding of the elaboration.

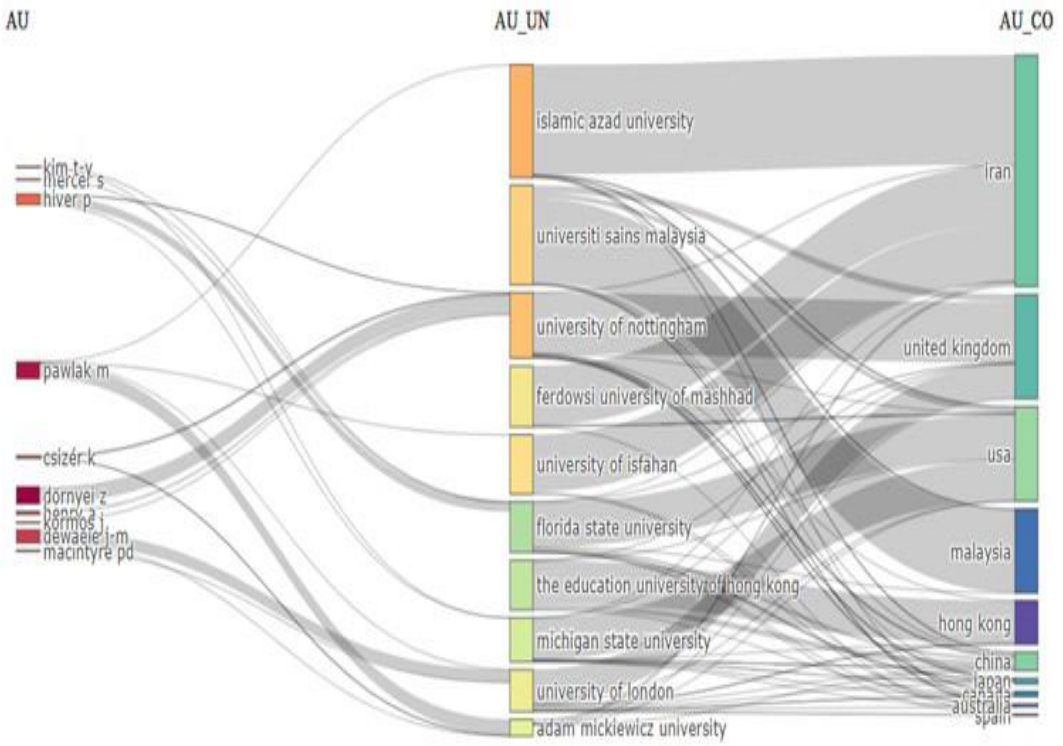


Figure 5. Connectedness of authors, their affiliations and countries

In Cluster 1 (pink), consisting of 14 authors, notable authors such as "Pawlak M" were identified with a betweenness of 253.75, a closeness of 0.01, and a PageRank of 0.08. Cluster 2 (Weldon blue) encompassed authors such as "Macintyre PD" (188.48, 0.01, and 0.06). The third cluster (Moss green) included eight authors, such as "Hiver P" (150.86, 0.01, and 0, 05). "Dörnyei Z" (291.20, 0.01, and 0.06), the focal point of Cluster 4 (lavender) consisting of eight authors, as expected, stood out with the highest betweenness, indicating significant centrality within the co-authorship. Lastly, Cluster 5 (tawny), consisting of only two authors, included "Liu Y" (43.00, 0.01, 0.02). This clustering approach could provide a structured understanding of the interconnectedness of ZI authors, with each cluster representing a distinct group of contributors to the academic discourse based on ZD's intellectual presence.

Institutional collaboration network. The analysis of institutional collaborations in publishing ZI reveals a diverse network of 46 institutions grouped into eight clusters (Figure 7). Note that the size of the dot corresponds to the number of publications by an organization (see Table 5). Noteworthy trends emerge within each cluster, showcasing the dynamics of institutional collaborations. Each cluster is followed by its respective color to facilitate understanding of the elaboration.

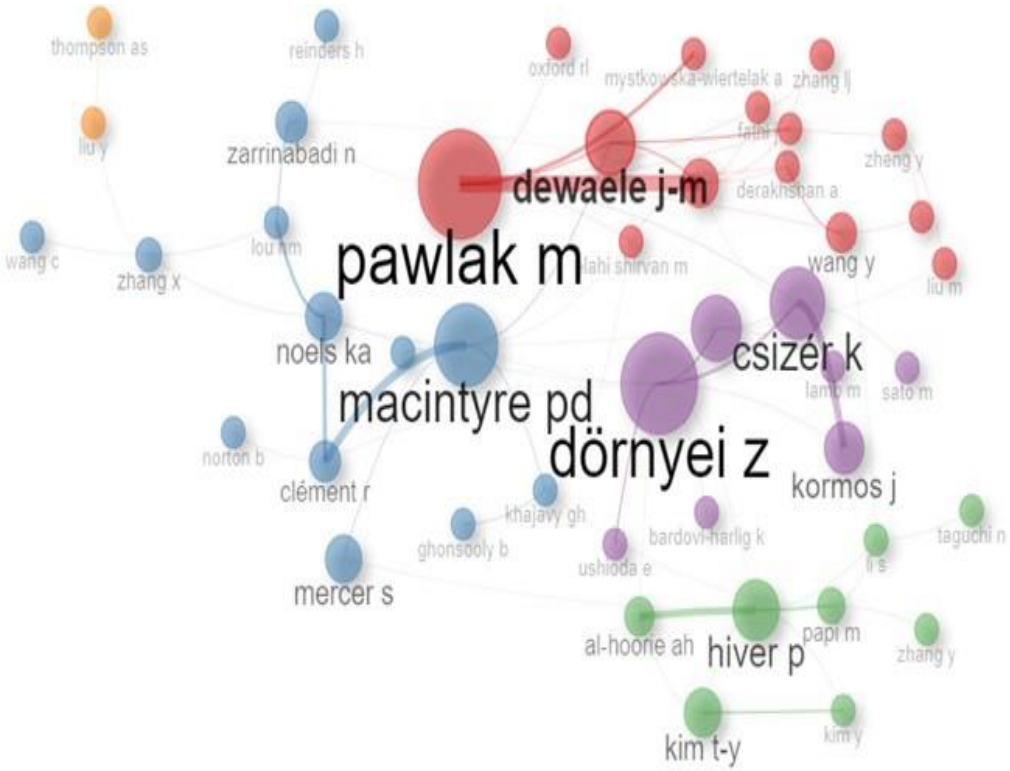


Figure 6. Individual co-authorship network of ZI

In Cluster 1 (red), which encompassed eight institutions, “Adam Mickiewicz University”, with a betweenness of 136.80, a closeness of 0.01, and a PageRank of 0.04, held significance in bridging collaborations among the institutions within this cluster. In Cluster 2 (blue), consisting of 13 institutions, “the Chinese University of Hong Kong” (214.88, 0.01, and 0.05) stood out with the highest betweenness, highlighting its central role in facilitating collaborations. Cluster 3 (green), consisting of 13 institutions, saw “Cape Breton University” (242.65, 0.01, and 0.04) as a key connector in the network. Meanwhile, “the University of Bojnord” (228.60, 0.01, and 0.05) took a central role in Cluster 4 (lavender) of four institutions. “University West” (79.74, 0.01, and 0.02) exhibited influence in Cluster 5 (apricot) of four institutions, while “Florida State University” (91.28, 0.01, and 0.02) played a significant role in Cluster (rose brown) 6 of three institutions. “Guangdong University of Foreign Studies” (83.00, 0.01, and 0.03) showcased its unique position in Cluster 7 (pale pink) of three institutions. Lastly, Cluster 8 (silver), comprising two Malaysian universities, exhibited distinct characteristics with a betweenness of 0, possibly indicating a more isolated collaboration pattern. Overall, the science-mapping analysis of institutional collaborations illustrates the varied roles played by different organizations surrounding ZI.

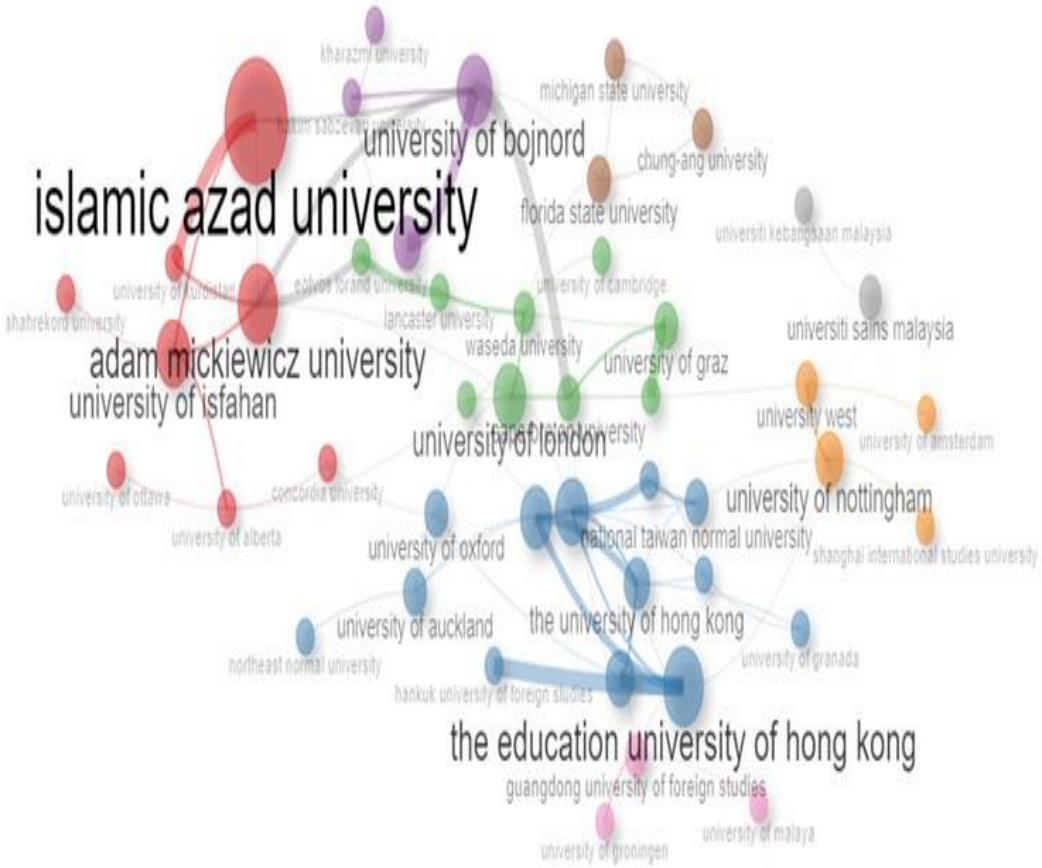


Figure 7. Institutional collaboration network of ZI

Country collaboration network. Figure 8 shows a diverse and widespread international collaboration in ZI. Note that the size of the dot corresponds to the number of publications by a single country (see Table 5). The countries with the highest betweenness centrality in each cluster could be observed, namely the United Kingdom (a betweenness of 235.36, a closeness of 0.02, and a PageRank of 0.10) in Cluster 1 (maroon), USA (203.75, 0.02, and 0.11) in Cluster 2 (steel blue), and India (6.79, 0.01, and 0.01) in Cluster 3 (pale green). Within their respective clusters, the three countries acted as key nodes in influencing the flow of collaboration among the countries involved in ZI. With a broad range of 29 countries, Cluster 1 demonstrated a widespread network of collaboration. Cluster 2 of 16 countries indicated a substantial but somewhat more focused collaboration. Cluster 3, with only three countries, represented a smaller but still notable international collaboration. The clustering approach could provide insights into the geographical distribution and patterns of international collaboration in ZI.

The country collaboration map in Figure 8 reveals notable trends in collaborative efforts to publish ZI. The analysis also underscores the United Kingdom's prominence in collaborative initiatives, with the highest number of collaborations with 50 countries across five continents. The collaborations initiated by the United Kingdom resulted in 281 documents.

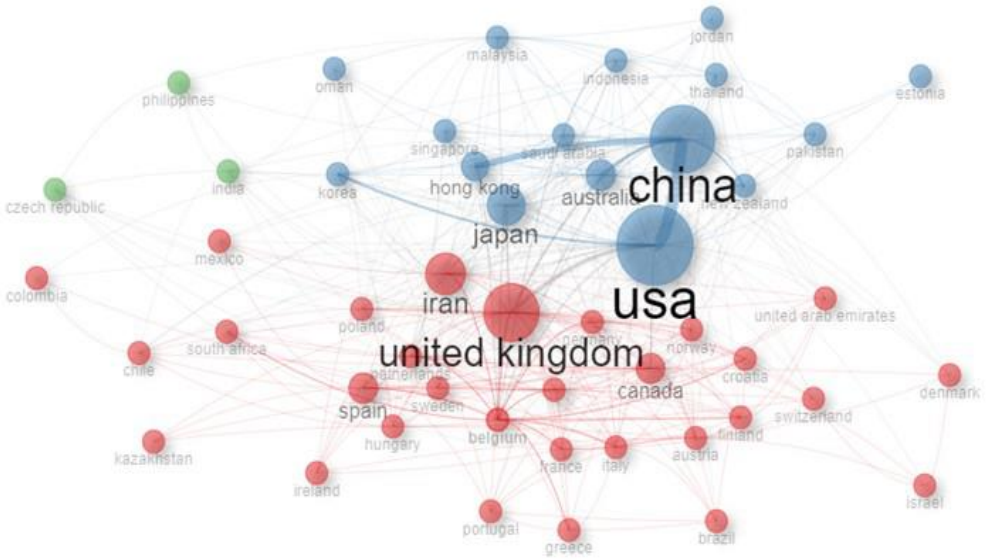


Figure 8. International co-authorship network of ZI

In contrast, while the USA initiated collaborations with 45 countries across five continents, the collaborations emerged as the most productive ones with 401 documents. The collaboration between the USA and China stood out as the most productive bilateral one, with 78 documents. The global collaborative effort accounts for approximately 16% of the overall 7,621 ZI documents (see Table 1).

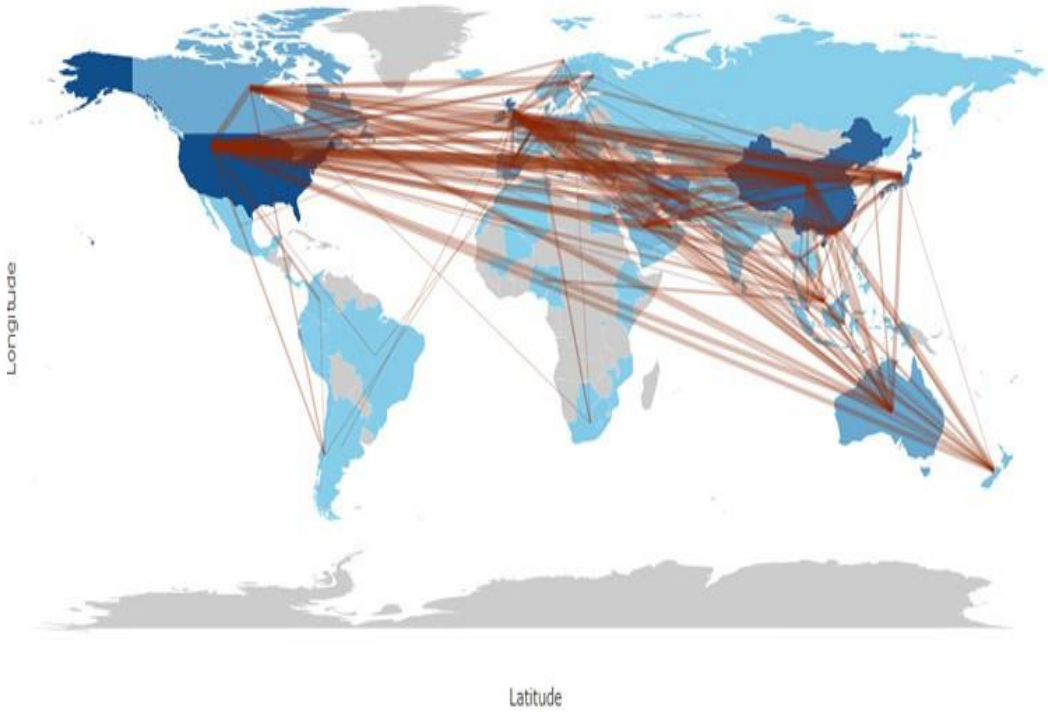


Figure 9. Collaboration world map of ZI

Intellectual structure of ZI. To examine the relationships among documents that represented influential research topics and established the intellectual structure of knowledge surrounding ZI (Aria & Cuccurullo, 2017), we generated Figure 10 by conducting a co-citation network of 50 cited documents. The intellectual structure of ZI was organized into three distinct clusters, each representing a thematic concentration within the broader field of second language acquisition and education.

Cluster 1 (salmon) consists of documents published between 1990 and 2008 focused on SLA, language learning strategies, and task-based language learning. Notably, Ellis' (1994) work, including its updated one (2008), titled "The Study of Second Language Acquisition", assumed a central role in Cluster 1. Both display high betweenness, closeness centrality, and PageRank (respectively, 10.711, 0.017, and 0.017 for the first work and 7.000, 0.017, and 0.013 for the updated version), indicating its pivotal position in connecting various nodes.

In the book(s), Ellis offered a comprehensive and balanced overview of research and theories in the field of SLA by incorporating various viewpoints, including cognitive, linguistic, sociocultural, and neurolinguistic approaches. As the topics in the book (s) were relevant to the topics explored in ZD's works, the authors of ZI found it valuable to include in their academic writings. In other words, the book(s) provided supporting context, evidence, or a theoretical foundation for the topics in ZI.

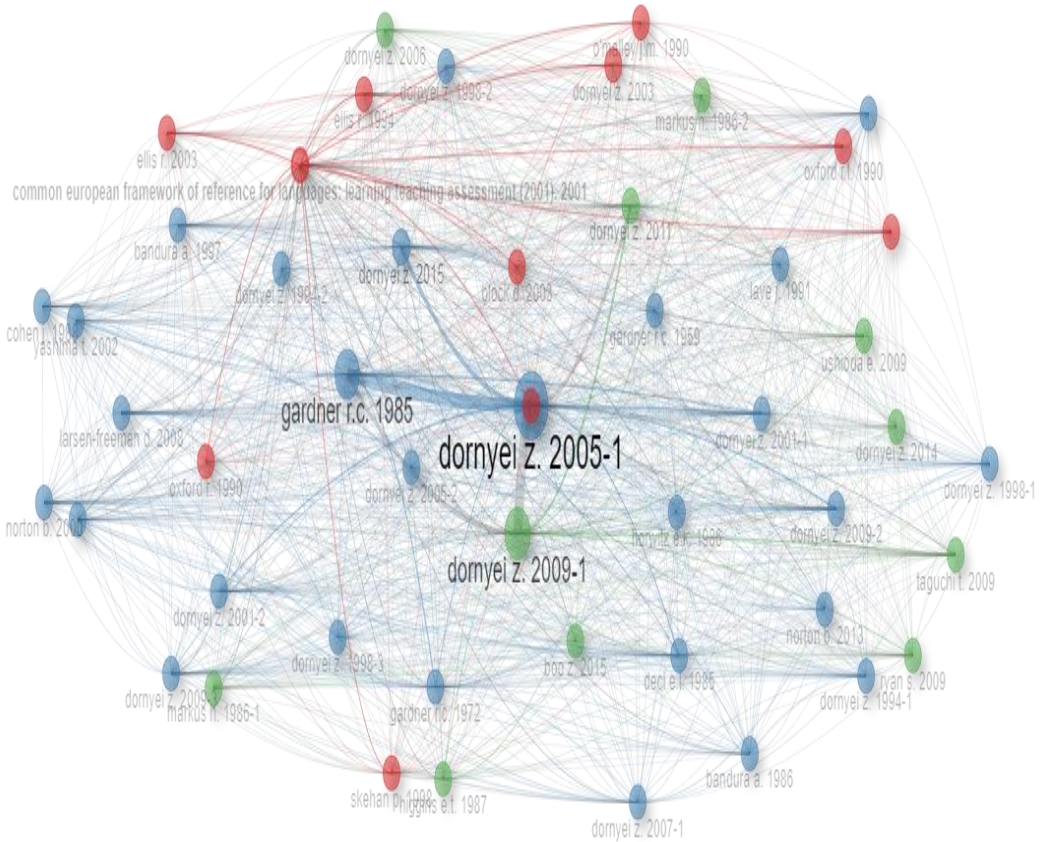


Figure 10. Co-citation documents networks of ZI

In Cluster 2 (steel blue), consisting of 28 documents published between 1959 and 2015, the spotlight is on motivation in language learning. "The Psychology of the Language Learner" (Dörnyei, 2005) as a focal point provided a review of relevant second language literature and a concise summary of psychological research in each area. As expected, the citing of some earlier ZD's contributions, such as "Motivation and Motivating in the Foreign Language Classroom" published in 1994 and previous seminal documents by the pioneer of language motivation theory (e.g., Gardner, 1985) emphasized the enduring impact and the interconnectedness of ZD in the domain.

Cluster 3 (pink), consisting of 11 documents, introduced a perspective on motivation from local to global levels, particularly with the findings from one of the most extensive language attitude and motivation surveys involving over 13,000 Hungarian teenage language learners in 1993, 1999, and 2004 (Dörnyei, Csizér, & Németh, 2006). The implications of the studies went beyond the European context. Interestingly, the central theme of Cluster 2 is the L2 motivational self-system (Dörnyei, 2009), on which ZD also collaborated with other researchers to contribute to the theme. In summary, Figure 10 could help provide a better understanding of the intellectual structure surrounding ZI in second language acquisition and education.

Conceptual structure of ZI. To identify the main themes that established the conceptual knowledge structure (Aria & Cuccurullo, 2017) surrounding ZI, we carried out an analysis of the co-occurrence network of authors' keywords, as displayed in Figure 11. Apparently, the central keyword is "motivation", which exhibited the highest betweenness, closeness, and PageRank values (461.27, 0.02, and 0.16, respectively) and its crucial role in ZI.

The main themes that established the conceptual structure were divided into four clusters. In Cluster 1 (light pink), "motivation" followed by "English as a foreign language" (69.17, 0.02, and 0.05) and "willingness to communicate" (29.81, 0.02, and 0.04) had crucial roles in the network. As depicted in Figure 11, the key theme in Cluster 1 is "motivation". Dörnyei (1994), for the first time, has developed motivation techniques. Later on, he concluded, "… motivation provides the primary impetus to initiate learning the L2 and later the driving force to sustain the long and often tedious learning process; indeed, all the other factors involved in L2 acquisition presuppose motivation to some extent" (Dörnyei, 1998, p. 117). Further, he points out that a high level of motivation can compensate for significant shortcomings in language ability and learning environments (Dörnyei, 2005).

Cluster 2 (light blue), consisting of four keywords, paid great attention to keywords related to L2 (second language) motivation, such as "L2 motivational self-system" (L2MSS) and "ideal L2 self". This cluster suggests a distinct theme focusing on motivation specific to second language acquisition, to which ZD has contributed significantly. The L2MSS, the prominent keyword in Cluster 2, is one of the constructs based on some of the most prominent perspectives in L2 motivation research (Dörnyei, 2005). The L2MSS refers to a new model of L2 motivation that includes three main concepts: 'Ideal L2 Self', 'Ought-to L2 Self', and 'L2 Learning Experience' (Dörnyei, 2005, 2009). The first concept relates to "the L2-specific facet of one's ideal self" (Dörnyei, 2005, p. 105), the second concept refers to "the attributes that one believes one ought to possess to meet

expectations and to avoid possible negative outcomes" (Dörnyei, 2009, p. 29), and the last concept refers to "situation-specific motives related to the immediate learning environment and experience" (Dörnyei, 2005, p. 106).

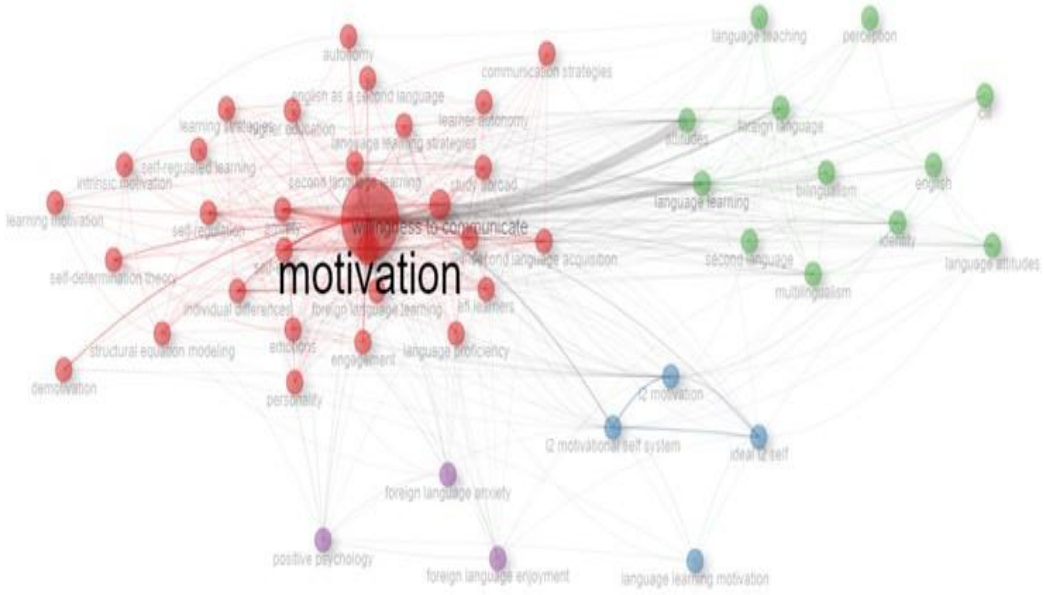


Figure 11. Co-occurrence network of authors' keywords in ZI

Clusters 3 (light green) with 12 keywords and 4 (lavender) with three keywords addressed language learning and attitudes. Cluster 3, encompassing keywords like "attitudes" and "identity", indicated a broader perspective on language learning and learner attitudes. According to Ajzen (2005), attitudes are a desire to react positively or negatively to someone or something. In different studies (e.g., Dörnyei & Csizér, 2002; Dörnyei et al., 2006), ZD investigated students' attitudes toward foreign language learning. Ushioda and Dörnyei (2009) argue that the theory of L2 motivation is currently undergoing a substantial reconceptualization within the concepts of self and identity. The term identity, according to Norton (2013), refers to "how a person understands his or her relationship to the world, how that relationship is structured across time and space, and how the person understands possibilities for the future" (p. 45). So, investing in the target language equates to investing in the learner's identity (Ushioda & Dörnyei, 2009).

The last cluster showed keywords associated with recent topics, including "foreign language anxiety", "foreign language enjoyment", and "positive psychology". This reflects a further exploration of learners' emotional experiences in the language learning process. MacIntyre and Mercer (2014) state that positive psychology is a quickly growing area within the field of psychology, which has significant implications for the field of SLA. The growing interest in positive psychology in L2 studies has resulted in the investigation of new notions of foreign language anxiety and foreign language enjoyment (Dewaele & Dewaele, 2020). While the first construct refers to the concern and negative emotional response triggered during the process of acquiring or using a second language (Dewaele & MacIntyre, 2014) such as Foreign Language Reading Anxiety (e.g., Limeranto &

Subekti, 2021), the second construct refers to "a complex emotion, capturing interacting dimensions of challenge and perceived ability that reflect the human drive for success in the face of difficult tasks" (Dewaele & MacIntyre, 2016, p. 216).

Overall, Figure 11 visualizes the structured representation and relationships of the key themes within the large body of literature influenced by ZD's works. Interestingly, while Hajar and Karakus (2023) found eight major research themes in publications authored or co-authored by ZD, our study identified four themes. This suggests that ZD and his co-author's research themes span a wider spectrum, including digital innovation. In contrast, the focus of ZI was narrower. The difference can be explained in part by a selective emphasis on citing documents due to the specific relevance and impact of the fundamental concepts within the broader academic discourse.

For example, positive psychology, one of the key themes in our study, has just been introduced to SLA since 2013 because of "the seemingly endless array of self-related concepts that have been invented, leading to confusion about vague and inconsistent use of terminology" (MacIntyre & Mercer, 2014, p. 160). Even though the context of citation is still not entirely clear, ZI considered ZD's self-related concepts one of the prior inquiry lines in language learning motivation theory as ZD and his colleagues did to Gardner and his colleagues' socio-affective concepts. While the socio-affective concepts were born from "psychologists who were interested in second language acquisition", the self-related concepts were born from "second language acquisition specialists (and often also language teachers), interested in psychology" (Dörnyei, 2020, p. xx). After a period of change, the pendulum is seemingly starting to swing back.

Conclusions

In this bibliometric study, ZD's impact was analyzed through publications citing his works over the past three decades. The immense impact was observable across not only institutions, countries, and languages but also subject areas. ZD's impact, as evidenced through the global co-authorship, co-citation networks of classic and recent works, and co-occurrence of authors' keywords, has established a great body of knowledge around motivation and foreign language learning, foreign language learning strategies and self-regulation, foreign language attitudes and multilingualism, and positive psychology in foreign language education. ZI has helped not only researchers understand better the language learning motivation within its internal locus but also educators to create motivational language learning environments. For example, in the EFL context, educators could employ practical techniques and collaborative projects to motivate learners and link language learning to their future professions.

This study could be valuable in providing a snapshot of ZD's massive impact but is not without limitations inherent in a bibliometric approach. Our thorough analysis may not escape from the selective data in the database, heavy reliance on the bibliometric tool, and time lag issues in fully capturing ZI, including the most recent developments. Specifically, merging bibliographic data from different databases with different data structures is challenging because it may lead to incorrect citation counts and potential inaccuracies in the analysis. Even though this study also offered contextual information on the research themes establishing the

great research body of ZI, such quantity-focused metrics may hinder a nuanced understanding of ZI. This study should, therefore, be approached with a critical awareness of these constraints and supplemented with qualitative methods for a better understanding of ZI.

In general, this study suggests positive citations of ZD's works. Nevertheless, future research can delve into the context and sentiment of these citations. Specifically, researchers could conduct a sentiment analysis to determine whether ZD's works were cited to commend their strengths, describe them neutrally, or criticize their weaknesses. One of these sentiment analyses could focus on the relationship with positive psychology, a rising topic in language education. Such studies can provide more nuanced insights into the perception and impact of ZD's works, contributing to a better understanding of ZD's impact within the field.

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