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Sketching the landscape of corrective feedback by bibliometric analysis and structural topic modeling

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Abstract

Corrective feedback (CF) has been playing an important role in language teaching. Even though previous reviews focused on written or oral corrective feedback, little attention has been drawn to provide a panoramic review of the whole CF field. This study aims to sketch the landscape of CF research over the past two decades (2000-2022) and identify latent topics of the CF field. A total of 1106 CF-related articles were analyzed using bibliometric analysis and structural topic modeling. The most influential journals, references, countries, and authors in CF were identified by bibliometric analysis. Eighteen important topics in CF were discovered by structural topic modeling, among which the most representative topics included eight student-related topics, four teacher-related topics, and four technology-related topics. The findings showed that among these eighteen topics, *implicit and explicit CF*, *teachers' beliefs in CF* and *uptake of recast* accounted for the largest proportion. Meanwhile, the topic trends indicated that more attention should be paid to *peer feedback*, *automated writing evaluation of feedback*, *assessment literacy* and *student engagement* in the future. More importantly, this study clarifies the relationship among teachers, students and technology in the CF field and constructs a conceptual framework in CF. This study contributes to pointing out potential directions for further CF studies and provides implications for deepening the understanding of CF in the language teaching field.

Keywords corrective feedback, language teaching, comprehensive review, bibliometric analysis, structural topic modeling

1. Introduction

Corrective feedback (CF) refers to both written and oral forms of response to learners' production of the second language (L2) (Li, 2010; Li & Vuono, 2019) and the purpose of CF is to assist learners in understanding and correcting their errors, enhancing their learning experience, and ultimately improving their performance. CF issues have obtained substantial attention and experienced a long history since the 1950s (Kang & Han, 2015). Looking back to the previous studies on CF and its scientific production, it is indicated that CF, a key feature of language teaching in the classroom (Sheen, 2011) has been receiving great attention from plenty of scholars and remains a crucial vehicle to facilitate L2 knowledge construction and enhance knowledge use (Han, 2002). Meanwhile, previous reviews have summarized the factors influencing oral feedback (Yu et al., 2018), the typology of feedback (Panadero & Lipnevich, 2022) and the effect of feedback on the learning environment (Cai et al., 2023). Considering the importance and popularity of the CF field, it is necessary to conduct a comprehensive review to delve into the development trajectory of CF and identify the knowledge gaps.

The study seeks to adopt a more convincing approach to make a comprehensive review of CF. Ever since 2000, some reviews on CF have been carried out (e.g. Brown, 2014; Kang & Han, 2015; Li, 2010; Lyster & Saito, 2010) and most of these studies were conducted via meta-analysis. However, some limitations existed in previous meta-analysis studies due to restricted sample size and ambiguous conclusions when the included studies yielded divergent results (Higgins, 2003). Meanwhile, another limitation of meta-analysis lies in its publication bias (Rothstein et al., 2006), which might also result in a lack of validity of meta-analysis results. In this regard, a more rigorous and objective method is needed.

Bibliometric analysis, a popular and rigorous method to perform a synthesis review, combines both quantitative and qualitative analysis to summarize large quantities of data to present the state of the intellectual structure (Donthu et al., 2021), which is more suitable for analyzing large volumes of scientific data in the CF field. To be further, bibliometric analysis can accomplish the theoretical contributions from four core elements (Mukherjee et al., 2022), which can enhance the theoretical contribution of this study.

To date, there have been two bibliometric reviews carried out by Crosthwaite et al. (2022) and Miao et al. (2023). The focus of the two reviews was written corrective feedback (WCF) and excluded oral CF, which cannot provide a bird's eye of the whole CF field. Moreover, previous reviews employed keyword occurrence network

analysis to predict CF topics, which generally ignored the dynamic changes of each topic in a certain period. To improve the validity of the results, structural topic modeling (STM), a type of more objective and machine learning technique for the extraction of latent topics from numerous textual data (Lester et al., 2019) is conducted in this study.

Via bibliometric analysis and STM, this study aims to analyze the annual development and topic trends of CF from a more panoramic perspective. This study is guided by the following research questions:

(1) What is the yearly publication production and what are the most influential journals and references in the CF field?

(2) Which countries and authors have the most significant influence, and how do they collaborate?

(3) What are the most influential topics and how do they evolve?

2. Methodology

2.1. Data collection and data cleaning

The most relevant articles, books, and book chapters from 2000 to 2022 were retrieved from the Scopus database. Scopus was chosen due to its largest curated abstract and citation database. Additionally, Scopus provided comprehensive metadata records of scientific articles (Baas et al., 2020), which ensured high precision of the data. Based on the definition of CF and the previous CF-related academic terms (Li, 2010; Li & Vuono, 2019), the search terms of this study included 15 words and phrases, that is '*feedback*', '*corrective feedback*', '*grammar correction*', '*written corrective feedback*', '*oral corrective feedback*', '*error feedback*', '*error correction*', '*feedback research*', '*teacher feedback*', '*peer feedback*', '*implicit feedback*', '*explicit feedback*', '*recast*', '*metalinguistic feedback*' and '*negative feedback*'. As long as these search terms appeared in the title, keywords, or abstract, the articles were downloaded at the initial time. Then, conference papers, erratum, and notes were excluded. Afterward, the author retained the journals whose aims and scopes are related to L2 learning and teaching. Consequently, the search scope was confined to 42 SSCI language teaching and learning journals, as the publications from these journals might contain CF-related studies. At last, 1465 articles were obtained.

To ensure the validity of the retrieval results, data cleaning is indispensable, which includes cleaning out misspellings, matching abbreviations, and normalizing the letters. In addition, the author carefully read the abstracts of all the chosen articles to check whether the research topic was relevant to CF. The specific inclusion and exclusion criteria are shown in Table 1. Hence, the final 1106 articles, books and book chapters were kept (All the data was retrieved on 15th January 2023). Referring to the latest WCF research by Crosthwaite et al. (2022) which included 493 L2 WCF-related articles, the present study covered both WCF and oral CF articles in language teaching and language learning. As a consequence, all the CF-related articles were roughly doubled, which also suggested that our retrieval process and the result were reasonable. The search strategy and analysis procedures are shown in Figure 1.

Table 1. Inclusion and exclusion criteria of manual process for metadata

Criteria	Descriptions
Inclusion criteria	1. Studies focusing on WCF or oral CF regardless of various types, such as recast, metalinguistic, implicit or explicit feedback and so forth. 2. Studies focusing on CF conducted in different L2 learning contexts or carried out with various methods for language teaching purposes. 3. Studies focusing on different factors influencing the effect of WCF or oral CF.
Exclusion criteria	1. Excluding conference papers, erratum, and notes. 2. Excluding articles without complete information (e.g., authors, abstract). 3. Excluding articles irrelevant to CF or beyond the language teaching and language learning field.

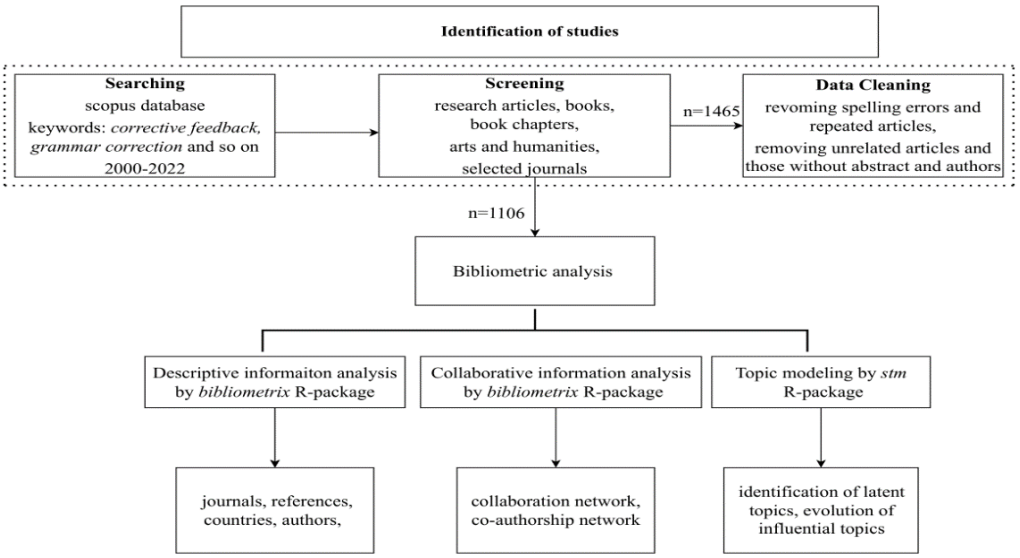

Figure 1. Data collecting process and analysis process

2.2. Data Analysis

To answer the first and the second questions, *bibliometrix* R-package was employed to figure out the descriptive information of the CF field, as well as the collaborative information. Descriptive information analysis, as an evaluation to assess productivity and impact (Mukherjee et al., 2022), includes annual production, journals, references, countries and authors. Collaborative information analysis mainly focuses on collaboration networks and co-authorship networks. These networks are further visualized by Gephi 0.9, which is an open-source and free visualization and exploration software for comprehensively figuring out collaborations in the CF field.

To answer the third question, STM was utilized to estimate latent topics and visualize the trends of topics along with other covariates (Roberts et al., 2019). It has been proven that this technique can discover the underlying topics from the text. However, as the results of the STM were a series of isolated words, the AntConc was further adopted to reconstruct the meaning of words to identify latent topics. That is, the isolated words were brought back to the article abstract to interpret the specific meaning in the context. In this way, the latent topics were figured out.

3. Results

3.1. Yearly publication production

The number of yearly publications is displayed in Figure 2. The overall trend can be roughly divided into two stages. The first stage ranged from 2000 to 2011, during which the number of CF-related articles remained at 30 to 40 or so. The other stage started from 2012 to 2022, which kept an overall rise. The number of relevant articles increased with continuous fluctuation after 2011. After that, the annual publication was at least 47 and the number even exceeded 90 from 2020 to 2022. As a whole, the annual scientific production of CF presented a significantly upward trend.

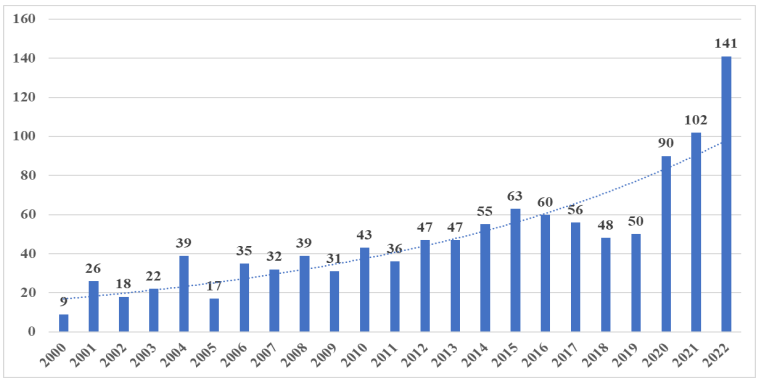

Figure 2. Publications per year of corrective feedback studies (2000-2022)

3.2. The most influential journals

The most influential journals were identified through the number of published papers and journal citations with the values of the h-index, g-index, and m-index, which were used to quantify an individual's scientific research output (Hirsch, 2010). The results in Table 2 demonstrated that the top six influential journals were the *Journal of Second Language Writing*, *System*, *Studies in Second Language Acquisition*, *Language Learning*, *The Modern Language Journal and Language Teaching Research*. All of these journals have boasted high h-index and total citations since 2000. The rest were also influential with large productions, which indicated these journals exerted great influence on the CF field.

Table 2. Top 20 journals

Journal	h_index	g_index	m_index	TC	NP	PY_start
Journal of Second Language Writing	43	82	1.792	8058	82	2000
System	40	65	1.739	5067	143	2001
Studies in Second Language Acquisition	35	48	1.458	5312	48	2000
Language Learning	32	49	1.333	3689	49	2000
The Modern Language Journal	31	51	1.292	3324	51	2000
Language Teaching Research	30	53	1.25	2951	100	2000
Computer-Assisted Language Learning	26	44	1.3	2268	80	2004
ELT Journal	25	42	1.087	1911	61	2001
Language Learning and Technology	20	30	0.952	1556	30	2003
ReCALL	20	36	0.87	1394	50	2001
TESOL Quarterly	16	26	0.696	1472	26	2001
Assessing Writing	15	29	0.714	875	30	2003
Foreign Language Annals	13	24	0.565	614	37	2001
Journal of English for Academic Purposes	12	23	0.571	554	33	2003
RELC Journal	12	19	0.5	430	52	2000
Language Teaching	10	22	0.5	1016	22	2004
English for Specific Purposes	9	10	0.409	404	10	2002
Innovation in Language Learning and Teaching	9	14	0.692	217	22	2011
Annual Review of Applied Linguistics	8	10	0.471	652	10	2007
Linguistics and Education	8	14	0.444	217	17	2006

Notes: The h-index indicates that a given author has had h articles published, each of which has h or more citations; the g-index is defined as a number such that the top g articles are cited an average of g times; the m-index is defined as an individual's h-index divided by the number of years since his or her first publication. (TC: total citations; NP: number of publications; PY_start: start from the publication year.)

Table 3. Most influential references

Author	Title	Journal	Citations
Lyster, R., Ranta, L. (1997)	*Corrective feedback and learner uptake: negotiation of form in communicative classrooms*	Studies in Second Language Acquisition	97
Truscott, J. (1996)	*The case against grammar correction in L2 writing classes*	Language Learning	89
Ellis, R., Loewen, S., Erlam, R. (2006)	*Implicit and explicit corrective feedback and the acquisition of L2 grammar*	Studies in Second Language Acquisition	70
Lyster, R. (1998a)	*Recasts, repetition, and ambiguity in L2 classroom discourse*	Studies in Second Language Acquisition	68
Lyster, R. (2004)	*Differential effects of prompts and recasts in form-focused instruction*	Studies in Second Language Acquisition	66
Schmidt, R. (1990)	*The role of consciousness in second language learning*	Applied Linguistics	64
Chandler, J. (2003)	*The efficacy of various kinds of error feedback for improvement in the accuracy and fluency of L2 student writing*	Journal of Second Language Writing	57
Li, S. (2010)	*The effectiveness of corrective feedback in SLA: a meta-analysis*	Language Learning	55
Sheen, Y. (2016)	*Corrective feedback and learner uptake in communicative classrooms across instructional settings*	Language Teaching Research	50
Lyster, R. (1998b)	*Negotiation of form, recasts, and explicit correction in relation to error types and learner repair in immersion classrooms*	Language Learning	48

The top ten impactful references are displayed in Table 3. Based on the thematic relevancy, these ten articles can be roughly divided into three categories. The first category focused on the role of consciousness in L2 learning and the dispute between the effectiveness and harmfulness of WCF (see Schmidt, 1990; Truscott, 1996). The second category pertained to the studies concerning the efficacy of different types of CF (see Chandler, 2003; Ellis et al., 2006; Li, 2010; Lyster, 1998a, 2004). These relevant articles examined whether the error should be corrected by teachers and how to correct was a continuous focus in the CF field. For instance, Ellis et al. (2006) pointed out that employing metalinguistic explanation (explicit feedback) was superior to recasts (implicit feedback) through testing instruments (e.g. oral imitation test, grammaticality judgment test and metalinguistic knowledge test). Chandler (2003) lent support to prove that direct correction and teacher's correction with simple underlining errors was the best way to inform the student. The last category dealt with the negotiation between CF and learners' uptake (e.g. Lyster, 1998; Lyster & Ranta, 1997; Sheen, 2016). For instance, Sheen (2016) emphasized the importance of context on CF and learners' uptake. In addition, Lyster and Ranta (1997) explored that students tended to respond to teachers' correction with student-generated repair when teachers stood to use the recast strategy under a communicative context.

3.3. The most influential countries and collaboration among countries

Table 4 demonstrates the most productive countries, among which the USA, New Zealand, Canada, China and the UK ranked top five. Betweenness, closeness and PageRank were used to further evaluate the country's impact. The result revealed that the USA and the UK emerged as the most influential countries in the field. Furthermore, the collaboration world map depicted in Figure 3 provided insights into the frequency of collaborations between different countries. The thickness of the lines on the map represented the proximity of collaboration between countries. Notably, the frequencies of collaboration between the USA and China, China and New Zealand, the USA and Japan, New Zealand and Australia, as well as the USA and the UK, were all above 6, indicating a strong and close collaborative relationship between these countries.

Table 4. Collaboration network among the top 15 countries

Country	Articles	TC	AAC	Cluster	Betweenness	Closeness	PageRank
USA	246	8940	36.34	5	405.213	0.017	0.167
New Zealand	35	3647	104.2	5	97.961	0.014	0.065
Canada	57	3418	59.96	2	35.748	0.014	0.056
China	49	1057	21.57	5	90.198	0.014	0.075
UK	40	1007	25.18	2	120.384	0.015	0.078
Australia	25	927	37.08	5	79.117	0.014	0.059
Iran	78	435	5.58	1	77.299	0.011	0.037
Netherlands	17	413	24.29	3	1.008	0.011	0.017
Spain	34	401	11.79	2	59.372	0.013	0.050
Korea	16	292	18.25	5	0.000	0.011	0.013
Japan	20	287	14.35	5	20.053	0.013	0.037
Chile	9	201	22.33	2	0.000	0.010	0.007
Belgium	4	158	39.5	3	0.633	0.012	0.013
Singapore	5	147	29.4	5	0.000	0.009	0.008
France	6	140	23.33	5	11.251	0.013	0.019

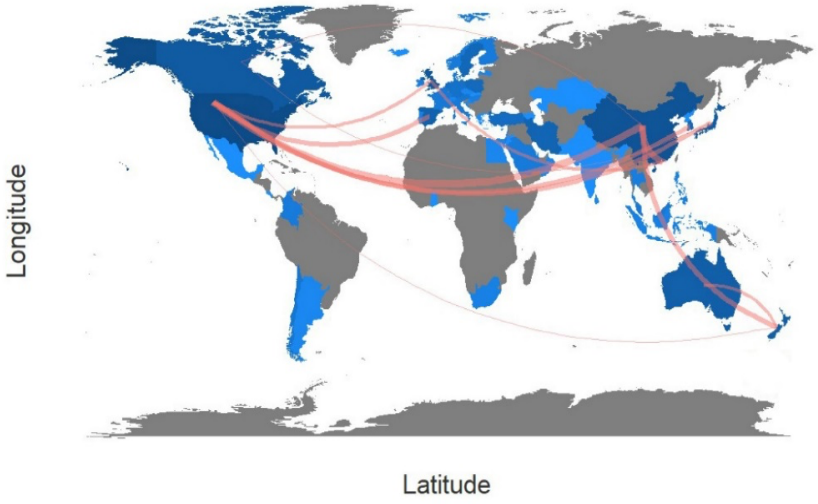

Figure 3. Collaboration World Map

3.4. The most impactful authors and authors' collaboration

Table 5 presents the most influential authors including Lee, Ellis, Lyster, Mackey, Loewen, Bitchener, Nassaji, Saito, and Yu, all of whose h-index values were at least 10, and the rest were also prolific. Their most important representative works were listed as follows. First, Lee has conducted a series of professional and influential studies on CF, especially in the teacher's role in WCF (see Lee, 2018, 2019, 2020). Second, Ellis also made a great contribution to the CF field. For instance, Ellis (2008) pinpointed a specific typology of WCF types and also further emphasized the theoretical and practical concern of CF when it referred to the effect of both oral and written CF (2010). Afterward, Lyster (1998) examined the relationship between the negotiation of CF and learner uptake, pointing out factors influencing the effect of CF. In addition, Bitchener and Knoch (2008) gave support to confirm the efficacy of CF and investigated the value of written CF for migrant and international students. At last, Li et al. (2016) explored the effect of the timing of CF on the acquisition of a new linguistic structure and Sheen (2010) found that CF effectiveness largely relied on the degree of explicitness of both oral and written CF. As a whole, numerous authors have done relevant research on CF issues, but the above prolific scholars are the most prestigious contributors to the CF field.

Table 5. Top 15 most impactful authors

Author	h_index	g_index	m_index	TC	NP	PY_start
Lee I.	18	23	0.857	1330	23	2003
Ellis R.	14	16	0.609	2192	16	2001
Lyster R.	14	15	0.609	2430	15	2001
Mackey A.	13	13	0.542	1599	13	2000
Loewen S.	11	12	0.478	1507	12	2001
Bitchener J.	10	10	0.526	1689	10	2005
Nassaji H.	10	11	0.588	530	11	2007
Saito K.	10	12	0.714	1089	12	2010
Yu S.	10	19	1	440	19	2014
Mcdonough K.	9	12	0.375	1094	12	2000
Yilmaz Y.	9	11	0.692	303	11	2011
Hyland F.	8	8	0.333	1115	8	2000
Li S.	8	13	0.533	848	13	2009
Rassaei E.	8	10	0.727	238	10	2013
Sheen Y.	8	8	0.4	1717	8	2004

Figure 4 plots the co-authorship among authors, which was composed of several major clusters with different color lumps. The result presented that Ellis, Sato, Mcdonough, Lee and Rahimi were the most collaborative, collaborating with five, two, five, three and two scholars respectively. Moreover, Knoch and Bitchener, Cucchiarini and Strike were the closest collaborators, followed by Lee, Liu and Yu. The representative collaborations were as follows.

The first cluster in light green shows the collaboration among Ellis, Shintani, Li, Loewen, Sheen and Kamiya. They enjoyed a close co-citation network and cooperation, such as exploring the effects of timing of CF (Li et al., 2016), examining the comparative effectiveness of different types of CF (Ellis et al., 2006; Kamiya, 2015), identifying mediators to the effect of CF (Shintani & Ellis, 2015; Shintani et al., 2014), as well as presenting focus-on-form in a different context (Ellis et al., 2001, 2002). The second cluster in yellow unfolded that Lee, Liu, Yu and Crosthwaite had a very strong collaboration. Yu and Lee (2016) put much emphasis on peer feedback, providing a critical interpretation of extant peer feedback research from 2005 to 2014 and clarifying the literature into seven important themes. Yu et al. (2022) developed a scale to assess learners' writing literacy, teachers' emotional experience and feedback literacy.

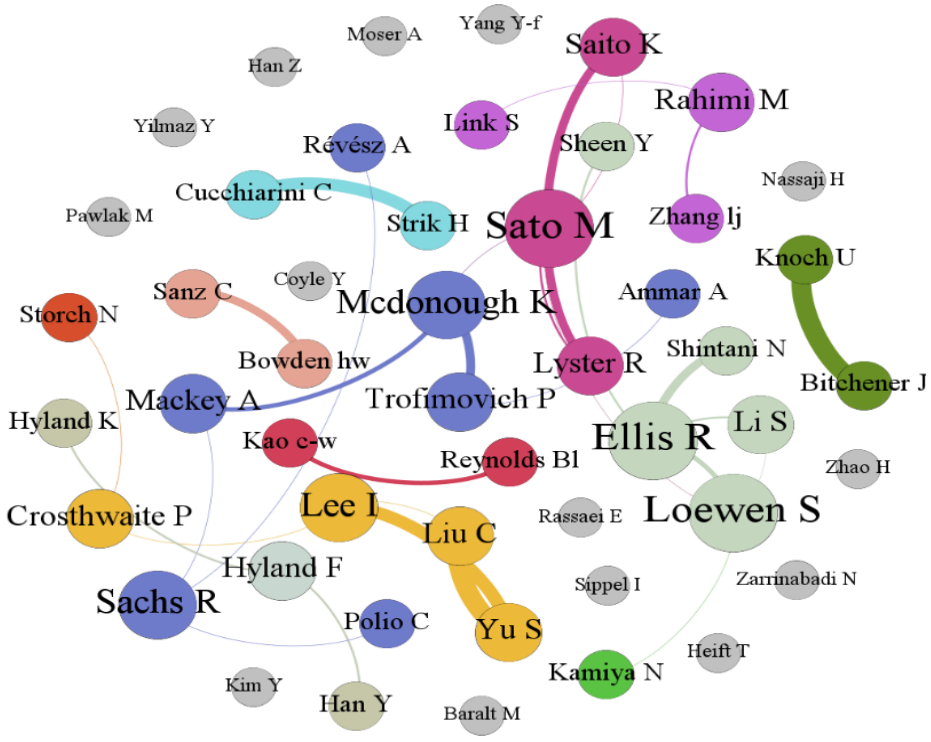

Figure 4. Author's collaboration

3.5. Latent topics and topic trends

The topic trend is an effective method to delineate the development trajectory of the CF field and point out future directions. Two indexes, semantic coherence and exclusivity, were usually used to evaluate the number of topics. Semantic coherence is based on the frequency of individual words or word pairs and its value is maximized when the keywords of a specific topic co-occur most frequently. The higher the semantic coherence is, the more relevant the topics are clustered (Zou et al., 2022). Exclusivity was used to indicate the terms linked to a particular topic. If the exclusivity is high, it reveals that the terms are more relevant (Kuhn, 2018). Figure 5 presents the semantic coherence and exclusivity scores for 40 topics. The topic number ranged from 1 to 40 and each point indicated that a model was fitted with the number of topics. The figure also shows that 18 topics obtained the largest semantic coherence and exclusivity values. Therefore, 18 was finally chosen as the number of latent topics for further STM analysis.

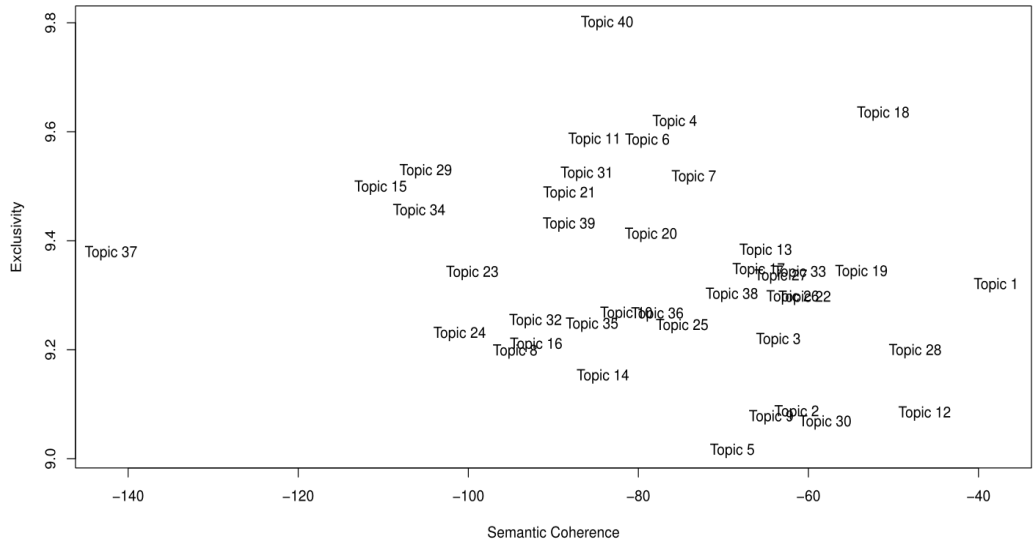

Figure 5. Semantic coherence and exclusivity in CF-related topics

Accordingly, the results of 18 topics on CF were identified (see Appendix A). Furthermore, based on the topic relevancy, the identified 18 topics can be grouped into four clusters shown in Figure 6, which were related to the student, teacher, technology and others. Specifically, student-related topics included *peer feedback*, *perceptions of CF*, *mindsets in CF*, *writing revisions*, *uptake of recast*, *interactional feedback*, *student engagement* and *CF for children*. Teacher-related topics encompassed *implicit and explicit CF*, *assessment literacy*, *teachers' beliefs* and *direct and indirect CF*. In addition, technology-related CF studies included *web-based CF*, *corpus-informed CF*, *automated writing evaluation* and *computer-assisted CF*. At last, *experimental designs for CF* accounted for a large proportion, while *reading-related CF* merely obtained scant attention till now.

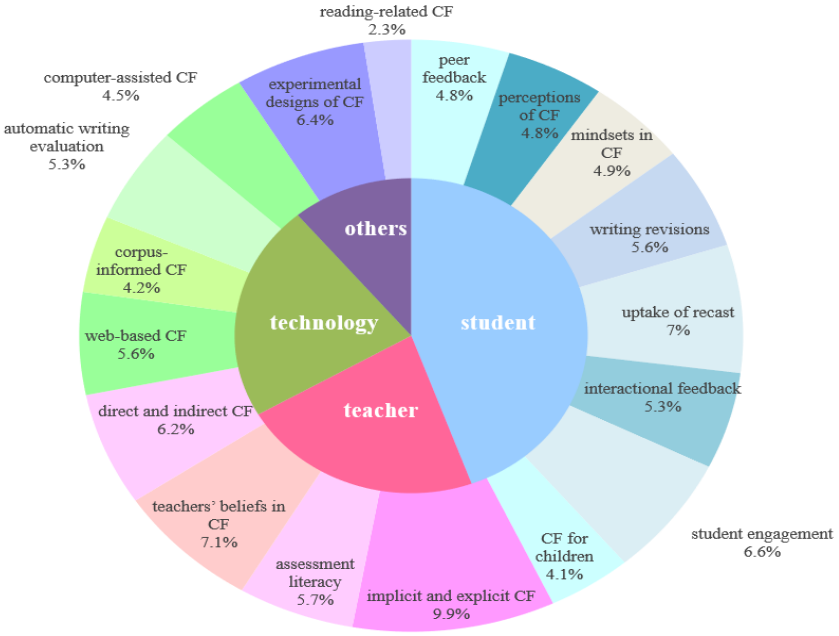

Figure 6. Clusters of 18 CF-related topics

To better understand the topic development, the annual distributions of each topic proportion and the trends of each topic (see Appendix B). Through the topic trends, readers can intuitively observe what each topic has experienced over the last two decades. For instance, *peer feedback*, *automated writing evaluation*, *assessment literacy* and *student engagement* showed a markedly increasing tendency, and the rate of these topics is expected to rise in the future. Meanwhile, *uptake of recast*, *interactional feedback*, and *computer-assisted CF* presented a sharp drop, particularly from 2005 to 2010. In addition, some topics had some fluctuations in the whole period, such as *corpus-informed*, *experimental designs for CF*, *reading-related CF* and *direct and indirect CF*.

4. Discussion

The first research question pertained to the yearly publication production, the most influential journals, and references in CF. The result showed that publication production had a yearly increasing tendency, especially after 2013. It suggested that CF has been drawing more and more attention in the language teaching domain. As to the most influential journals, the *Journal of Second Language Writing* and *System* ranked in first and second place respectively. One explanation might be that CF is a major issue in the L2 writing domain and the scope of these two journals is dedicated to L2 writing and language teaching respectively. The finding was consistent with that of Crosthwaite et al. (2022) and Miao et al. (2023), which also indicated that the *Journal of Second Language Writing* ranked first place.

The second question examined the most influential countries, authors and their collaborations. Concerning the most influential countries, the majority of the research was predominantly from developed countries and English-speaking countries, such as the USA, New Zealand, and Canada. The finding suggested that in the future more attention should be paid to other underexplored areas, like Asian and African countries, South American areas and so on. Considering the most impactful author in the CF field, Lee is the most influential author with the most publications, especially in recent years. The number of her publications on CF issues has exceeded that of Ellis and Lyster. One possible explanation might be Lee's CF publications emerged in a certain successive period and she has collaborated with massive Chinese and foreign scholars. In terms of the author's collaboration networks, it is pointed out that close cooperation is generally conducted among impactful authors, such as Lee, Ellis, Lyster, Sheen, Bitchener, Li and so on, in that these authors have very similar research orientations. This also implies that author collaborations are likely to carry on if the authors are from the same institutions. For instance, both Ellis and Li are from the University of Auckland and they collaborated to explore the effects of the timing of CF on the acquisition of past passive construction (Li et al., 2016). Thus, it suggests that research orientation and the background of the author's institution would be the factors promoting author collaboration.

The third research question explored the most influential topics and their evolving trajectory. It was mainly grouped into three clusters, namely, student-related cluster, teacher-related cluster, and technology-related cluster. With further analysis of these topics, a conceptual framework was constructed as Figure 7 exhibited. This framework was proposed based on the analysis of all the previous CF studies over the past 23 years, which pinpointed the most essential variables in CF. The two-way arrows in Figure 7 represent that the relationship between these three variables was not isolated but interacted with each other. Students are usually the CF receivers, teachers are the CF providers, and the technology-assisted mechanism generally functions as a medium to give impetus to the CF process. Meanwhile, experimental design played a key role in controlling each CF-related study. The further discussion of these variables was as follows.

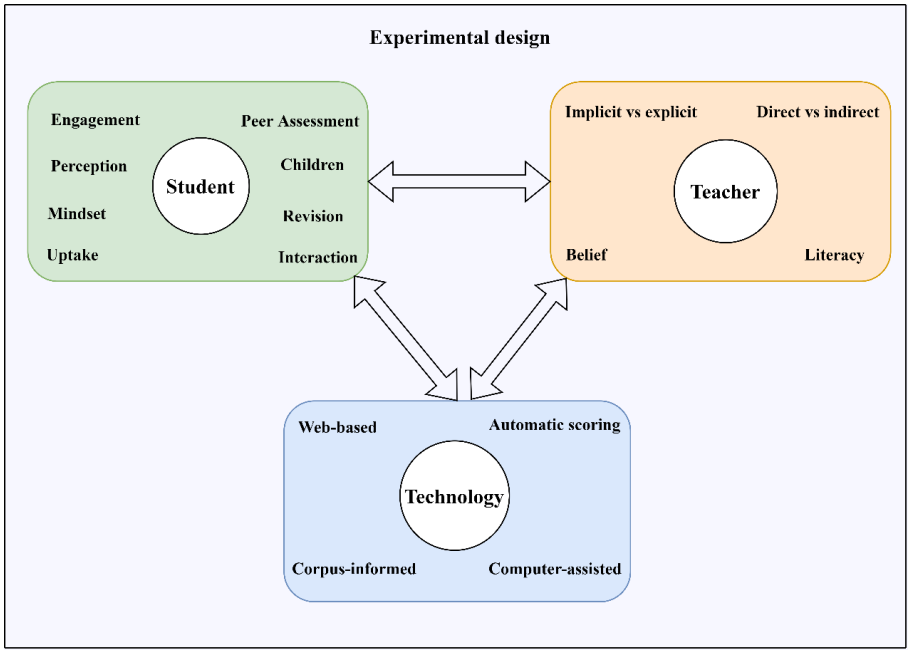

Figure 7. Conceptual framework of CF

When it comes to *student engagement* in the student-related cluster, relevant research was reflected by different theoretical and practical perspectives. Theoretically, sociocultural theory is essential to guide student engagement, such as adopting sociocultural theory to unpack insights into student engagement (Mao & Lee, 2022), and scaffolding student engagement (Nguyen, 2021), as well as delving into the impact of written languaging on the grammatical accuracy of writing with Vygotskyian sociocultural theory (Moradian et al., 2017). Practically, students' empirical participation via the automatic writing evaluation (AWE) system (see Ranalli, 2021; Zhang, 2017; Zhang & Hyland, 2018) was also an important focus. Future studies can further explore the factors influencing the effect of student engagement. Regarding the *perception and uptake of CF*, it was concerned with the adoption of various CF types, such as the directiveness type (Baker & Hansen Bricker, 2010) and supervisory CF (Neupane Bastola, 2020), as well as the effects of different types of WCF on learners' accuracy in revision (Sinha & Nassaji, 2021). Moreover, learners' perceptions had relationships with their foreign language anxiety levels (Rassaei, 2013). But till now, previous studies hardly considered positive emotions in learners' perceptions. Thus, the future direction could consider positive emotional factors on learners' perceptions of CF. Concerning *peer assessment*, *students' interactional feedback,* and *students' mindsets*, it is indicated that peer assessment was beneficial to students' learning and its summative assessment use (Joh & Plakans, 2021), as well as benefiting the feedback provider and optimizing the cognitive process (van Popta et al., 2017). Students' interactional feedback played an important role in classroom activities (Lyster & Mori, 2006) and mindsets would impact students' CF preference (Papi et al., 2021). Furthermore, apart from students, children's language development is a kind of targeted learner group. When it comes to *children's feedback*, the children's learning ability to learn and generate targeted language structure was a major focus (e.g. Ferman et al., 2022). Considering *students' revision*, Karim and Nassaji (2018) explored whether students' revision abilities can be carried over when students encounter new pieces of writing and new forms of errors. Previous studies mainly focused on the accuracy of revision under the usage of different CF but neglected the influence of contexts on revision accuracy. In the future, more focus can be put on students' revisions in different forms and different contexts. Overall speaking, these eight topics represented the most important concerns in CF in terms of students. This can cast important light on the further direction for the CF in terms of students. Moreover, other important individual factors, such as students' age, children or teenagers, and learning abilities, as well as students' emotional factors, should be taken into consideration.

Four topics were teacher-related CF issues. For *implicit and explicit CF* and *direct and indirect CF*, they pertained to teachers' strategies to provide CF (Ellis, 2009). A line of studies showed that teachers preferred to provide implicit and indirect CF, which can engage students in "guided learning and problem-solving" (Lalande, 1982), as well as inspire them with a reflection about linguistic forms to foster long-term acquisition (Ferris & Roberts, 2001; James, 1998). For *teachers' beliefs*, Nahid and Mostafa (2019) examined that in providing CF, L2 teachers' beliefs would be influenced by their experience and it served as a substantial factor in guiding their practice. However, in real practice, mismatches existed between teachers' beliefs and their practice (Lee, 2008). In addition, in the classroom context, inconsistency existed between what teachers said or teachers' beliefs and what they truly did (Yüksel et al., 2021). One possible reason is due to the imposition of institutional context, and values, such as exam pressure and school policy. For *teachers' assessment literacy*, it was concerned with the shift from focusing on feedback information to feedback process and feedback ecology (Chong, 2022). That is, the teacher, as the feedback provider, should have a good command of assessment literacy, which would influence the feedback effect (Lee, 2017). Carless and Winstone (2020) found that teacher feedback literacy enabled students' uptake of feedback and seeded the development of student feedback literacy.

Moreover, four technology-related topics were identified. Regarding *corpus-informed CF*, it was found that corpus-based correction and consultation can help students improve their writing ability (Zaki, 2020). However, scholars also pointed out that it was imperative to ensure the effectiveness of applying the corpus for error resolution (Crosthwaite et al., 2020) and error types should be taken into account (Satake, 2020). Regarding *computer-assisted CF*, it was a special tactic used in CF, especially in WCF, because it can solve the issue that teachers cannot manually provide WCF for huge numbers of learners in the classroom. With the computer-assisted CF method, modern devices, like *MY Access!*, *Pigai,* and *Grammarly* can provide synchronous and asynchronous corrective feedback to learners, which is quite effective in improving L2 writing accuracy (Shintani & Aubrey, 2016). Concerning topic tendency, *computer-assisted CF* wholly presented an abrupt decrease after 2003 and kept a minor fluctuation since then. One possible reason for this phenomenon might be due to controversy. That is, researchers advocated that applications of computer machines in WCF should aid L2 development (e.g. Huang & Renandya, 2020). However, the effectiveness of this computer-assisted feedback was uncertain (Bahari, 2020) and it was unsure to foster learners' L2 writing ability development (Godwin-Jones, 2008). Therefore, in the future, the application of computer-assisted CF should further consider whether it is advantageous to learners' L2 development.

Concerning *web-based CF,* automatic speech recognition technology has been applied to provide corrective feedback for students (Chen, 2011) and students can get personal feedback via web-based language tutoring systems (Heift, 2001; Yeh et al., 2014), which indicated that web-based mechanism has been applied in different forms. As to the growing topic trend, it can be predicted that web-based mechanisms will continuously play an essential role in the CF field, in that it can narrow the distance to provide feedback in remote locations (Murphy, 2010), provide new forms of collaborative writing (Yang, 2017) and expand the scope writing tasks (Harker &

Koutsantoni, 2005). Concerning *automated writing evaluation*, it has attracted more and more attention over the past two decades (Link et al., 2022). The popularity of this topic may be due to the rapid technological revolution, such as the development of machine learning and natural language processing (Zhu et al., 2020).

Taken together, studies on these topics have endeavored to investigate how AWE impacted student engagement (Zhang & Hyland, 2018), students' acceptance (Zhai & Ma, 2022), and writing accuracy (Barrot, 2023). With the development of natural language processing (e.g., GPT-4), AWE has been gaining high popularity. More researchers are expected to conduct CF-related studies with the help of AWE tools in the future.

Aside from these three important aspects of CF, the *experimental design of CF* is also an essential topic. Experimental designs predominate most CF empirical studies because in real situations different experimental designs could directly influence research results. For instance, one unexpected finding was that some mismatches existed in previous research results. Ellis et al. (2006) and Sheen (2007) interpreted their results that metalinguistic feedback was more effective than recasts. On the contrary, some research construed that recasts were more effective (e.g. Iwashita, 2003; Mackey et al., 2001). The reason might be related to the different experimental designs, like differences in the adoption of the control group and the sequence of experiments. Meanwhile, three points should be regarded in the later research. First, in the future, when conducting experimental design, researchers should define the theoretical and operational definitions of different CF types clearly. Second, ecological validity should be given due attention in the experiment for CF (Liu & Brown, 2015). Third, potential moderators (e.g. participants' age, language proficiency, background) should also be taken into account.

5. Conclusion, implications and limitations

To detect the overall development of CF from 2000 to 2022, the study conducted analyses on 1106 CF-related articles by bibliometric analysis and STM. The most influential journals, the most cited references, the most productive countries, the most impactful authors, and their collaborations were identified. This descriptive information gives us a bird's eye view of the CF field and a handful of research proves that CF is a popular and important issue in language teaching. Compared with previous reviews, this study manages to figure out 18 latent topics and provide topic trends to relevant researchers in a more objective way. The topic trends show that more studies are worthwhile in *peer feedback*, *automated writing evaluation of feedback*, *assessment literacy* and *student engagement* in the future, while the studies on *corpus-informed feedback* are inclined to decrease in the future. Meanwhile, the contributions of this study lie in both theoretical and pedagogical perspectives.

Theoretically speaking, this study provides a conceptual framework for CF research. This framework vividly and intuitively presents what has been done in previous CF-related research, which can help us understand where the field is going. Moreover, with this framework, it can better showcase the interactions of student, teacher and technology factors in the CF field and further help us recognize potential knowledge gaps to situate future research directions. Pedagogically speaking, to improve students' CF quality, the current study can inspire teachers to realize that the CF process is an integral part of a class. It highlights that the effectiveness of CF is not solely dependent on students but also-teachers and the application of technological mechanisms. More importantly, the study informs that teachers should comprehensively consider these factors, especially learners' mindset in CF, learners' age, and learners' perception of CF before employing a specific CF method.

The study is not without limitations. The research database is confined to Scopus and excludes other databases like Web of Science and ERIC. Therefore, the final research articles may not cover all the academic outcomes. Nevertheless, the study can provide a general development trajectory of the CF field, which provides new sights for language practitioners, teachers, and researchers in language teaching, as well as offers new lenses for the advancement of the CF field.

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Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Appendix A: Top words associated with each topic

Topic No.	Keywords	Latent topics
Topic 1	Highest Prob: peer, feedback, group, writing, study, interaction, language FREX: peer, review, peers, video, intervention, mobile-assisted, face--face Lift: belonging, demanding, dominant, expert, novice, listened, multi-draft, posting Score: peer, writing, givers, receiver, rater, receivers, mobile-assisted	peer feedback (4.8%)
Topic 2	Highest Prob: learning, language, students, online, technology, english, skills FREX: technology, listening, presentation, web, skills, implementation, journals Lift: backdrop, byrams, cloud-based, computing, disrupt, enhancements, films Score: technology, listening, web, online, presentation, competencies, website	web-based CF (5.6%)
Topic 3	Highest Prob: error, correction, errors, corpus, language, students, study FREX: corpus, error, correction, corpora, correct, errors, corrected Lift: detects, missed, appropriacy, consonant, critiques, deletion, discipline-specific Score: corpus, error, correction, errors, corpora, featural, consultation	corpus-informed CF (4.2%)
Topic 4	Highest Prob: learners, feedback, language, study, perceptions, corrective, anxiety FREX: anxiety, condition, noticing, affective, perceptions, modes, learners Lift: card, ftf, non-verbal, self-assessments, think-alouds, assumed, filled Score: anxiety, wtc, ftf, condition, noticing, communicate, high-anxiety	perceptions of CF (4.8%)
Topic 5	Highest Prob: language, english, learners, study, learning, feedback, development FREX: mindsets, languages, mediation, feedback-seeking, intelligence, nonverbal, orientation Lift: -initiated, childhood, kanji, parents', pure, whatsapp, aiding Score: mindsets, feedback-seeking, priming, speakers, languages, pure, lres	mindsets in CF (4.9%)
Topic 6	Highest Prob: group, feedback, learners, groups, two, recasts, study FREX: implicit, ffi, treatment, explicit, control, memory, randomly Lift: -hr, analogical, batteries, battery, benefiting, classifiers, compos Score: recasts, ffi, implicit, control, grammaticality, assigned, posttests	implicit and explicit CF (9.9%)
Topic 7	Highest Prob: students, feedback, writing, study, comments, two, strategies FREX: draft, comments, revisions, strategy, essay, organization, drafts Lift: -proficient, boring, copied, drafted, electronically, files, higher-proficiency Score: writing, revisions, draft, essay, comments, revision, -proficient	writing revisions (5.6%)
Topic 8	Highest Prob: research, studies, language, feedback, second, learning, written FREX: empirical, methodological, sla, theoretical, linguistics, future, applied Lift: academics, contrasted, engagement-mediator-feedback, meta-analytic, recognised, sct, timeline Score: wcf, sla, methodological, published, meta-analytic, replication, ids	experimental designs of CF (6.4%)
Topic 9	Highest Prob: writing, study, students, academic, feedback, awe, language FREX: awe, writing, conferences, writers, automated, awcf, rhetorical Lift: -group, adolescent, anothers, audiorecordings, cause--effect, citation, collective Score: writing, awe, adolescent, awcf, academic, writers, automated	automated writing evaluation (5.3%)
Topic 10	Highest Prob: assessment, students, academic, english, feedback, learning, study FREX: assessment, literacy, eap, formative, instrument, academic, emi Lift: biology, cael, cda, desired, reproduction, responsibilities, scripts Score: assessment, eap, academic, literacy, formative, emi, socialization	assessment literacy (5.7%)
Topic 11	Highest Prob: recasts, feedback, errors, learners, study, uptake, corrective FREX: uptake, recasts, repair, recast, gaze, modified, form Lift: deictic, facial, fss, grammar-oriented, observational, pushed, subject-verb Score: recasts, repair, recast, uptake, errors, scmc, ocf	uptake of recast (7%)
Topic 12	Highest Prob: classroom, students, teacher, language, feedback, learning, use FREX: talk, conversation, discourse, classroom, irf, conversations, majority Lift: accomplished, lifeworld, transitions, troubles, -rf, arguing, inhibiting Score: talk, irf, conversation, repair, turns, discourse, markers	interactional feedback (5.3%)
Topic 13	Highest Prob: feedback, student, teacher, writing, students, engagement, study FREX: engagement, student, emotions, awe, clil, students', papers Lift: observers, behaviourally, fed, mle, teacher-centred, behaviorally, behavioural Score: awe, engagement, writing, student, emotions, clil, supervisors	student engagement (6.6%)
Topic 14	Highest Prob: learning, learners, language, system, pronunciation, feedback, call FREX: misspellings, capt, spell, pronunciation, system, computer-assisted, automatic Lift: attractive, nlp, nocf, programmed, spell, alternatives, arabic Score: pronunciation, capt, misspellings, spell, system, icall, asr	computer-assisted CF (4.5%)

Topic 15	Highest Prob: feedback, learning, language, lexical, results, words, effect FREX: spacing, childrens, children, words, young, bilinguals, spaced Lift: chinese–english, hvpt, latencies, richness, toddlers, word-object, autism Score: spaced, children, spacing, bilinguals, massed, referent, childrens	CF for children (4.1%)
Topic 16	Highest Prob: reading, students, language, study, english, online, results FREX: reading, non-native, health, comprehension, raters, reaction, read Lift: dialogism, friends, habits, health, knoch, portrayed, signs Score: health, reading, dmcs, comprehension, raters, reception, wtc	reading-related CF (2.3%)
Topic 17	Highest Prob: teachers, teaching, beliefs, teacher, language, practice, practices FREX: beliefs, professional, teaching, pre-service, teachers, teachers', practices Lift: -service, drama, mismatches, qualifications, cognitions, collegial, counts Score: beliefs, teachers, teaching, professional, practices, pre-service, ocf	teachers' beliefs in CF (7.1%)
Topic 18	Highest Prob: feedback, writing, accuracy, written, wcf, corrective, group FREX: direct, wcf, indirect, accuracy, pieces, explanation, written Lift: animation, conditional, drills, fifty-three, happening, icf, meta-linguistic Score: wcf, writing, direct, indirect, pieces, dcf, swcf	direct and indirect CF (6.2%)

Notes: The keywords and the proportions of these 18 topics were identified via structural topic modeling (STM) using the *stm* package. Highest Prob (Highest probability) means containing the words within each topic with the highest frequency of occurrence. FREX weights words by how frequent words are in a particular topic and also by how exclusive they are to that particular topic. Lift is a similar metric that weights words by dividing by a word's frequency in other topics thereby giving higher weights to words that appear less frequently in other topics. Score weights words by the log frequency of a word in a topic divided by the log frequency of the word in other topics.

Appendix B: Development trajectory of each topic