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Big Data Analysis of 'VTuber' Perceptions in South Korea: Insights for the Virtual YouTuber Industry

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Abstract: The global VTuber market is experiencing rapid growth, with VTubers extending beyond mere content creators to be utilized in various fields such as social interaction, public relations, and health. VTubers have the potential to expand the existing content market and contribute to increasing economic and public value. This study aims to investigate the perception of VTubers in South Korea and to provide insights that can contribute to the global activation of the VTuber entertainment industry. For this purpose, unstructured data on VTubers from the past three years, during which interest in VTubers has significantly grown in South Korea, was collected. A total of 57,891 samples were gathered from Naver, Daum, and Google, of which 50 highly relevant data points between VTubers and users were selected for analysis. First, key terms such as 'Broadcast', 'YouTube', 'Live', 'Game', 'Youtuber', 'Japan', 'Character', 'Video', 'Sing', 'Virtual', 'Woowakgood', 'Fan', 'Idol', 'Korea', 'Twitch', 'IsegyeIdol', 'Communication', 'Worldview', 'VTuberIndustry', 'Contents', 'AfricaTV', 'Nijisanji', and 'Streamer' were extracted. Second, CONCOR analysis revealed four clusters: 'Famous VTubers', 'Features of VTubers', 'VTuber Industry', and 'VTuber Platforms'. Based on these findings, the study offers various academic and practical implications regarding VTubers in South Korea and explores the potential for global growth in the VTuber industry.

Keywords: VTuber; virtual YouTuber; content industry; big data analysis; CONCOR

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1. Introduction

With the advent of the new media era, various social media platforms have emerged to diversify content consumption methods beyond those of the old media era. Particularly during the COVID-19 pandemic, government policies on social distancing have restricted in-person meetings and outdoor activities. This has resulted in an increase in the number of mobile app users and daily usage time, significantly boosting the amount of time people spend on mobile platforms. For instance, the usage time of the YouTube app increased from 67.1 billion minutes in October 2020 to 104.4 billion minutes in October 2023, marking continuous growth over three years (W. Lee 2024). With the stable growth of social media use, interest in online and virtual content has also surged. Activities such as hosting meetings or events through the metaverse have become prevalent. For example, the K-pop group BLACKPINK's metaverse fan signing event attracted 46 million participants (S. H. Park 2021). The metaverse, similarly to social media, enables multiple users to connect and communicate simultaneously in a virtual space. The context of COVID-19, which prevented people from gathering, has shifted public attention towards interactive virtual spaces, such as social media and the metaverse. In this environment, the market for virtual YouTubers (VTubers), who utilize social media and the metaverse, has grown (Ha and Kim 2024). A virtual YouTuber (VTuber) is a 2D or 3D virtual character (avatar) that interacts in a virtual environment without revealing the creator's actual face. This is made possible through motion capture technology, which captures real-time movements (Li 2023). VTubers interact with people through live internet broadcasts, engaging in real-time communication, sharing content, and forming close relationships with their viewers

(Sakuma et al. 2023). An interactive environment with VTubers provides a sense of reality, presence, and intuitive participation, making the virtual experience resemble real actions (Hwang and Kim 2023). VTubers build relationships with viewers through unique characters and content, generating revenue through advertising, sponsorships, subscriptions, merchandise sales, and external activities on various platforms such as YouTube and live Internet broadcasts (J. M. Park 2023). According to Playboard, a YouTube statistics analysis company, seven of the top ten earners from YouTube Super Chat (real-time broadcast donations) between January 2020 and November 2023 were VTubers. The U.S. market research firm MarketWatch predicts that the global VTuber market will grow to 17 trillion won by 2030 (Joo 2023).

According to PR Newswire in 2024, the global market share of VTubers reveals that companies such as Anycolor, Cover Group, Bilibili, YouTube, and 774 Inc. are the major global leaders in the virtual YouTuber industry, with the top five companies holding approximately 17% of the market. The Asia-Pacific region boasts the highest market share, exceeding 74%, followed by North America and Europe, which account for 12% and 11%, respectively (Valuates Reports 2023).

Looking at the VTuber trends in Japan, which is leading the VTuber market, the Japanese company Cover, managing 85 avatars, operates 'Hololive Production', which includes a large number of VTubers and boasts over 82 million YouTube subscribers worldwide. Cover Corporation, the parent company of Hololive Production, reported substantial growth in its fiscal results for the third quarter of 2023, with revenue surging by 49.7% to approximately $13,702,170, operating profit climbing 84.2% to about $2,289,390, and net profit jumping 101.6% to around $1,680,360, according to their financial results briefing on May 12th (VTuber News Drop 2023).

Among them, 'Gawr Gura', who can speak English, is one of the Hololive-affiliated VTubers with the highest number of subscribers, reaching 4.5 million on her YouTube channel. With half of Gawr Gura's YouTube viewership being under 24 years old and 90% being male, the LA Dodgers, a famous Major League Baseball team in the U.S., collaborated with her in an effort to engage a younger fanbase (Shaikin 2024). Marine Ch. is a Japanese VTuber signed with Hololive Production. She boasts the second-highest subscriber count among all Hololive VTubers. Data from Playboard, a YouTube analytics platform, reveals that Marine Ch. generated $369,257 in Super Chat revenue in 2023, securing the sixth position among all Japanese VTubers (Playboard n.d.). Super Chat is a feature that allows viewers to financially support VTubers by sending monetary donations during livestreams. Despite not appearing in the top ranks for Super Chat earnings in 2023, Gawr Gura boasts a diverse income stream, including advertising revenue, sponsorships (like her collaboration with the LA Dodgers), and merchandise sales. This highlights the varied and individualized revenue structures that VTubers can develop.

Nijisanji is a virtual YouTuber agency operated by Japan's Anycolor Inc. Launched in February 2018, it has grown into one of the largest virtual YouTuber groups in the world. The agency includes VTubers who perform in a variety of languages, such as Japanese, Korean, English, and Chinese. Notable VTubers like Fuwa Minato, Kuzuha, and Kanae each have over 1 million subscribers. Notably, Fuwa Minato emerged as the top Super Chat earner among VTubers in the second quarter of 2024. Data from Playboard, a YouTube analytics platform, reveals that she generated over USD 110,000 in Super Chat revenue during this period (W.-Y. Lee 2024a). Thus, the VTuber market comprises agencies and companies that manage these VTubers. VTubers, with their distinct personalities and characters, leverage diverse revenue streams to generate income and cultivate dedicated fanbases.

In addition, there is the U.S.-based VTuber agency VShojo. It is the first VTuber MCN established in the U.S., and its members include Ironmouse, Matara Kan, and Kuro Kurenai. They primarily operate in the U.S. and produce English content. Rather than limiting its activities to the U.S., VShojo has aimed to expand into Japan, the largest VTuber market and the spiritual home of VTubing, by recruiting VTubers who were active in Japan (Amos 2022). The examples of Japanese and American VTuber companies illustrate how

VTubers are capitalizing on their ability to transcend linguistic and cultural barriers to establish a presence in the global market. Having explored the trends in the global VTuber market, I would now like to examine how the VTuber market is developing in Korea.

In the Korean market, VTubers have proven their industrial value beyond mere popularity and have established themselves as part of the mainstream culture. On 17 December 2021, the VTuber idol group 'Isegye Idol', which prominently features the metaverse, debuted through YouTube. As of May 2024, 'Isegye Idol' is a six-member VTuber idol group planned by 'Woowakgood', a YouTuber with approximately 1.68 million subscribers. The group debuted through an audition involving interactive communication between viewers and broadcast participants through live chats and donations. Capitalizing on the narrative of the audition content, where the general producer and famous gaming YouTuber 'Woowakgood' collaborated with his numerous subscribers in real-time to create a VTuber idol group, their debut song 'RE:WIND ' achieved significant success. The song ranked 36th on the Melon chart, first on Bugs, and first on the Gaon chart download section, accomplishments that are usually challenging for new idols to reach (Bae 2022). As of May 2024, the music video for 'RE:WIND ' has recorded 21.13 million views. Further, another song they released, 'Kidding', ranked 167th on the Billboard Global 200 chart, expanding its presence both domestically and internationally (Newsis 2023). This marks the beginning of these VTubers' activities, extending beyond online platforms to the offline realm. On 23 September 2023, the first offline metaverse festival in Korea, 'Isegye Festival', was held at Songdo Moonlight Festival Park in Incheon. The initial 10,000 tickets sold out in eight minutes, and the subsequent second and third ticket batches also quickly sold out, totaling approximately 20,000 paid entries (Gwak 2023). Furthermore, in February 2024, a pop-up store featuring the VTuber groups 'Isegye Idol' and 'Stellive' was hosted in Hyundai Seoul (a famous department store in Korea). This event attracted approximately 100,000 visitors, with sales exceeding seven billion won, demonstrating remarkable success (Seo 2024).

As a new method for engaging with younger audiences, the use of VTubers for promotional purposes is increasing among local governments. On 21 February 2023, Gangseo District introduced 'Saeromi', the first VTuber public official in a local government. The first video exceeded 100,000 views within a week of uploading (S. W. Kim 2023) (This view count is significantly higher than other YouTube content, demonstrating the government's ability to communicate effectively with a large audience through VTuber content. Following this, other VTubers such as 'Seodong' from Iksan City and 'Haetteumi' from Ulsan County have also emerged, each uploading their unique content. The individual characteristics and content of each VTuber can be expanded into character intellectual property (IP) businesses and utilized as secondary works in original music, games, and so on. This shows the potential of content production businesses to use virtual characters beyond the entertainment industry (Yoo 2024). For instance, the webtoon 'Magical Girls Isegye Idol', released on Kakao Webtoon and Kakao Page on 21 June 2023, ranked first for consecutive weeks, attracting over 150,000 pre-registrations and topping the Kakao Emoticon ranking for four days immediately after its release (Yoo 2024).

Despite the rapid industrial growth of VTubers, there is limited understanding of how VTubers are consumed by users as a topic of interest. VTubers, characterized by their interactions with users on social media and collaborative content creation, often see topics from broadcasts amplified or reproduced, generating new discussions among fans and inspiring them to create secondary work. Therefore, it is crucial to analyze user reactions to VTubers on various social media platforms. This understanding of the VTuber ecosystem can inform strategies for the long-term development of content production businesses that leverage the VTubers' IP.

Previous research on VTubers has primarily focused on its spread and case analysis from the perspective of utilizing the metaverse (Hwang and Kim 2023; Lee et al. 2022; You 2023). However, these studies have often generalized the term VTuber to refer to other virtual singers or general YouTubers using a metaverse, without focusing on the unique characteristics of VTubers. Additionally, some studies have attempted to understand pub-

lic reactions to VTubers (Seo and Chan 2023; C. Lee 2023; Kim et al. 2022), but these were primarily based on surveys. Consequently, they did not capture the immediate reactions of users interacting with VTubers on social media, relying instead on respondents' recollections or their reactions after briefly watching the videos. Research is noticeably lacking in the analysis of the reactions of actual social media users watching VTuber content in real time. In light of the rapid expansion of the Korean VTuber industry, investigating audience perceptions and engagement with VTubers is of paramount importance. This study aims to analyze the current state of the Korean market in comparison to leading trends in the global VTuber landscape, including those in Japan, thereby offering valuable insights and recommendations for future development.

Therefore, this exploratory study aims to examine VTuber viewers' perceptions of VTubers by analyzing unstructured big data extracted from major social media and the web. Second, the research will be specifically conducted by focusing on the collected unstructured big data, utilizing key text mining methodologies such as TF-IDF analysis and semantic network analysis based on social network analysis. Third, the study aims to derive academic implications that can be discussed within the field of media studies, as well as practical implications that can be applied in the VTuber industry, based on the key findings. Through this, the goal is to establish a more concrete understanding of the concept of VTubers within the media field.

2. Literature Review

2.1. Virtual Human

In early descriptions of the post-human, Katherine Hayles, in her book *How We Became Posthuman*, defined it as the idea of the mind having consciousness and running a program that constructs and guarantees itself (Hayles [1999] 2013). According to Hayles, the posthuman provides a means to reconsider the conjunction between humans and intelligent machines (Hayles [1999] 2013). In today's era, where virtual and real are intertwined, Hayles' argument is closely related to virtual humans that exist at the boundary between humans and non-humans.

In depictions from the 1990s, virtual humans were designed as avatars controlled by real humans, allowing interaction with others and requiring unique human abilities to show actions, intentions, and emotions (Badler et al. 1999). With technological advancements, human body structures and movements have been digitized and analyzed, enabling virtual beings to move like real people in virtual spaces, display realistic facial expressions, and engage in real-time conversations with human-like emotions (Lee and Song 2023). Virtual humans are defined as digital image data of virtual human appearances featuring virtual personas that interact in a manner that feels as if they exist in reality (Ahn and Kim 2023). For example, the earliest virtual humans include the virtual singers 'Date Kyoko' (1996) from Japan and 'Adam' (1998) from Korea. Research on computer graphics and AI technology has led to the emergence of various enhanced-quality virtual humans (Lee and Lee 2023). Based on their activity scope, virtual humans are known by different names, such as virtual influencers on Instagram or in advertisements, virtual BJ and virtual streamers on live-streaming platforms, and virtual YouTubers on YouTube (Kim and Cha 2022). However, virtual humans often operate across multiple platforms, leading to the mixed usage of these terms. In Korea, the term 'Virtual YouTuber' or 'VTuber' is widely used, even for activities beyond YouTube (Kim and Cha 2022). For example, virtual influencers in Korea include Rozy, Louis, and Sua who appear as SNS influencers in corporate advertisements, dramas, and games. Virtual humans are created by planners and developers without any original human form (J. H. Park 2024). They have similar names to real humans and unique characteristics (gender, age, personality, etc.) but lack spatiotemporal constraints, allowing them to be tailored to the preferences and content of their viewers (J. Kim 2022). Examples of virtual humans active as virtual BJs and VTubers include 'Isegye Idol' and 'Woowakgood', while those active as virtual streamers and VTubers include 'TamTamBurin' and 'Ayatsuno Yuni'. They are classified based on their

primary activity areas, such as 'Virtual BJ' on SOOP (formerly AfreecaTV) and 'Virtual Streamer' on Chizich. Unlike virtual influencers, these virtual humans either represent themselves through avatars or act as fictional characters, thereby experiencing spatiotemporal constraints (Ryu 2023). Despite the virtual nature of these spaces, because VTubers are controlled by real people, their perceptual experiences in virtual spaces are rooted in the actions of their actual physical bodies (Ryu 2023). Based on the ontology of technical objects, VTubers develop unique identities in virtual worlds, becoming individuated as technical entities, and evolving into forms similar to those of natural beings. Through interactions with humans in the real world, they form relationships and embody the characteristics of post-human subjects (You 2023). The existence of spatiotemporal constraints and the formation of unique identities in virtual worlds for interaction with people in the real world make VTubers well suited to the future of the post-human era. In addition, YouTube enables the realization of freedoms such as freedom of expression and opportunity, providing 'digital citizenship' with opportunities for creation, expression, information, personal growth, and even labor or market growth, while expanding relationships and social interactions and empowering users to position themselves as 'influencers' of the post-digital era (Gil-Quintana et al. 2023).

2.2. Virtual Youtuber

A virtual YouTuber (VTuber) is an individual who uses a virtual character (avatar) instead of a real person to conduct live Internet broadcasts (Gwak 2023). As mentioned earlier, the term VTuber is used when virtual BJs and virtual streamers operate on YouTube, often leading to the interchangeable usage of these terms. VTubers are characterized by the use of 2D or 3D rendered virtual characters, rather than utilizing their real human identity (H. Park 2021; S. H. Park 2021). These virtual characters are animated using motion-capture technology, which allows them to interact with viewers in real-time during broadcasts. Additionally, VTubers upload self-produced content to various social media platforms, such as YouTube, TikTok, and other Internet broadcasting sites (Li 2023). VTubers provide a variety of content themes, including interactive broadcasts, gaming streams, and sharing daily life, which are often shared and redistributed by viewers (Kim and Han 2020). By establishing unique concepts and worldviews, as well as actively communicating with fans, VTubers have driven popularization and are even used in corporate promotions and marketing. As communication becomes more mainstream, the activities and scope of VTubers are expected to expand and gain importance (You 2023). First appearing in Japan in 2017, VTuber content quickly gained popularity and became a significant part of Japanese media. A prominent Japanese VTuber company, 'AnyColor', recorded revenues of 14.1 billion KRW and operating profits of 4.1 billion KRW in 2022, indicating continuous growth (C. Lee 2023). In China, the number of VTubers on the 'Bilibili' website increased by 40% in 2022 compared to 2021, reaching 32,000 VTubers (Cui 2024). However, VTubers face the challenge of overcoming the issue related to the 'uncanny valley', namely a phenomenon in which characters that appear almost as humans can evoke discomfort or aversion at certain levels of similarity. If not properly managed, this issue can lead to increased levels of dislike (Park and Jeong 2022).

Therefore, while VTubers are experiencing global growth and show potential for future development through various content and virtual character IP businesses, the uncanny valley phenomenon still creates a gap between VTubers and the general public. Therefore, further research is required to identify the key topics surrounding VTubers to achieve broader popularization.

More and more social environments and digital platforms now allow us to create, co-create, generate content, interact, share ideas, and emotionally influence others. This study found that adolescents often utilize YouTube videos as a key resource for improving their academic performance, with many valuing the contributions of YouTubers in their learning process (Gil-Quintana et al. 2020). Rafael Regis and colleagues conducted a literature review to provide a comprehensive understanding of the VTuber phenomenon, noting that

VTubers originated in Japan, the market is rapidly growing, and VTubers are being utilized not only as content creators but also in various fields such as social interaction, education, public relations, and health (Regis et al. 2022). Dhanar Intan Surya Saputra and colleagues conducted a study on VTubers, indicating that using VTubers as content in online learning media can be effective in education and the learning process, as it allows students to feel as though they are interacting with someone (Saputra and Setyawan 2021).

Carina Miranda and colleagues conducted a survey-based exploratory and comparative study between Portugal and the United States to examine the global expansion of VTubers and their impact on modern society, concluding that VTubers are more popular in the United States than in Portugal, and while they can have a positive influence, they may sometimes negatively affect health (Miranda et al. 2024). Yijin Li conducted a survey exploring the attraction between viewers and VTubers through parasocial interaction, examining how this attraction influences mediated interactions, identifying the factors that lead viewers to watch VTubers, and analyzing the interaction patterns between VTubers and their audience (Li 2023).

In addition, several studies have been conducted to understand the primary issues related to virtual humans. For instance, Kong and Kwon (2022) used topic modeling analysis based on YouTube comments of virtual influencers and found that people are highly interested in the physical appearance of virtual influencers, with perceptions and emotions generally being positive (Kong and Kwon 2022). Further, Ha and Kim (2024) conducted a topic modeling analysis based on YouTube comments to identify 11 key characteristics of VTubers, focusing on attractiveness, relatability, playfulness, collaboration, entertainment, identity, professionalism, connectivity, creativity, innovation, and stardom. They found differences in the importance of these characteristics depending on the level of user engagement (Ha and Kim 2024). Moreover, Choi et al. (2024) compared users' emotional interactions with real and virtual idol content using a topic-modeling analysis of YouTube comments. Specifically, they highlighted the importance of emotional empathy factors in developing virtual idol content and confirmed that virtual idol content has the potential to create new fandoms (Choi et al. 2024).

Studies on virtual humans have utilized YouTube as one of various media platforms. However, since VTubers do not produce content limited to a single platform (D. J. Kim 2023), a limitation exists in that the discussions on YouTube cannot encompass the reactions of VTubers and users across various social media platforms. This study differs from previous research by setting a specific period and analyzing user reactions across multiple media platforms to obtain objective responses to the topics surrounding VTubers. Big data research is not confined to specific groups; rather, it is an effective method for understanding perceptions and phenomena across society and analyzing necessary changes. Furthermore, text mining can serve as an effective methodology for ensuring the objectivity of research, improving reliability by utilizing large-scale data, and addressing the subjective limitations that may arise in qualitative research (Lu and Kim 2020). Moreover, by using related terms collected from big data as material, it is possible to analyze the social context and content with timeliness and efficiency, thereby addressing the limitations of literature reviews (Zeng and Lee 2022).

3. Materials and Methods

3.1. Research Question

This study conducted a big data analysis to investigate users' motivations, needs, and perceptions regarding VTubers by collecting unstructured data from social media and the web using the keyword 'VTuber' over the past three years (13 June 2021 to 12 June 2024), a period during which interest in VTubers has significantly increased. In order to identify the frequently mentioned keywords and issues by users and to explore the connections between these words, the following research questions were proposed.

Research Question 1: What characteristics can be identified from the frequency analysis and TF-IDF analysis of VTuber-related keywords collected from social media and the web?

Research Question 2: What characteristics are revealed through the semantic network analysis, including centrality analysis, and CONCOR analysis of VTuber-related keywords collected from social media and the web?

Research Question 3: Based on the above analysis results, what characteristics do the VTuber-related keywords exhibit, and what insights can they provide?

3.2. Research Stage

Data collection and analysis are carried out in three stages, as shown in Table 1. The first stage is data collection, which is divided into local and global data. Local data include web and news content from Korea, with web content being collected using Textom. The data collection focuses on 11 web platforms, including Korea's largest portal platform Naver, as well as Kakao, Google, and others. Korean news content is gathered using BigKinds, an archiving platform operated by the Korea Press Foundation under the Korean government, which holds approximately 8 million articles from 102 Korean news agencies. For global content, web data are collected using TDM Studio, while news content is collected through Clarivate's Global Newsstream platform. Among these, the data analysis in this study focuses on local data, while content analysis based on both local and global contexts utilizes global data.

Table 1. Research stages and analysis tools.

Steps	Details		Tools
Data collection	Local	Web contents	Textom
		News contents	KPF BigKinds
	Global	Web contents	TDM Studio
		News contents	Newsstream
Data processing	Natural language processing		Stanford CoreNLP
	Stop word processing, Special letters, Keyword unification		Textom
Network Analysis	Calculation of network centrality		UCINET v.6.772
	Dendrogram		
	CONCOR		NewDraw v.2.176

The second stage is data processing. For natural language processing, CoreNLP, developed by Stanford University, is used. CoreNLP is an excellent natural language processing tool that separates morphemes, extracts root words, and analyzes syntax. The unstructured text data collected in the first stage is processed into structured text data using CoreNLP, based on parts of speech such as common nouns (NNF), proper nouns (NNP), and dependent nouns (NNB). The processed natural language undergoes further steps, including stop word removal, special character handling, and duplicate word merging, and is ultimately refined into well-structured matrices.

The third stage is data analysis. The data analysis utilizes UCINET to conduct frequency analysis (TF) and inverse frequency analysis (TF-IDF), calculate network centrality, and generate dendrograms for examining hierarchical relationships. Following this, CONCOR analysis is performed using NetDraw to further examine clusters between hierarchies. CONCOR is a representative block modeling analysis method used to identify hierarchical structures between nodes and uncover hidden patterns to explore deeper relationships. This study utilizes a dendrogram to derive a three-level hierarchical tree structure and employs CONCOR analysis to identify four distinct clusters.

3.3. Research Targets and Data Collection

The data collection for this study's analysis utilized Textom and BigKinds to gather unstructured data from 13 June 2021 to 12 June 2024, using the keywords 'VTuber' and 'Virtual Youtuber', as shown in Table 2.

Table 2. Data collection procedure for VTuber.

Category	Description
Collection period	13 June 2021–12 June 2024
Analysis data collection	Domestic web + News contents
Search keywords	'VTuber', 'Virtual + Youtuber'

The data collected from 11 domestic and international platforms used in Korea amounted to a total of 57,891 cases, as shown in Table 3. Additionally, overseas papers and articles were collected for global content analysis and reference on Korean VTubers. The data collection tools utilized TDM Studio to gather academic papers from around the world, and Clarivate's Global Newsstream was used to collect articles globally.

Table 3. Research stages and analysis tools.

Year	Naver (Knowledge)	Daum (Tistory)	Naver (Blog)	Naver (Cafe)	Google (Web)	Daum (Web)	Google (News)	Google (Web)	Daum (Cafe)	Naver (News)	Daum (News)
2021	83	479	1894	2313	145	126	51	15	59	16	5
2022	548	1212	6354	9310	357	240	126	26	331	206	57
2023	930	1248	8413	9902	651	212	411	142	374	651	221
2024	336	554	4082	4399	377	100	190	55	227	334	129
Subtotal	1897	3493	20,743	25,924	1530	678	778	238	991	1207	412
Total					57,891						

3.4. Frequency Analysis

To determine how frequently specific keywords appear in the data collected on VTubers, the term frequency (TF) was analyzed. Keywords that frequently appear in the data are likely to represent important concepts related to VTubers, allowing for the identification of core concepts. However, since there are aspects that cannot be solely assessed by the frequency of keywords, frequency-inverse document frequency (TF-IDF) analysis is typically conducted following the TF analysis (Alammary 2021). TF-IDF determines the importance of specific keywords by considering not only their frequency within a document but also how frequently they appear across a set of documents, such that even if a word appears frequently in a specific document, its weight is reduced if it is commonly found throughout the entire document set (You et al. 2020). Based on this, the inverse document frequency (IDF) values were calculated to enable more accurate keyword extraction. Therefore, in this study, the top 50 keywords were selected, and the TF, TF-IDF, and IDF values were sequentially derived.

3.5. Social Network Analysis: Centrality and Egonet Density Analysis

To identify the significance of the relationships between nodes and edges related to VTubers, a centrality analysis is conducted. Centrality analysis enables the identification of important nodes within the entire network, allowing for an understanding of the flow of information and its structural characteristics (Saad et al. 2021; Avella-Medina et al. 2017). Centrality analysis consists of various types, including degree centrality, n-degree centrality, and eigenvector centrality, as shown in Table 4, and aspects that cannot be identified through degree centrality are analyzed using ego network density. Ego network density analysis refers to the connections among all nodes directly connected to a specific node,

as well as the connections between those neighbors, and it is a method to examine the density between a particular node (ego) and its neighbors (alters) among the nodes that are pushed to the periphery. This study conducted network analysis using the scaling and ordination layout technique based on the centrality analysis of nodes and edges. This network intuitively represents the flow between central nodes and peripheral nodes, allowing for the derivation of Gini coefficient values for the central and peripheral aspects of VTubers, thereby enabling the understanding of the structure of complex keywords as a single network.

Table 4. Description of the centrality analysis and egonet density algorithm.

Category	Description
Degree Centrality	The number of edges connected to a particular node is measured. Nodes with high degree centrality are directly connected to many other nodes, which suggests that they are likely to serve as communication hubs within the network.
nDegree Centrality	Normalized Degree Centrality, which is a measure of how well-connected a particular node is in a network, relative to the maximum possible connections it could have. It provides a normalized value of a node's degree, allowing for a more meaningful comparison across different nodes within the same network or even across different networks.
Eigenvector Centrality	Evaluates the importance of a particular node by also considering the importance of its connected nodes. Nodes connected to influential nodes are assigned higher centrality, emphasizing the importance of who a node is connected to within the network.
Egonet Density	Egonet Density refers to the density of a particular node's ego network. An ego network consists of a specific node (the 'ego') and all the nodes it is directly connected to (the 'alters'), as well as the connections among those alters. This method is an analysis that allows us to discover areas that cannot be identified through centrality analysis.

3.6. Hierarchical Clustering Analysis: CONCOR

CONCOR (Convergence of Iterated Correlations) is a method used in social network analysis and data clustering to identify similar entity groups or blocks based on relational patterns, making it particularly useful for analyzing complex networks and identifying structural equivalence between nodes (Breiger et al. 1975). CONCOR, which represents the structural equivalence and hierarchical clustering among nodes, can be visualized using network diagrams. Nodes represent entities, while edges represent the relationships between those entities. Clustering nodes into blocks based on structural equivalence provides valuable insights into the underlying structure of the network. This is an analytical method that focuses on analyzing the connection patterns between structurally similar words rather than the connections across the entire network (Wasserman and Faust 1994). According to several researchers, topic modeling analysis, which is frequently used in semantic network analysis, has limitations in adequately distinguishing the complex contextual relationships and polysemy between keywords; thus, they utilize CONCOR analysis as a complementary method (Stappen et al. 2021; Qiao and Williams 2022; Xue et al. 2020). Accordingly, this study aimed to identify the structural characteristics of VTubers through hierarchical clustering and structural equivalence.

4. Results

4.1. The Yearly Trends of VTuber Search Keywords

Examination of the changes in VTuber-related data in Korea showed a rising trend starting in June 2021, with a significant surge observed in the latter half of 2021 Figure 1. According to Google Trends, global interest in VTubers spiked sharply in the first half of 2020, coinciding with the widespread impact of COVID-19 (S. W. Lee 2022). Although Ko-

rea's interest in VTubers increased relatively later than the global trend, the consistent rise in domestic VTuber-related keywords and the substantial formation of the global market indicate a positive outlook for the Korean VTuber market.

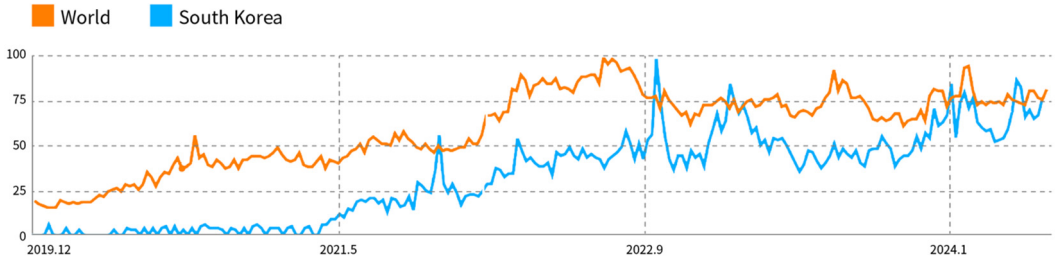


Figure 1. Trend graph of 'VTuber' mentions on Google Trends.

In particular, the VTubers were mentioned significantly more frequently in Naver blogs and cafés than in news articles (Figure 2). This indicates that the primary online spaces in which VTuber users engage and communicate are Naver blogs and cafés. For instance, the VTuber idol group 'Isegye Idol', active on Afreeca TV, and their creator Woowakgood have a total of 642,124 members on a joint Naver's Café platform, as of June 2024, ranking first in overall Naver fan cafe rankings (Naver Cafe 2015, February 26). Similarly, the VTuber idol group 'Stellive', active on Chizich, has a total of 151,582 members as of June 2024, ranking sixth in the overall Naver fan cafe rankings (Naver Cafe 2018, May 20). This trend shows that while VTubers are moving beyond subculture towards mainstream culture with a large number of engaged users, mentions in news articles are still significantly less than the volume of user-generated data.

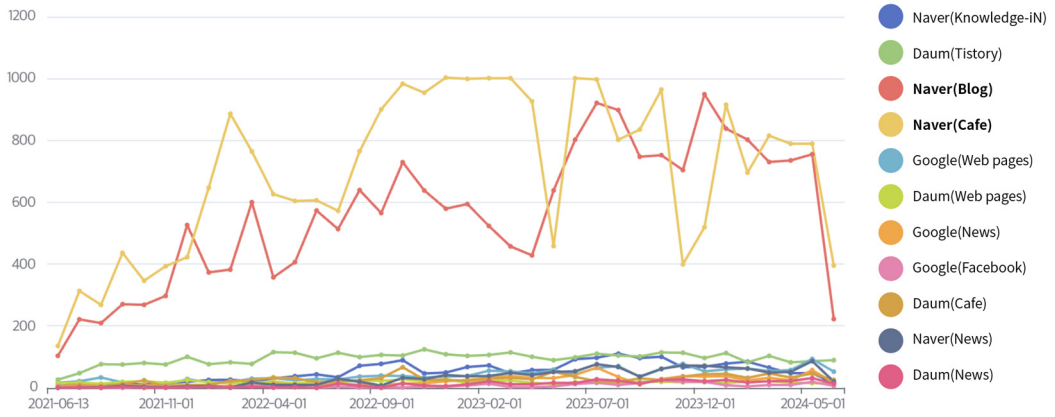


Figure 2. Time series analysis of data collection for 'VTubers'.

4.2. Keyword Frequency Analysis

The results of the analysis of the top 50 keywords based on frequency (TF) and inverse frequency (TF-IDF) are presented in Table 5. Specifically, the TF analysis showed that the keywords 'broadcast (11,993)', 'YouTube (10,462)', and 'live (9384)' were mentioned the most frequently. The interest of VTuber users in broadcasts and live streams can be interpreted as a result of the real-time interactive communication between VTubers and their users. YouTube was the most frequently mentioned platform among the VTubers. This is because VTubers are active on SOOP (AfreecaTV), and Chizich commonly uses YouTube as a platform. Content from live broadcasts is edited and uploaded to YouTube, allowing users to watch the live broadcast as well as those who do not access and share the content. The TF-IDF analysis revealed 'live' as having a relatively high TF-IDF value. This indicates a common interest among VTuber users to overcome the limitations of time and

space through live communication. VTubers conducted fan meetings offline and interacted with humans using avatars displayed on tablets (Gil 2023; W. Y. Lee 2023). The stronger the motivation to use virtual human live streaming, the more immersive the content; further, users engage more deeply when there is a personal connection to the content and character and when the motivation is based on entertainment and enjoyment, leading to experiences such as pleasure and time distortion, thus increasing the intent to interact (Kim and Cha 2022).

Table 5. Keyword frequency analysis of VTuber.

Rank	Word	TF	TF-IDF	Rank	Word	TF	TF-IDF
1	Broadcast	11,933	23,514	26	NaverCafe	1941	7338
2	Youtube	10,462	20,363	27	Avatar	1876	7176
3	Live	9384	21,084	28	Channel	1874	6286
4	Game	6666	17,068	29	Cover	1874	6691
5	Youtuber	6014	14,887	30	Zepeto	1721	6360
6	Japan	5604	14,453	31	Gosegu	1706	6812
7	Character	5464	14,905	32	Izumo	1646	6328
8	Video	5059	13,907	33	Voice	1636	6254
9	Sing	4842	13,913	34	Viewers	1323	5227
10	Virtual	4613	13,039	35	AI	1307	5647
11	Woowakgood	4384	12,961	36	Metaverse	1302	5527
12	Fan	4175	12,068	37	Chzzk	1299	5110
13	Idol	4049	12,301	38	Animation	1238	5024
14	Korea	3647	10,674	39	Concept	1193	4881
15	Twitch	3462	9273	40	Platform	1101	4593
16	IsegyeIdol	3342	10,647	41	Vrchat	940	4019
17	Communication	3184	9831	42	Otaku	891	3903
18	Worldview	3163	10,080	43	Concert	878	4053
19	VirtuberIndustry	3148	9553	44	Illustration	843	3845
20	Contents	3093	9874	45	Usadapekora	824	3853
21	AfricaTV	2768	9661	46	Stelive	789	3703
22	Nijisanji	2606	9112	47	Cosplay	784	3765
23	Streamer	2589	8609	48	Suisei	556	2759
24	Manga	2203	7904	49	Soop	548	2762
25	Sale	2095	8235	50	Gawrgura	439	2241

Although ‘concert (1576)’ ranked low at 43rd in terms of TF, it showed a significant result with an IDF of 4628. This outcome suggests that although concerts by VTubers are less frequently mentioned, compared to more regular content such as ‘game (6666)’, ‘song (4842)’, and ‘communication (3184)’, they still spark significant interest. This is because celebrations are event based and occur infrequently. When VTubers hold concerts, they attract substantial user attention; for instance, the debut concert broadcast of ‘Gosegu’, a member of Isegye Idol on AfreecaTV, recorded a peak of 70,000 concurrent viewers and sparked interest with up to 789 chats per second during the broadcast (W.-Y. Lee 2024b). Additionally, an online concert featuring VTubers such as Isegye Idol and Stellive, along with regular singers, was watched by approximately 430,000 viewers across AfreecaTV, Chizich, and YouTube (Joo 2024).

4.3. Centrality and Egonet Density Analysis

Centrality analysis was conducted to assess the importance and influence of each node. Additionally, to examine the normalized degree centrality in the centrality analysis, it was represented as nDegree by dividing by the maximum number of connections possible in the entire network. Furthermore, Eigenvector centrality was also examined to assess the importance of specific nodes within the network. To examine the peripheral nodes that cannot be identified through centrality analysis, an ego network density analysis was conducted to assess strong network cohesion, the efficiency of information transmission, and high levels of cohesiveness. The results of the centrality analysis, as shown in Table 6, indicate that Broadcast had the highest degree centrality, while YouTube, Live, Youtuber, and Virtual also exhibited high centrality. The Eigenvector centrality, which measures the dependence on the influence of neighboring nodes, also showed that Broadcast had the highest result. Figure 3 illustrates the network structure resulting from the centrality analysis, where nodes with higher degree centrality are located toward the center of the network and have larger sizes. Based on the centrality analysis, the scaling and ordination network analysis resulted in a Gini coefficient of 0.417 for the central/peripheral values. At the center of the network, large nodes such as 'broadcast', 'YouTube', and 'live' were formed, indicating that VTubers are primarily recognized as streaming-based broadcast content. These central nodes are surrounded by content-related nodes such as 'games', 'songs', and 'communications', forming a tight network with broadcasting. Additionally, nodes representing online streaming platforms, such as AfreecaTV and Chizich, were linked around the content nodes, highlighting the importance of broadcast platforms where VTubers can be accessed. One notable feature is the presence of 'Japan' at the center of the networks, reflecting Japan's status as a hub for the VTuber industry. According to the 2023 YouTube Super Chat rankings in Japan, the proportion of VTubers is expected to increase rapidly. Last year, 95 Japanese VTubers earned over 100 million yen through Super Chat, and the total watch time for VTubers surpassed 1.1 billion hours (J. H. Park 2024). Near 'Japan' on the network's periphery are nodes such as 'Manga', 'Cosplay', 'Otaku', and 'Izmuno', indicating the influence of Japanese culture centered around manga and anime on Korean VTuber content. For example, 'Isegye Idol', located on the network's outskirts, is a term referring to an alternate world, through a Japanese expression, and is the name of a Korean virtual idol group formed in 2021. Then, an analysis of the ego network was conducted among the peripheral nodes that could not be examined through centrality, focusing on those with high cohesion and information transmission efficiency. The top five nodes with high ego network density are highlighted in red in Figure 3. The analysis revealed that Usadapekora, which had a low degree centrality, possessed the highest ego network density. Similarly, Stelive, Soop, Gawrgura, and Africa TV, all of which also exhibited low degree centrality, demonstrated high ego network density, indicating that they remain on the periphery of network centrality while being strongly connected to surrounding nodes.

Table 6. Centrality and egonet density analysis of VTuber.

Word	Degree Centrality	nDegree Centrality	Eigenvector Centrality	Ego Network Density
Broadcast	**40,264**	**0.220**	**0.525**	204.98
Youtube	**32,124**	**0.176**	**0.421**	211.90
Live	**33,442**	**0.183**	**0.449**	210.78
game	22,014	0.120	0.320	220.50
Youtuber	**30,212**	**0.165**	**0.438**	213.53
Japan	20,990	0.115	0.316	221.37
Character	20,935	0.114	0.304	221.42
Video	17,724	0.097	0.255	224.15

Table 6. *Cont.*

Word	Degree Centrality	nDegree Centrality	Eigenvector Centrality	Ego Network Density
Sing	14,911	0.081	0.213	226.54
Virtual	**22,953**	**0.125**	**0.347**	219.70
Woowakgood	16,292	0.089	0.212	225.36
Fan	15,805	0.086	0.216	225.78
Idol	18,377	0.100	0.242	223.59
Korea	11,974	0.065	0.171	229.04
Twitch	15,029	0.082	0.219	226.44
IsegyeIdol	13,018	0.071	0.166	228.15
Communication	14,876	0.081	0.238	226.57
Worldview	15,235	0.083	0.200	226.26
Virtuber industry	10,894	0.060	0.161	229.95
Contents	12,860	0.070	0.176	228.28
Africa TV	11,160	0.061	0.151	**246.83**
Nijisanji	8637	0.047	0.120	231.87
Streamer	12,413	0.068	0.177	228.66
Manga	3820	0.021	0.051	235.97
Sale	7004	0.038	0.085	233.26
Naver cafe	7581	0.041	0.104	232.77
Avatar	8278	0.045	0.109	232.18
Channel	9030	0.049	0.145	231.54
Cover	8281	0.045	0.130	232.18
Zepeto	6118	0.033	0.100	234.02
Gosegu	5619	0.031	0.074	234.44
Izumo	7899	0.043	0.111	232.50
Voice	4676	0.026	0.069	235.24
Viewers	5617	0.031	0.084	243.09
AI	4279	0.023	0.059	243.72
Metaverse	5833	0.032	0.076	242.59
Chzzk	5606	0.031	0.062	234.45
Animation	4578	0.025	0.062	235.33
Concept	3764	0.021	0.054	236.02
Platform	5642	0.031	0.077	234.42
VR chat	4596	0.025	0.061	243.08
Otaku	2203	0.012	0.028	244.58
Concert	3641	0.020	0.051	236.12
Illustration	3234	0.018	0.048	244.58
Usadapekora	2534	0.014	0.043	**260.05**
Stelive	2913	0.016	0.039	**253.83**
Cosplay	2283	0.012	0.034	237.28
Suisei	1842	0.010	0.030	242.84

Table 6. *Cont.*

Word	Degree Centrality	nDegree Centrality	Eigenvector Centrality	Ego Network Density
Soop	2131	0.012	0.028	**251.97**
Gawrgura	1499	0.008	0.023	**251.81**

Note: The top 5 centralities are marked in green and bold.

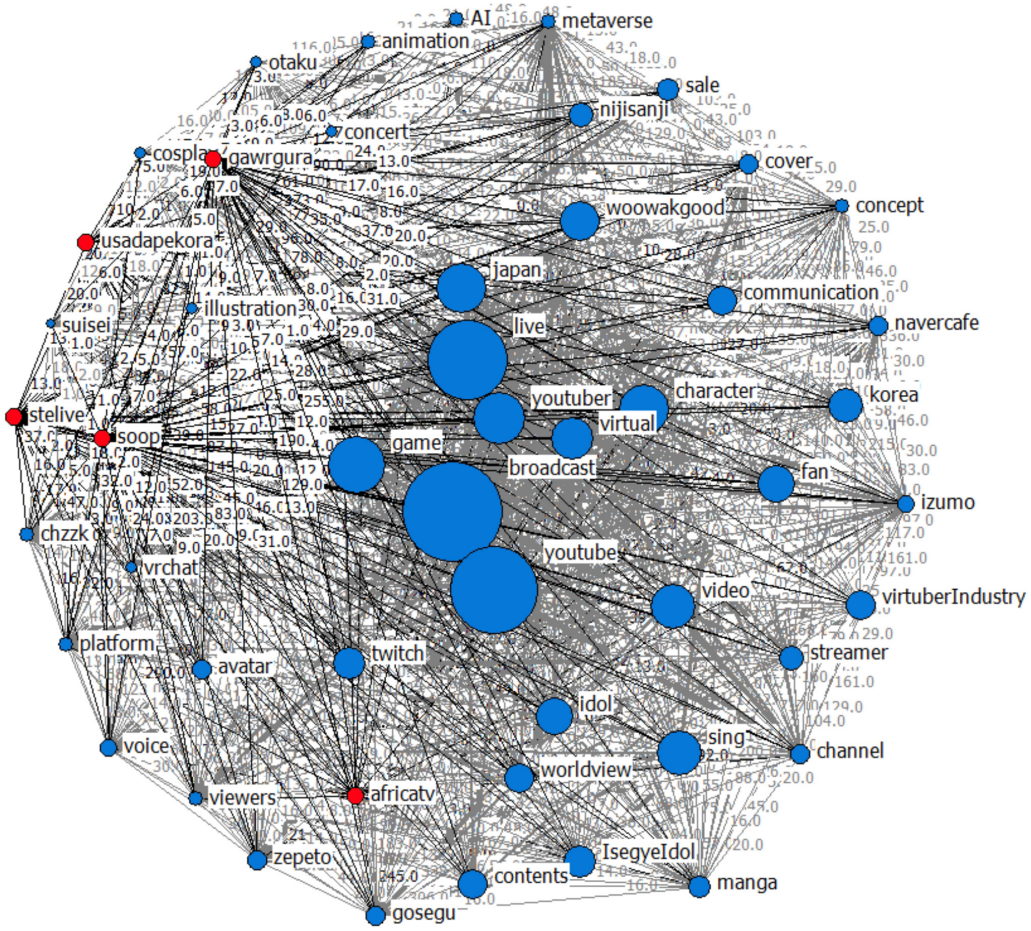


Figure 3. Centrality analysis and ego network density analysis for 'VTuber'.

4.4. CONCOR Analysis

CONCOR analysis examines the patterns and connections between keywords to identify similarities. In other words, the greater the similarity of the connection patterns, the more commonalities emerge in the structure of the words, leading to the formation of each cluster (Zeng and Lee 2022). CONCOR analysis is a method that further subdivides the network derived from semantic network analysis into clusters, allowing for a deeper analysis of meaning (Kim and Kim 2016). To cluster entities with similar characteristics among nodes, 50 keywords related to 'VTuber' were derived for CONCOR (CONver-gence of iterated CORrelations) analysis. Developed by Boorman and White (1976), CONCOR analysis is a sociometric algorithm that uses correlation and iterative calculations to block the model of the network structure. For the CONCOR analysis, a dendrogram was used to distinguish three levels of depth, and up to eight groups were formed based on the attribute values.

CONCOR analysis was conducted using the standard function under the Roles and Positions in UCINET and the Categorical Attribute function in NetDraw. Specifically, the group attribute was set to 2, and the Scrunch Factor was adjusted to 5. As a result, four

distinct cluster groups were identified, as shown in Figure 4. As a result of the CONCOR analysis, a total of four clusters were formed, including one central cluster and three peripheral clusters. The central cluster was categorized into central and peripheral clusters, as shown in Table 7. First, Group 2 included the following members: streamer, IsegyeIdol, idol, gosegu, suisei, gawrgura, cover, stelive, woowakgood, usadapekora, and nijisanji. This cluster was named 'Famous VTubers'. In the peripheral cluster, Group 1 included contents, avatar, metaverse, AI, virtual, communication, concept, voice, and character, and this cluster was named 'Features of VTuber'. The second cluster, Group 3, included animation, illustration, manga, game, otaku, and fan, and this cluster was named 'VTuber Industry'. The third cluster, Group 4, included twitch, youtuber, zepeto, chzzk, soop, africatv, navercafe, and youtube, and this cluster was named 'VTuber Platforms'. The results of the CONCOR analysis on VTubers are shown in Table 7, and the visualization of the CONCOR analysis results is presented in Figure 4.

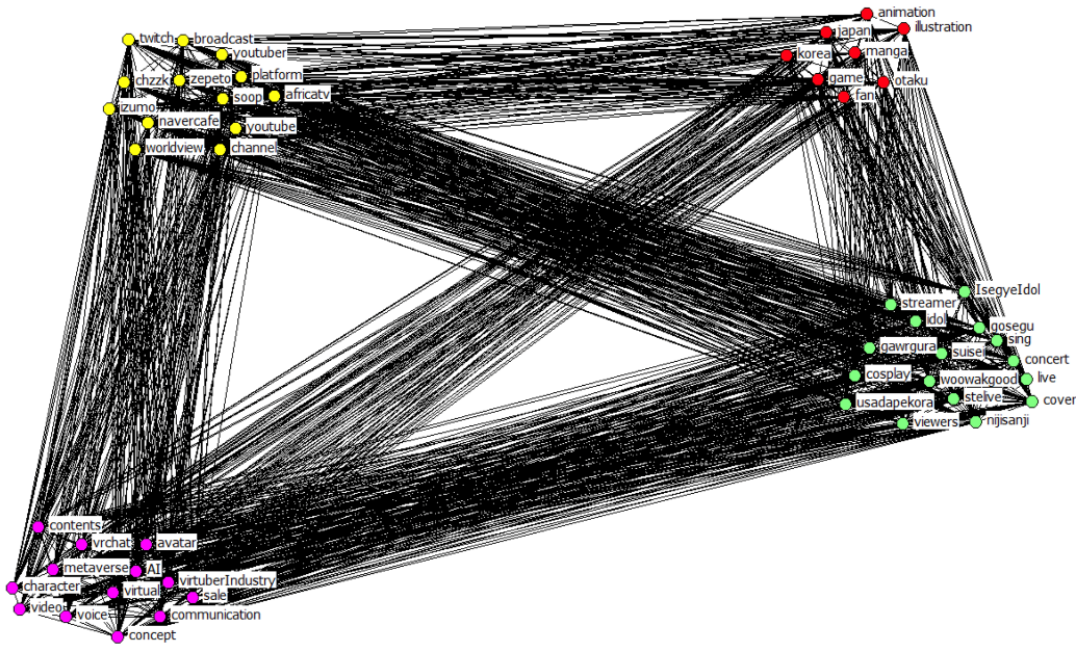


Figure 4. CONCOR analysis network of 50 nodes for 'VTuber'.

Table 7. Result of CONCOR analysis of VTuber.

Cluster	Group	Major Keywords
Central cluster (Group 2)	Famous VTubers	streamer, IsegyeIdol, idol, gosegu, sing, suisei, gawrgura, concert, live, cover, stelive, woowakgood, cosplay, usadapekora, viewers, nijisanji
Surrounding cluster (Group 1, 3, 4)	Features of VTuber	contents, vrchat, avatar, metaverse, AI, virtuber Industry, sale, virtual, communication, concept, voice, video, character
	VTuber industry	animation, illustration, korea, japan, manga, game, otaku, fan
	VTuber platform	twitch, broadcast, youtuber, platform, zepeto, chzzk, soop. africatv, izumo, navercafe, youtube, channel, worldview

Upon closer examination, the data can be categorized as shown in Table 8, with Cluster Group 1 composed of the topic 'Features of VTubers'. VTubers create content by forming avatars in the metaverse that represent themselves and interact with the viewers. A

growing outlook on advanced IT technologies, like AI, will increasingly enable the creation of new content such as AI VTubers. An example is 'Neuro-sama', an AI virtual human streamer based on a generative AI model with TTS (text-to-speech) technology developed by an individual programmer (W. Y. Lee 2023). Specifically, the VTuber technology employs motion capture to mimic real human expressions, gestures, and actions in real time, which can be easily combined with VR/AR fields, allowing many VTubers to broadcast VR content. VRChat is a game platform where users can use avatars to engage in voice conversations, play mini-games, and experience virtual life on maps created by other users (Hwang and Kim 2023). VTubers use VRChat to form avatars, create content, and sometimes collaborate with other VTubers on VRChat maps). Therefore, we can define VRChat as a medium for VTubers to produce content. VTubers have unique characteristics that distinguish them from each other, with each VTuber having different concepts, voices, characters, videos, and avatars, allowing viewers to watch them according to their preferences. Because each VTuber has distinct features, it is possible to implement marketing strategies in the VTuber industry using virtual character IP such as OSMU (One Source Multi-Use).

Table 8. CONCOR groups of 50 nodes for 'VTubers'.

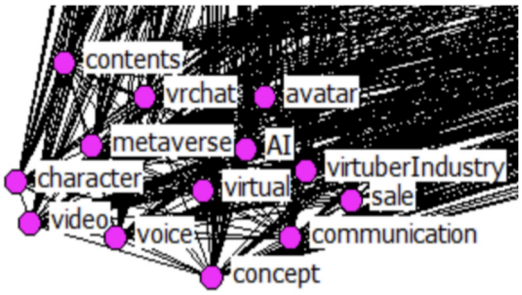
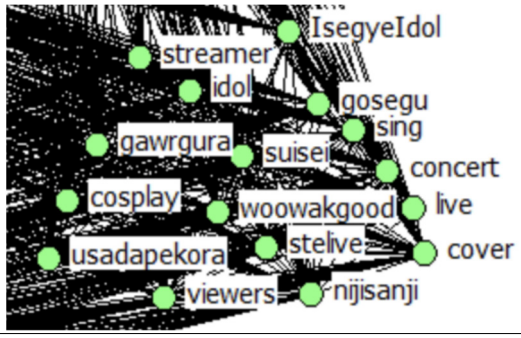
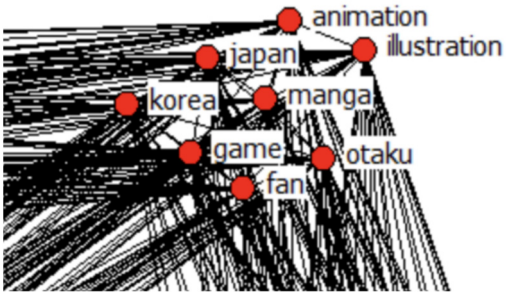
Cluster Groups	Cluster Keywords	Keywords
Group 1: Features of VTuber		contents, vrchat, avatar, metaverse, AI, virtuber Industry, sale, virtual, communication, concept, voice, video, character
Group 2: Famous VTubers		streamer, IsegyeIdol, idol, gosegu, sing, suisei, gawrgura, concert, live, cover, stelive, woowakgood, cosplay, usadapekora, viewers, nijisanji
Group 3: VTuber industry		animation, illustration, korea, japan, manga, game, otaku, fan

Table 8. *Cont.*

Cluster Groups	Cluster Keywords	Keywords
Group 4: VTuber platforms		twitch, broadcast, youtuber, platform, zepeto, chzzk, soop. africatv, izumo, navercafe, youtube, channel, worldview

Cluster Group 2 is composed of the topic 'Famous VTubers'. The VTubers that are primarily active in Korea include IsegyeIdol, Gosegu, Stellive, and Woowakgood. In Japan, HoloLive members such as Suisei, GawrGura, UsadaPekora, and the VTuber group Nijisanji are prominent. As of May 2024, HoloLive members in Japan have a total of 84.18 million subscribers, demonstrating a large VTuber user base (W.-Y. Lee 2024c). VTubers' main content includes daily communication, gaming, song covers, collaborative broadcasts with other YouTubers, and cosplay. Short term, they also conduct concerts online and offline, which attract significant interest and engagement from Vtuber users. In Korea, the VTuber idol group IsegyeIdol performs live 3D concerts based on both title tracks and cover songs on the virtual reality platform 'VRChat'. In Japan, XR (extended reality) concerts that offline audiences can attend have been held multiple times (W. Y. Lee 2023). On 7 July 2023, the Japanese VTuber group 'Hololive' held a concert at Tokyo Dome City Hall (Ikeuchi and Shimbun 2023). They are also building global recognition by holding concerts in North America (Cover 2024, February 27).

Cluster Group 3 is composed of the topic 'VTuber Industry'. This suggests the potential for a virtual character IP business. VTuber users often create and share avatar drawings, photos, and videos on fan cafés and interact with each other through comments and communication. The success of K-pop idol fandoms, where fans actively create fan art, goods, and videos, has positively influenced idols by activating fandom through cultural production activities (Y. Kim 2021). Similarly, fan art and goods created by VTuber users are expected to positively affect the VTuber industry. Successful cases of utilizing the VTuber IP in manga and games have emerged in Korea and Japan. The webtoon Magical Girls Isegye Idol by Kakao Entertainment set a record in Korean crowdfunding history by raising 4.198 billion KRW from 31,336 backers on the domestic crowdfunding platform Tumblbug in about a month (This is Game 2024). Game companies such as Krafton and Nexon gained popularity by collaborating with VTubers from Hololive and Nijisanji through local Japanese channels (T. M. Lee 2023). This demonstrates the VTuber users' interest in and demand for businesses leveraging VTuber intellectual property (IP).

Cluster Group 4 is composed of the topic 'VTuber Platforms'. In Korea, the platforms on which VTubers interact with users in real time include Chzzk, Soop (formerly AfreecaTV), YouTube, and Zepeto. After 27 February 2024, when Twitch withdrew from the Korean market, many VTubers who were active on Twitch transitioned to Chzzk and Soop (Gil 2024). Notably, Isegye Idol and Woowakgood, virtual streamers on Twitch, moved to SOOP and became virtual BJs. Navercafé is more actively used by VTuber users than by VTubers themselves. While other platforms focus on VTubers as the main content creators, users take the lead on Navercafé. In fact, they not only watch VTubers but also engage in cultural production activities, such as creating fan art and goods through fan cafés, showcasing their roles as producers (Y. Kim 2021)

5. Discussion

Based on the frequency and network analysis related to VTubers, cluster groups for each keyword were derived using the CONCOR methodology. Examining the relationships between these groups based on the CONCOR analysis revealed that the clusters of the four groups were structured as shown in Figure 5.

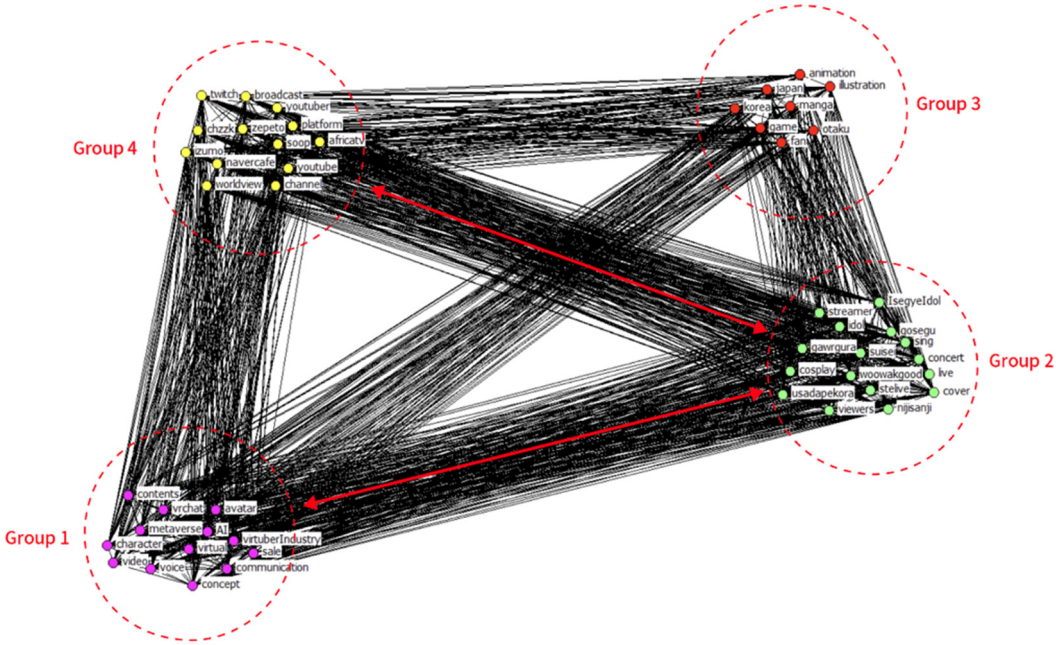


Figure 5. The four groups and clusters among the groups.

The clusters among the four groups, as shown in Figure 5, indicate that Group 1 (Features of VTubers) and Group 2 (Famous VTubers) are closely linked based on the central cluster of Group 2, while Group 2 (Famous VTubers) and Group 4 (VTuber Platforms) also exhibit strong connections.

The close connection between Groups 1 (Characteristics of VTubers) and 2 (Famous VTubers) can be attributed to the features of active VTubers in Korea and Japan eliciting the user responses found in Group 1 (Characteristics of VTubers). Daily communication, gaming, song covers, and collaborative broadcasts with other YouTubers were the primary types of VTuber content produced in Korea and Japan. However, event-based content like concerts seems to be primarily offered by 'virtual idol' VTubers. In Group 2, the virtual idols that are VTubers include IsegyeIdol, gosegu, suisei, gawrgura, stelive, usadapekora, and nijisanji. Among these, the Korean VTubers are gosegu (affiliated with IsegyeIdol) and stelive, while the Japanese VTubers include suisei and gawrgura (affiliated with Hololive), as well as the VTuber group nijisanji.

The leading player in the VTuber market is Japan, the original source, which significantly influences the VTuber ecosystem through the production of content in various languages and global expansion. Kirara Mimi, a Japanese VTuber with approximately 258,000 YouTube subscribers, has successfully built a Brazilian fandom and expanded her global audience by producing educational videos that teach and learn Portuguese through live streaming, while also emphasizing multilingual communication by providing subtitles in various languages, including Korean, Portuguese, and Spanish (Regis et al. 2022). Another example is Hololive EN, a prominent VTuber group that has successfully built a global fandom by targeting English-speaking viewers. Hololive EN's first overseas live event, 'Hololive English 1st Concert—Connect the World', showcased tremendous enthusiasm with tickets for the 6000-seat venue selling out almost instantly and 15,000 viewers watching online, while the key to Hololive's popularity lies in building a rich universe through mul-

tilingual content and fan participation that transcends both online and offline platforms (One Career 2023). The Japanese VTuber group Hololive produces a short animation series, 'Holo no Graffiti' (HoloGra), depicting the daily lives of its VTubers. This series supports subtitles in Japanese, English, Spanish, Indonesian, Korean, Chinese, and Simplified Chinese for all episodes (Hololive Production 2024). Thus, VTubers can communicate with fans worldwide through the internet, build a global fandom by providing multilingual support and content creation for overseas fans, and possess the unique ability to operate without the constraints of time and space through internet broadcasting platforms, which gives them the potential for global growth (Tambunan and Setiawan 2023). The Korean market is also witnessing VTubers establishing themselves as a mainstream culture, proving their industrial value beyond mere popularity; however, in terms of the number of VTubers, revenue, and content diversity, it still falls short compared to the leading player, Japan. This can be confirmed through the results of GROUP1 and GROUP2. While VTubers possess the unique ability to operate relatively free from language and cultural barriers, the Korean VTuber industry has fewer VTubers active in various languages compared to Japan's VTuber industry, and it has yet to expand globally, making it a somewhat disappointing situation in comparison to Japan. As can be seen in Group 1 and Group 2, while Japan actively produces 'animation' content with multilingual subtitles to enter the global market, Korea is still in the early stages, with limited activity in animation production. The Korean VTuber market can also refer to the Japanese VTuber industry, which utilizes VTuber IP as a leading market, to secure linguistic and cultural diversity in its content and thereby plan for global expansion. In this regard, the individuality of VTubers, manifested through their unique concepts, voices, characters, videos, and avatars, provides a reason for the creation of content that utilizes VTuber voices, similar to animation. This is also seen as a reason for the close connection between Group 1 and Group 2.

The close connection between Group 2 (Famous VTubers) and Group 4 (Platforms Used by VTubers) is due to the fact that VTubers form relationships with users through these platforms. A common platform for both Korean and Japanese VTubers is YouTube; however, Korean VTubers and their users predominantly use Chzzk, Soop (formerly AfreecaTV), Zepeto, and NaverCafe. In contrast, platforms used distinctively by Japanese VTubers include the Hololive Official Fanclub Site, Nijisanji Site), and China's video site Bilibili). Analyzing the differences between the platforms used by Korean and Japanese VTubers, the Japanese have their own dedicated broadcasting sites for each famous VTuber group. The reason for their activity on China's video site, Bilibili, is that YouTube is not accessible in China; therefore, they use Bilibili to communicate with Chinese VTuber users, indicating their global market reach. On the other hand, like their Japanese counterparts, Korean VTubers primarily use platforms operated by domestic companies and lack independent broadcast sites. They also have fewer channels for communicating with Chinese and global VTuber users. Korean VTubers primarily use platforms operated by domestic companies because the Korean VTuber market is not as large as the Japanese one; further, they aim to secure the domestic market first. Korean VTubers are expected to follow the marketing strategies of the leading Japanese VTuber market for future global expansion. As previously mentioned, the U.S.-based VTuber agency VShojo is not limited to activities in the U.S. but aims to expand into Japan, the largest market for VTubers and the spiritual home of VTubing, similar to its efforts in the VTuber market (Amos 2022).

Finally, the relationships between Group 1 and Group 2, as well as the connections between Group 2 and Group 4, can ultimately be viewed as the current state of the Korean VTuber market, based on the results of collecting unstructured data over the past three years using big data. The Korean VTuber market is significantly influenced by the successful K-POP industry and, in turn, is now also impacting the K-POP market. VTubers have engaged in activities such as concerts, busking fan meetings, and live broadcasts to interact with fans, making their range of activities similar to that of actual K-POP idols (Han 2024; Kim 2023). The success formula of the 'virtual idol' PlayB involves securing scarcity in the saturated idol market and generating fan enthusiasm through a growth narrative,

which is similar to the growth process of existing K-POP idols (J. M. Lee 2023). According to reports, SM Culture Partners, the investment arm of SM Entertainment, is investing in Scon, the operator of the VTuber entertainment company 'Mitchu', indicating a potential collaboration in VTuber-related and entertainment businesses (Y. Kim 2024). The rise of VTubers, which influences the Korean K-POP market, is attributed to the unique appeal that distinguishes them from general content creators.

The unique personas and avatars of VTubers are the reasons people are drawn to them, as they allow individuals to express themselves online and build fan communities while protecting their real identities, thereby representing the future of content creation by providing opportunities for anyone to challenge the cultural and physical barriers that define celebrities in the real world (Sliwinski 2023).

6. Conclusions

The Korean VTuber market is rapidly growing as it moves past the COVID-19 period, transitioning from a minor market to a major one both domestically and internationally. The attractive features unique to VTubers, distinct from general content creators, not only expand the existing content market but also contribute to the increase in both economic and public values. In this context, this study was conducted to identify perceptions of VTubers within Korea that can contribute to the global activation of the VTuber market and to establish implications for future applications. To this end, unstructured data were collected from major websites and social media over the past three years, a period during which attention to VTubers in Korea has significantly increased. After performing basic statistical analysis, frequency analysis, semantic network analysis, network analysis, and CONCOR analysis were executed using text mining techniques to interpret the deeper meanings. Through the application of various text-mining techniques, this study went beyond simple frequency analysis to explore overall keywords and derived relationships between keywords through network analysis. Furthermore, the CONCOR analysis revealed the distinguishing features that VTuber users focused on and the differences between groups, providing diverse results not offered by other methodologies. First, as shown in the VTuber keyword collection using Textom, VTubers were mentioned much more frequently in Naver blogs and cafés than in the news. This indicates that Naver's blogs and cafés are the main online spaces in which VTuber users actively engage and communicate. Despite significant user engagement driving VTubers from subculture to mainstream culture, the amount of news coverage remains significantly lower than the volume of user-generated data. Additionally, a basic statistical analysis reveals differences between the Korean and global VTuber markets, and a trend graph reporting VTuber mentions confirms the positive state of the domestic VTuber market. Keyword frequency and inverse frequency analyses highlighted users' interest in broadcasts and live interactions. The relatively high TF-IDF for 'live' suggests that VTuber users have a strong interest in real-time interactive communication. While celebrations were mentioned less frequently owing to their one-time nature, they garnered significant attention when held. Network analysis identified the relationships between VTuber industries and content and the importance of Japan in the VTuber market, revealing critical keywords that are not evident in simple frequency analysis. Furthermore, to conduct the centrality analysis, degree centrality and eigenvector centrality were analyzed alongside ego network density, allowing for an examination of the centrality and connection levels among neighboring nodes around specific nodes. The CONCOR analysis identified four groups of VTubers (Group 1: Characteristics of VTubers, Group 2: Famous VTubers, Group 3: VTuber Industry, Group 4: Platforms Used by VTubers). Finally, by analyzing the characteristics of each group, we derived the features of VTubers and identified the potential for virtual character IP businesses and global growth. The findings of this study are as follows:

First, VTubers possess unique characteristics with different concepts, voices, characters, and avatars. Therefore, their users tended to select and watch VTubers based on their personal preferences. VTubers' main content includes daily communication, gaming, song

covers, collaborative broadcasts with other YouTubers, and cosplay. Event-based content, such as concerts held both online and offline, also attract significant interest and engagement from many VTuber users. The contents of the VTubers in Korea and Japan are highly similar.

Second, the VTubers frequently mentioned in Korea include Isegy Idol, Gosegu, Suisei, Gawrgura, Stellive, Woowakgood, Usadapekora, and Nijisanji. The VTubers that are primarily active in Korea are Isegy Idol, Gosegu, Stelive, and Woowak Good. Suisei, Gawrgura, and Usadapekora from the Hololive, as well as the VTuber group for Nijisanji, are mainly active in Japan.

Third, the potential of virtual-character IP businesses is confirmed. VTuber users voluntarily create and share avatar drawings, photos, and videos on fan cafés and communicate through comments. Similar to the success of K-pop idol fandoms, the creation of fan art and goods is expected to have a positive impact on the VTuber industry.

Fourth, the VTubers and platforms frequently mentioned in Korea include Twitch, Broadcast, Platform, Zepeto, Chzzk, Soop, Izumo, NaverCafé, YouTube, channel, Worldview, and VRChat. The platforms on which VTubers interact with users in real time in Korea are Chzzk, Soop (formerly AfreecaTV), YouTube, and Zepeto. Specifically, VRChat serves as a platform for VTubers to create content, whereas Naver Cafe is distinct in that it is driven primarily by VTuber users rather than by the VTubers themselves.

By analyzing the four groups and their clusters, the relationship between Group 1 (Characteristics of VTubers) and Group 2 (Famous VTubers) revealed the similarities and differences in content between Korean and Japanese VTubers. Additionally, the relationship between Group 2 (Famous VTubers) and Group 4 (Platforms Used by VTubers) highlights the commonalities and distinctions between the platforms used by Korean and Japanese VTubers. Subsequently, by analyzing the closely linked relationships between the two groups, the current state of the Korean VTuber market was assessed, along with the identification of factors related to its correlation and influence on the K-POP market. The specific academic and practical implications derived from the research findings are as follows.

First, existing research on VTubers primarily consists of literature reviews regarding the concept and definition of VTubers, their technical aspects, and ethical issues, with a majority focusing on studies that investigate the relationship between viewers and VTubers through surveys. This study is significant in that it aims to understand the comprehensive perceptions of VTuber users based on the key terms extracted from major websites and social media, thereby providing foundational data for VTuber research.

Second, the majority of big data studies focused on VTubers have primarily analyzed data left by VTuber users in YouTube comments. This study expanded the existing research, which primarily identified VTuber users through YouTube comments, by recognizing that VTuber users form and communicate within their fandom across various websites and social media, thereby extending the scope of unstructured big data research on VTuber users. Additionally, the study was further expanded by applying text mining procedures, centrality analysis, semantic network analysis, and CONCOR analysis for the unstructured big data research.

Third, based on the results of the centrality analysis, Broadcast exhibited the highest degree centrality and eigenvector centrality within the VTuber network, while YouTube, Live, and Youtuber also demonstrated high centrality. Additionally, to evaluate the cohesion and information transmission efficiency of peripheral nodes, an ego network density analysis was conducted. The results indicated that Usadapekora, Stelive, Soop, Gawr Gura, and Africa TV, which exhibited low degree centrality, showed high ego network density, demonstrating strong connectivity. VTubers exhibit characteristics centered around YouTube while also prominently showcasing the features of live streaming, as seen with Usadapekora, Stelive, and Gawr Gura.

Fourth, based on the results of the CONCOR analysis, four key topics in the Korean VTuber market were identified. The primary trend revealed that issues related to Group

2: Famous VTubers were the most significant. In the case of Famous VTubers, discussions among Korean VTuber users about both Korean and Japanese VTubers have been ongoing. While the number of Korean VTubers and the variety of their content increased during the COVID-19 pandemic, it would be beneficial to refer to the successful cases in the Japanese VTuber market to further activate the global VTuber market. Currently, Korea's VTuber market is not as large as that of Japan. While channels for securing domestic VTuber users are well established, there are fewer avenues for attracting global fans compared to the Japanese VTuber market. These distinctions could be beneficial for the Korean VTuber market, as it seeks to expand into the global market. Therefore, to advance toward the global VTuber market in the future, the production of content that offers various languages should be pursued. With globalization and the increased accessibility of information internationally, VTubers can overcome linguistic and cultural barriers to reach global audiences, unlike general YouTubers who may encounter such limitations through the internet and translation services. As a result, they attract viewers from diverse cultural and racial backgrounds, thereby expanding their audience and potential market (Valuates Reports 2023).

VTubers have been utilized in various fields, including social interaction, education, public relations, and health (Regis et al. 2022). This indicates that the global expansion of businesses utilizing VTubers is possible, and it is believed that the utilization of VTubers is a crucial aspect for the development of the VTuber IP industry. Despite the academic and practical implications discussed above, the limitations of this study and plans for future research are outlined below. Through the analysis of unstructured big data, a general understanding of the Korean VTuber market was obtained; however, to derive additional insights, it seems important to expand the research through qualitative studies on VTubers in order to understand the content and revenue structures based on their individuality and characteristics. The derivation of key qualitative insights through methods such as 'FGI (focus group interviews)' is also considered an important task for expanding research aimed at the more detailed development of VTuber entertainment.

Additionally, while there is potential for VTubers to grow globally, limitations also exist. According to research by Respati Pakusadewo et al., Japan's Hololive Production has successfully entered the Indonesian VTuber market, contributing to its growth; however, the local VTuber industry faces limitations in growth due to technological and resource constraints, particularly a lack of 3D technology, which has hindered deeper development (Pakusadewo and Situmeang 2024). It is evident that for the VTuber market to advance into a major industry, it must also overcome technological limitations present in specific countries, which poses a significant challenge.

Additionally, further research on AI VTubers is necessary, focusing on exploring the reasons why human fans are attracted to AI VTubers, as well as examining whether this phenomenon is similar to or different from the formation of fandoms around traditional VTubers. By understanding the differences in how the identity of AI robots impacts fandom, it is anticipated that this knowledge can be applied to the entertainment industry in the future.

Finally, since the term VTuber is referred to in various ways in Korea, including virtual YouTuber, virtual streamer, and virtual BJ, the search-related key term was set as 'VTuber' to encompass a comprehensive understanding of global VTubers. As a result, some of the collected key terms, such as Otaku and Cosplay, which are particularly observed in the Japanese VTuber market, were included. Future research should focus on selecting more specific key terms by field to reduce the influence of these terms during the keyword selection process.

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