



A study on social media and higher education during the COVID-19 pandemic

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Abstract

Nowadays social media usage has increased drastically among the stakeholders of higher educational institutions. The COVID-19 pandemic has suddenly increased the surge of social media users due to the forced implementation of online pedagogy and travel restrictions. The research study presented in this paper attempted to analyze social media usage in higher education. The data were collected from primary and secondary sources with the help of leading research databases, survey questionnaires, the Delphi method, and brainstorming sessions. Statistical tools and analytic techniques incorporated in the study included bibliometric analysis, word cloud, co-occurrence network, thematic map, thematic evolution, co-word analysis, country-wise analysis along with collaboration network, statistical survey, mind mapping, and analytic hierarchy process. The study justified the aspects of social media usage in the higher educational environment. It was found that the research fraternity around the globe focused more on understanding the aspects of social media and higher education during the trying times of the Coronavirus crisis. The maximum impact of social media usage on higher education was found to be from teaching–learning and discussions, and public relations and networking. It was also found that social networking platforms like WhatsApp, YouTube, Facebook (Meta), LinkedIn, Instagram, and Twitter were very common among the stakeholders of higher education. This study is of huge importance because it can help in paving the way to strategize remedial measures for increasing positivity and minimizing the negativity of social media usage in institutions of higher education across the world.

Keywords Social media · Higher education · Bibliometric analysis · Analytic hierarchy process · COVID-19 pandemic

1 Introduction

Nowadays in the Internet era, various social media platforms are playing an important part in the swift information passage and planning among all sections of society. Social media presence has been witnessed in higher education with the help of educational technology. Social media usage has increased among all stakeholders of academic fraternities during the COVID-19 pandemic, but some universities faced digital accessibility issues with regard to online training, accessing documents, emergencies, procurement, awareness, captioning, etc. [1]. The importance of social media is gradually increasing, but social media platforms are also found

to be performing an essential role in instilling such sentiments, mood shifts, etc. The problem is becoming serious because of the increase in the misuse of social media users rather than its positive use which is creating an abnormal atmosphere in almost all walks of life. A study discussed literature regarding Web site usability among social media and educational areas. It also reviewed relevant studies which pondered upon analyzing the usability of social networking platforms with the help of various automated tools for evaluation purposes. It was found that social media usability and its Web sites regarding higher education institutions are essential themes to explore [2]. A subsequent review of the literature provided in the next section also justified the need to resolve the research gaps and extracted problems by attaining the formulated objectives in this research study. Therefore, it has been observed that there is a need to understand social media usage in higher education.

The current research study moved forward by collecting a significant amount of data from primary and secondary sources during various stages of the Coronavirus crisis.

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The data collection process and extraction from various research databases, articles, respondents, subject matter experts, social networking platforms, etc. have been explained in the “Methodology” section of the study. The data collected from various authentic sources and stakeholders of higher educational institutions were found to be reliable. This novel study has been conducted ethically and the work is completely original. The research has been segregated into various sections which cover the introductory part, the review of relevant literature, the methodology of the study, the analysis and findings, the future scope, and the limitations of the research study. This research can pave the way for the formulation of remedial strategies that can increase positivity and minimize the negativity of social media usage in the educational environment. Thus, this study attempts to understand social media, its usage, and its impact on higher education. The preliminary objective was to find the main social media usages among stakeholders of higher education institutions. However, while exploring research studies across the world it was observed that it is essential to dig deeper insights into this domain with a special focus on India. Secondary data were collected to analyze its impact on the research fraternity across the world. The study also attempted to find the ranking among the social media usages. The research study’s applicability is widespread and dynamic. The implications presented in the forthcoming sections can help in understanding various aspects of social media in higher education. This study would pave the way for a better understanding of the social media usage responsible for creating an impact on higher education. It will also provide a platform to design remedial measures and dynamic strategies to minimize the negative impact on neutrality and maximize the positive impact of social media on higher educational institutions. Relevant reviews of the literature have been referred to, in the next section, to understand the niche perspectives of social media in higher education globally. The following sections of this research study present the literature review, methodology, analysis, findings, limitations, future scope of research, conclusion, and recommendations.

2 Literature review

Relevant research studies extracted from the review of literature have illustrated the use of social media in higher education along with supporting pieces of evidence from across the world. The excerpts provided in the subsections below were collected from motivational publications in leading scholarly research databases like Web of Science (WoS), Scopus, Springer Nature, Google Scholar, etc.

2.1 What is social media?

A study defined social media as a tool that provides online interactive platforms along with the newest application which is Web-enabled applications. Through these, the users are engaged in content creation with the help of social media to communicate and interact with other users and the public in general [3]. Social media is used in the educational process, especially for connecting with students, teachers, and colleagues, to access a news feed on their walls [4]. Social media or social networking platforms is the medium that enables the interactive Web-based Internet by fetching users to participate, share, comment, and create content to communicate with others and ensure public presence on social media. The educational content shared on social media can be any form of text, audio or video, etc. Learning is a process that is based on the principles of innovation, play, and shared study rather than a personalized mode of instruction [5]. This idea can be implemented in a classroom arrangement to enhance the value of the learning process. From the word “social media,” people generally understand that it means all the famous social networking sites like WhatsApp, LinkedIn, Facebook, Instagram, and Twitter, but it is not limited to these. According to a research study [6], social media platforms include a wide variety of arrangements like social networking sites, Blogs, Wikis, Podcasts, etc., which empower the users to share or communicate information through a variety of content formats like audio/videos, pictures, graphs, text, PDF, and audios through the cyberspace. A study justified that social media had been invoked largely as digital and network-based applications [7]. It eased content exchange and communication among all sorts of users or organizations. Moreover, social media is a term that is applied to new media forms which ensure collaborative involvement. Media development is categorized into two different ages, namely the broadcast age and the interactive age. From the broadcast age, the media meant the centralized media where only one entity like radio, a newspaper company, television, production of movies, studios, etc. dispersed messages to people. Moreover, feedback from the media outlets was mostly indirect, impersonal, or delayed. Social networking Web sites are Web-based services that let a person create his/her profile within a limited system. It also shows a list of people with whom they are sharing a common connection and a list of connections formed by other users in that bounded system. Moreover, it assists users in viewing and traversing their connection list. The type, nature, or nomenclature of such connections may vary from various platform to site [8].

2.2 Social networking platforms

Facebook (renamed “Meta”) is a famous social media platform. Mark Zuckerberg (the founder of Facebook) defines it as a platform or a social app where people connect and communicate more efficiently with their family, friends, colleagues, acquaintances, relatives, etc. Nowadays, Facebook is being used to connect educators with students so that they can communicate and send schedules, news, and education-related stuff. The idea of using social media as a tool for learning is now even carried forward, also to the business world. Social media is being popularly used in our society which reflects human expression and recognition. A study found that interacting socially for educational purposes has generated a surge in the availability of modern techniques in social media usage [9]. With the help of these techniques of social networking, there is good scope for learning among the students because it offers several communication channels among their peer groups which can help in gaining information and knowledge enhancement. Social media has an enormous role in the process of educational development. Educators are using Facebook for learning and imparting knowledge, and without disturbing the workflow going on in the classroom or campus, the students and teachers can ask questions and respond to the lesson, post photographs, and related educational material with hyperlinks. In that way, everyone remains on the same page with only a few disruptions [10]. A research study analyzed the usage of Facebook in Spanish universities and it was found that public universities used it for professional communication [11]. Facebook is an extraordinary learning tool, and teachers can easily use it for class projects, improving communication, and engaging the students in such a way that might not be possible in a face-to-face classroom arrangement. Teachers also use Twitter professionally [12] to ensure that the students are well engaged in the learning and knowledge-imparting process in a classroom is ensured by the way of strengthening the modes of communication between the students and student and educator so that the information keeps flowing through the class. Nowadays, students spend their time working on new technologies, which helps them to become familiar with electronic devices, computers, laptops, and other gadgets. In the education and business field, the focus has increased on technological advancement. This helps the students to build and work on their skills, which will benefit them throughout their lives [13]. For a university, it is cheaper using Facebook as a means of learning and knowledge delivery compared to Moodle. The teachers and professors appreciated the uniqueness and quality of the engagement with the students on Facebook. They even appreciated the visual resources that paved the way for a different type of learning [14]. A research study provided knowledgeable insights to develop the digital competency skills of teachers

for educational purposes [15]. Many students rely on social media and the Web for providing answers. This reflects that the focus on learning and retaining information has been reduced. Also, for the students who support multitasking with social media, i.e., surfing social networking platforms while studying, a reduction in academic performance has been observed because of such distractions. The ability of the students to concentrate on their academic duties is thus reduced because they access YouTube, Facebook, Twitter, Instagram, etc., which acts as a distraction and hinders their academic performance [13]. The students who spend more time on social networking sites, remain online and spend less time socializing with people face-to-face can communicate less effectively in person. In the student feedback, there is a need for more structuring, especially in the syllabus with clarity in learning objectives, guidelines for assignments, weekly discussion topics, projects, etc. [14] The teachers find it difficult to load students’ posts, blogs, and Web pages [16]. The advantage of social media platforms like Facebook is to give a familiar atmosphere to the students and teachers. The design of Facebook promotes social interchange between the users, increasing the association between the students working on the activities. Additionally, the teachers also have this opportunity to educate the students regarding how to use social networking platforms like Facebook and other social media platforms responsibly so that it benefits them [17].

2.3 Usage and applications of social media in higher education

Social media has brought a revolution recently in extending its subsequent applications and rapid generalization. This revolution is comparable to the rise in e-mail-based communication because it also has the power to alteration in social relations among users in the network. Therefore, social media has become a resourceful mode of interaction within different spaces. Higher educational institutions around the world are facing challenges to widening access to instructional content [18]. In the present scenario, social networking services allow people with common interests to get in touch through networks. Also, on social media platforms chat groups can be made along with messaging or a private chat feature is also available. Platforms like Facebook came into existence to support various congregations of students on college campuses, while some professional platforms like LinkedIn establish professional contacts, job types, recruitments, and trade through networking [19]. A research study provided a systematic review of research done on social media in higher education along with discussions on professional development. Nowadays it has been witnessed that social media-based online communities of

practices and professional learning networks are emerging as important avenues for faculty engagement [20].

It has been observed that people with different levels of education use different types of social media to perform their work [21]. Social media is also used professionally as a communication platform. It is used to build connections between professional individuals through networks for exchanging information [3]. Initially, people used social media mostly for routine activities and entertainment purposes, but gradually social media started gaining importance among individuals [22]. With the help of different applications, uses, and tools of social media, people and organizations directly communicate and interact with each other [23, 24]. Social media has witnessed a huge presence for learning and teaching purposes. Students are using social media for interactive communication in form of groups or private discussions [25]. A research study analyzed some aspects which affected the intent of social media usage for learning purposes. The factors explored along with confirmation were self, Information and Communication Technology (ICT), communication, efforts, performance, and collectivism [26].

Furthermore, social networking platforms have become a popular media for the dissemination of information and instrumental facilitators for performing social interactions. Social media users in higher education institutions are increasing day by day. Numerous research studies have attempted to elaborate and ponder upon the assistance of the educational process with the help of new technologies like social networking platforms, cloud computing, the Internet, and other online communities [27–30]. Social media characteristics and future avenues for development among students in the universities of Pakistan have also been discussed in a relevant research study [31]. For example, modern technologies have been advocated to support learning by students [32], teaching assistance [33], helping in collaboration among researchers from various parts of the world [34, 35], etc. Social media is playing a major role in recruitment and in improving the institutional staff's skills through professional training and development for overall growth [36]. A research study found that staff members of higher educational institutions used social media [37]. Factors to engage consumers of higher education, i.e., students, can be judged by customer engagement analysis [38]. Increased focus on students' social media usage has been witnessed gradually [39]. A research study was done on initiatives for e-learning in Indian higher education institutions during the Coronavirus crisis [40] and it was found that social media-based e-learning is gaining huge popularity [41]. Social media is playing a major role in learning and teaching pedagogy [42]. It was also found that in high schools in Ghana, social media integration had a positive impact on teaching and learning [43]. Impression management is an important tool for self-promotion [44]. Social media is a popular marketing strategy

for admissions to educational institutions [45]. Facebook has played a major role in the advertising and promotion of outreach events as well [46]. Social media has been an essential factor in educational assessments, online delivery, and collaborative networking [47]. Social media platforms like Twitter, ResearchGate, Academia, LinkedIn, etc. provide various benefits like proper execution of educational activities, career progression, collaborative projects, and management [48, 49]. Twitter is a major source of social media data [50]. A systematic mapping study observed how mobile learning applications including social networking can play a vital role in educational technology [51]. Assistive technology has been instrumental in learning, teaching, and administration [52]. ICT infrastructure has played a major role in educational improvement among learners with learning disabilities [53]. The amalgamation of social media platforms with Information and Communication Technology-based infrastructure can help in higher education development around the world. Social media platforms can help in the facilitation of an interactive experience along with cooperative and participative learning [54]. Social media has played a major role in higher education along with an essential driver to continue usage along with better Internet access [55]. A research study also performed structural equation modeling and confirmatory factor analysis to analyze social media usage among Japanese students [56].

The negative impact and misuse of social media in higher education need to be addressed. The prominence of online social networking and the massive speed at which undesirable information is distributed has made a negative effect. It also has a negative impact on the users' disposition toward appropriate spellings and the correct structure of sentences. This reduces the users' capacity to viably compose without depending on a computer's spell check highlight. It increases the possibility of hackers performing fraudulent activities like spamming, hacking, and virus attacks. It increases the risk of user's data and identity exploitation and theft. It drastically affects organizational behavior when negative appraisals, feedback, and comments start emerging between different levels of employees. Productivity, learning capacity, and memory retention ability are also getting hampered due to increased usage of social media. Students who do multitasking, i.e., use social media Web sites while studying, exhibit decreased academic performance. Face-to-face communication and socialization have decreased due to the increased usage of social media. The students prefer to talk with their classmates on social media rather than physically meeting them. This also results in the deterioration of communication skills. Many students are using social media for planning strikes and agitations in educational institutes. They are also using it for creating negative awareness among students. Students can post negative comments or

messages regarding their teachers. The increased availability of private information in the social media profiles of various students and employees has increased the risk of the information being exploited by potential hackers and criminals. Constant surfing and scrolling of Facebook and Twitter profiles result in addiction and depression. Some people get stressed and over-depressed by seeing their enemies. The probability of getting jealous also grows due to such posts, mainly photographs or videos. Social media has been a key medium in aggravating conflicts, agitations, and political participation [57]. Social media-based discussion forums also witnessed quarrels and conflicts among students and colleagues [58].

2.4 Various forms and types of social media

Some of the common forms of social media provided by a research study [59] are as follows:

- Social networking sites, e.g., Facebook, LinkedIn, Twitter, and others are quite common nowadays. Even those who do not have any social media profiles can get access to information circulated on such platforms. A key feature of such social networking sites is the list of users that connect among themselves.
- E-mail—this was found to be one of the most common forms of social media. E-mail (Electronic mail) involves users logging into an account for sending and receiving messages or emails.
- Texters—similarly, a texter is a two-way communication channel that allows users to send messages quickly to another person or a group of people.
- Blogs—the word blog was derived from “weblog.” A blog is a Web-based platform where people share information or ideas with a large group of readers via the Internet.
- Message boards—it was found that most sports channels, television programs, or other popular entertainment channels frequently circulate information on message boards. Message boards allow users to post messages that talk about a clearly defined subject.
- Connection sites—it is a type of connection site that comes under the classification of various forms in social media. Various users are found to approach such online dating sites by creating a profile.
- Games and entertainment—nowadays social media platforms provide gaming facilities like online games and entertainment. They often carry a social dimension.
- Apps—apps are mobile applications. These apps are not directly coming under forms of social media, but most of the time users can connect through apps through another

form of social networking platform. More often apps have built-in social media facilities.

The secondary data collected from the review of literature also helped in extracting social media usage in higher educational institutions. The review of the literature helped in finding the research gaps and problems. There is a huge need to explore new avenues of social media and higher education because of the Coronavirus crisis. One of the main research questions of the study was to find the major social media usages among the stakeholders in higher educational institutions. Various problems are being faced due to the COVID-19 pandemic. Analyzing the consequences of social media usage during such trying times of the Coronavirus crisis is the need of the hour. A panoramic view of all the research studies done in this domain was also needed. Formulation of educational strategies and remedial measures to bring out the advantages and minimize the disadvantages was also a crucial challenge. The research gaps and problems of the study were addressed accordingly. The next section of the study discusses the research methodology.

3 Methodology

The research study attempted to analyze the impact of social media on higher educational institutions. The stakeholders of higher education institutions considered in the study were teachers, faculties, students, administrative officers, staff, and other employees working for the institution. External entities like guardians or parents of students, government agencies, vendors or third parties, industries, and other sponsored bodies were also taken into account. The study collected data from both primary and secondary sources around the world with a special emphasis on India while collecting primary data. Primary data were extracted with the assistance of expert surveys, brainstorming sessions, the Delphi method, and a survey questionnaire that was voluntarily filled or answered by respondents who were stakeholders of higher education institutions. The primary data needed for the study were collected through online mode to maintain social distancing norms and travel restrictions. The type of sampling implemented during the primary survey-based data collection process was judgmental sampling. This helped in extracting accurate data from the respondents because they already had prior knowledge regarding the survey. Secondary data were extracted from renowned databases research articles and other relevant sources across the world. The study was performed with the help of an extensive literature review that facilitated the extraction of various impacts of social media usage on higher education from the relevant research articles and motivational studies in the domain. Primary data were collected from April 2020 to December

2021, whereas secondary data were collected from January 2002 to August 2022. Therefore, the data collected to find social media usage were extracted from secondary sources, whereas primary data were also collected to pursue further analysis.

The research questions of this study are as follows:

- What is the current status of research studies on social media and higher education?
- What are the major social media usages in higher education institutions during the COVID-19 pandemic?
- What is the prioritized ranking of social media usage according to the perception of the stakeholders in higher education institutions?
- How to reduce the negativity of social media usage and enhance the positivity in the higher education environment?

The bibliometric analysis of social media and higher education institutions was done to investigate research studies across the world. The keywords taken into account in the study were derived after a rigorous review of the literature at the global level and formulated after continuous validation among the experts in this domain. A mind map was developed with the help of brainstorming sessions conducted among a few experts all over the world. The flowchart was designed to get a panoramic view of the various social media usages by the stakeholders of higher education. It also provided a platform for the formation of the preliminary framework for the study. The Delphi method and expert surveys were done for further validation because many factors and uses of social media in the educational environment were found from a secondary source-based review of the literature. So, to justify and extract the main social media usages the Delphi method-based expert surveys along with brainstorming-based discussion sessions were conducted among the higher educational stakeholders, professionals, and expert academicians. After this, a questionnaire-based primary survey was done using Google Forms. It was circulated to get the views of all the internal and external stakeholders of higher education institutions for having an idea regarding all the social media usage during the COVID-19 pandemic. Necessary permissions and consent were ensured while conducting the data collection process. The primary survey-based questionnaire was floated among all the stakeholders of higher education institutions in India while the Delphi method was conducted among experts across the world. The data collected from the responses helped in verifying the inputs for further analysis.

The tools and software used in the research study were RStudio, Google Forms, Diagrams.net, and AHP-OS. This study used multiple tools and techniques to achieve various objectives to cover the gaps and derive suitable

findings or answers to the research questions accordingly. RStudio is an IDE (Integrated Development Environment) for the R programming language useful for statistical computations and bibliometric analysis [63, 66]. IBM-SPSS is a statistical tool useful for advanced analytics, Diagrams.net is an online tool used for drawing flowcharts or graphs and Google Forms is a software used for the administration of surveys [63]. The AHP-OS tool was instrumental in performing the analytic hierarchy process (AHP) [60]. It was done after the extraction of the respondents' feedback based on ranking various factors of social media usage in the higher education environment. The AHP helped in performing the quantitative analysis. It was done with the help of the multicriteria decision-making (MCDM) technique which was essential for the calculation of the ranking-based priorities [61]. AHP is a relevant technique being used extensively nowadays [62]. Its implementation of AHP helped in assigning weights to various social media usage-based factors accordingly. This also facilitated the generation of a suitable method for ranking social media usage and the factors could be evaluated because of the weighted priorities. Moreover, another relevant study performed analytic hierarchy process with the assistance of the AHP-OS tool along with bibliometric analysis with the help of RStudio's Bibliometrix package which was also found to help in providing crucial insights to move forward [63–66].

The primary survey-based data collected from stakeholders of higher educational institutions also helped in understanding social media usage with deeper insights. It provided a qualitative analysis of the relationship between various social media usages based on factors in the higher educational atmosphere. The analytic hierarchy process (AHP) helped in justifying the prioritization of the various factors of social media usage. The results obtained from the analytic tools were subsequently validated and verified accordingly. The subject matter experts and data extracted from the review of the literature provide a substantial contribution to the formulation of the research objectives.

The research objectives of the study have been developed on the basis of the research questions and gaps found while pursuing the study. These are as follows:

- Exploring the research studies being pursued around the globe on social media and higher education;
- Finding various social media usages in higher educational institutions during the COVID-19 pandemic;
- Ranking social media usage according to the higher education perspective;
- Suggesting remedial measures and educational strategies for enhancing the positivity of social media impact on higher education.

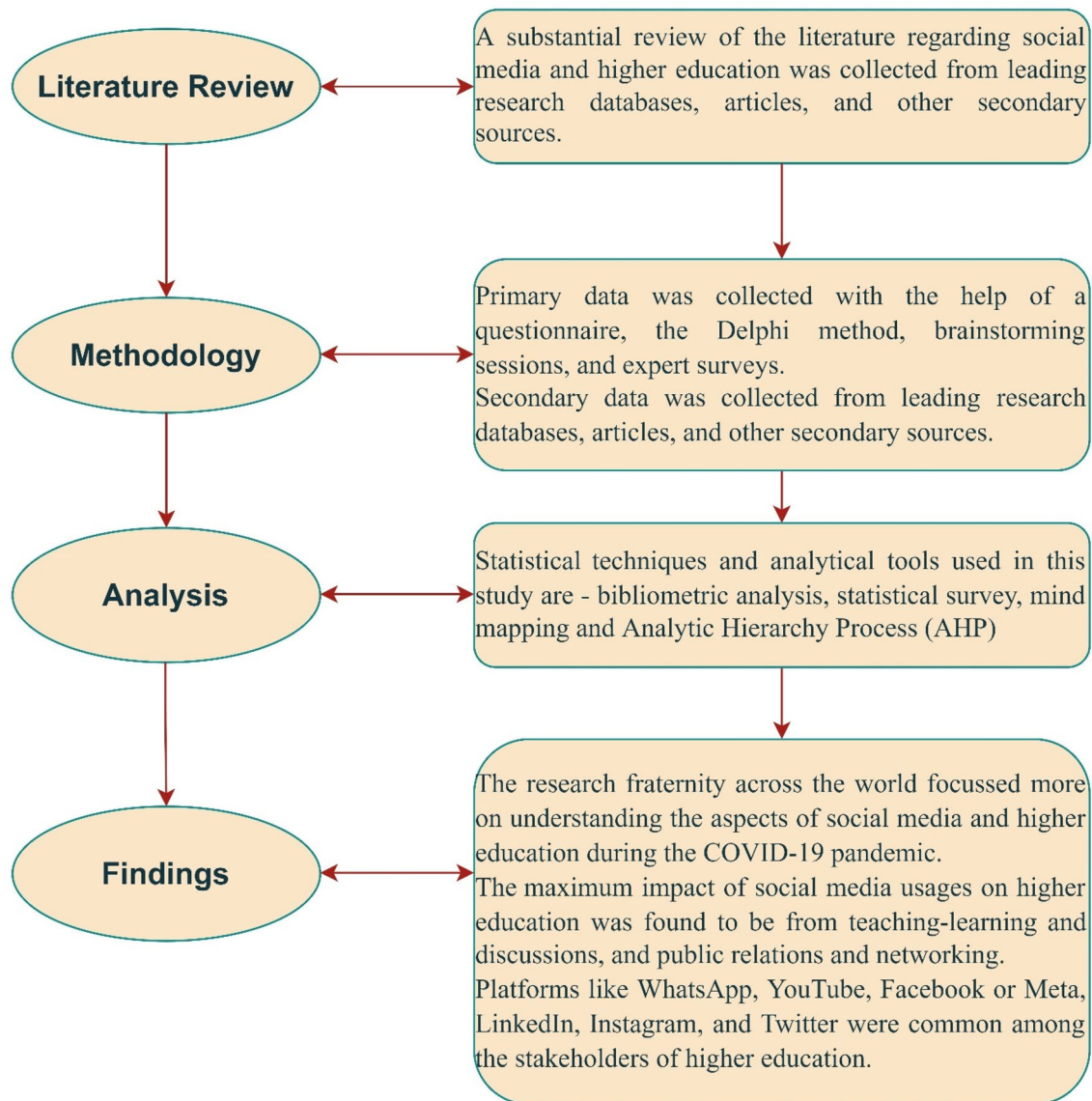


Fig. 1 Structure regarding research plan (generated by Diagrams.net tool)

The structure of the research plan is depicted in Fig. 1. The figure provides a panoramic view of the research study in the form of a modular flowchart. It was generated by the help Diagrams.net tool.

The factors or aspects of social media usage which were taken into the study were as follows:

- Teaching, learning, and discussions—social media can be used for teaching, learning, and discussion purposes;
- Grievance and conflicts—social media can be used in sharing or resolving grievances and negotiating conflicts in educational institutions;
- Outreach activities—social media can be used in circulating information, planning, and organizing academic events or other activities;
- Publicity and branding—social media can be used for marketing and publicity to ensure branding. This helps in increasing the institutional reach in making it famous
- Admissions—social media can be used for procuring and circulating information regarding admissions and managing them accordingly
- Execution management—social media can be used to manage and execute academic activities
- Public relations and networking—social media can be used for maintaining public relations and ensuring social networking among various stakeholders
- E-procurement—social media can be used for purchasing or procurement of products and services
- Project management—social media can be used for getting information, planning, and managing projects

- Impression management—social media can be used to manage the impression and influence the perception of others
- Placements and recruitment—social media can be used for procuring or circulating information regarding placements and recruitments (off or on campus). It can be instrumental in conducting recruitment and also help potential candidates with the joining processes.

4 Analysis and findings

The study performed various types of analysis to extract crucial findings required to justify the research being conducted. This section comprises various sub-parts, namely bibliometric analysis, mind mapping, statistical survey, and analytic hierarchy process (AHP).

4.1 Bibliometric analysis

The bibliometric analysis was done with the help of secondary data collected from renowned research databases across the world. All the relevant research publications and motivational studies extracted for this study were explored thoroughly. The Clarivate Analytics' Web of Science (WoS) and Elsevier's Scopus are considered to be major databases for research articles and bibliometric analysis has been done on the extracted data by relevant studies [63–65]. The bibliometric analysis was performed by the software RStudio

which has a package named Bibliometrix [66]. The co-occurrence network of keywords, word cloud, thematic map, thematic evolution, co-word analysis, and country-based collaboration network was done. The Internet-based services, namely Zoom, Google Meet, and Gmail, and social networking platforms like WhatsApp, Facebook (Meta), LinkedIn, and Twitter ensured proper data collection and validation of the set of keywords along with the pilot testing for justification of relevant results. The rigorous review of the literature also helped in finalizing the keywords. Firstly, the keyword-based search comprised social media and higher education to extract research articles across the world. The keywords used in the study were also validated by subject matter experts and social media analysts. Hence the search process was done with “social media” as the first keyword along with “higher education” as the second keyword and the AND Boolean gate or operator was used. So, the intersection set of both keywords was taken with the help of AND Boolean gate. The criteria regarding the “all fields” search option were selected to take all fields of the research publications present in the leading databases. After this process, a total number of 1108 research publications were extracted from the WoS database and 35,115 research articles were found from the Scopus database. Further analysis was done with RStudio software on the data retrieved from the WoS core collection because it was relevant and a huge amount of data gathered from the Scopus database was not feasible for analysis due to the limitations of the RStudio software. Figure 2 provides an analysis done year-wise of the research studies

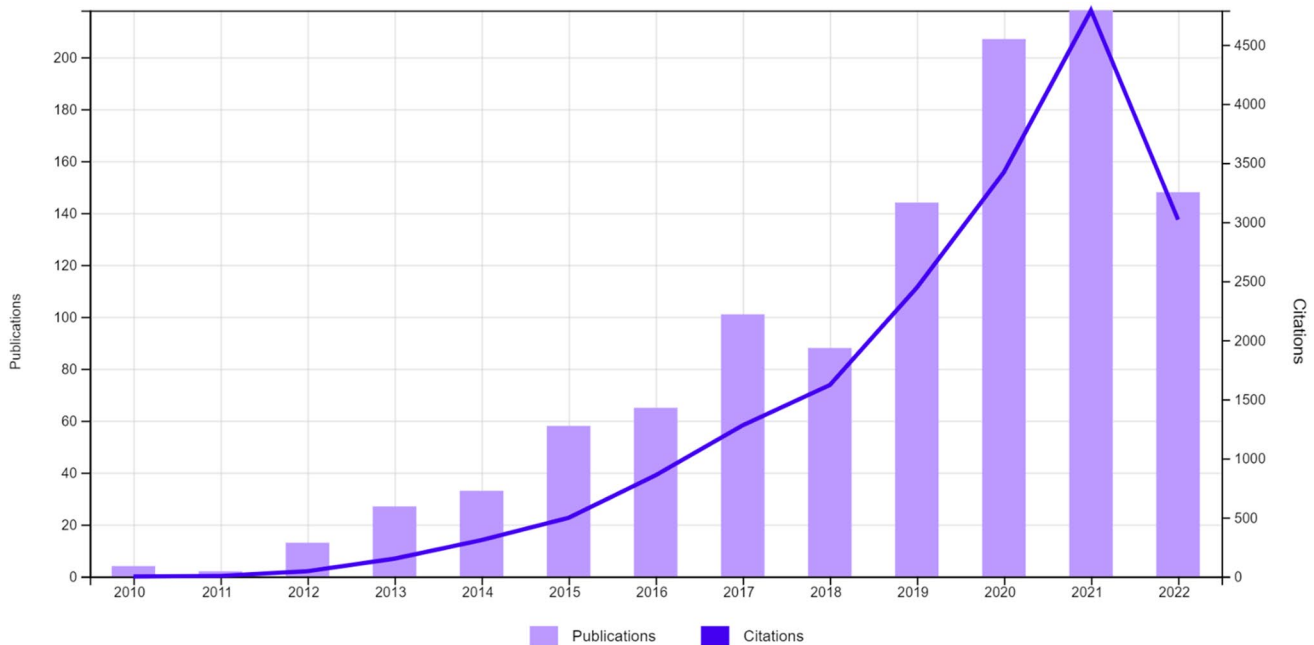


Fig. 2 Chart regarding research publications based on the years V/S No. of publications and citations from January 2002 to August 2022 (Source: Web of Science)

published from 1 January 2002 to 19 August 2022, i.e., the date until which the research study was completed. The years are denoted by the horizontal axis while the vertical axis is divided into two parts, where the left part denotes the number of publications and the vertical axis denotes citations on the right side of the figure. The color-coding for indexing purposes is provided in Fig. 2. It can be observed that the vertical Y-axis denoted the number of publications from the left, whereas it denotes the number of citations at the right part of the figure. The horizontal X-axis denotes the years in ascending order from 2010 to 2022. It should also be noted that on the left part of the figure, 1 unit of the Y-axis is equal to 20 publications, whereas on the right side of the figure, 1 unit of the Y-axis is equal to 500 citations. Moreover, 1 unit of the X-axis represents each year. While observing the figure, it was found that the number of research publications and citations has increased during the COVID-19 pandemic as observed in the figure. Figure 2 is created by using the WoS platform.

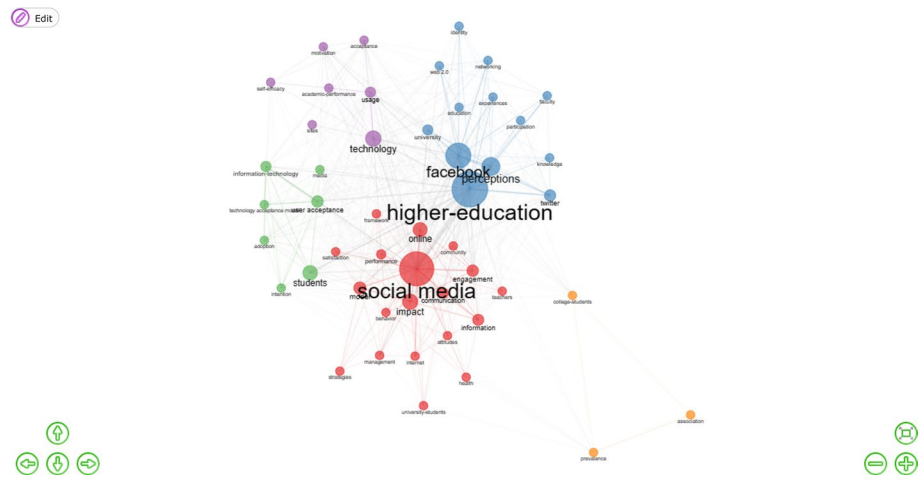
Further analysis was done with the help of the WoS database by using the same set of keywords, i.e., social media and higher education. A total number of 1108 research articles were extracted from conference proceedings, journals, reviews, research articles, etc. and were explored thoroughly. The retrieved data were in the form of BibTeX which was appropriate as an input file for the Bibliometrix package of RStudio and its Biblioshiny interface. The top 10 words

based on a relevance that was being used frequently in the WoS research studies across the world were social media, higher education, Facebook, perceptions, impact, students, technology, online, model, and Twitter. Figure 3 depicts the word cloud. The number of words was set to 100 and the field chosen was keywords plus. According to the frequency of the occurrence of the keywords, the word occurrence measure was set. The shape selected was a circle with a font size of 1 and ellipticity of 0.65 for better observation of the figure. Figure 4 depicts the co-occurrence network based on the keywords extracted. The co-occurrence network was designed by selecting the type of field setting as keywords plus and the network layout was set to automatic. The normalization was set to the type named association, and the clustering algorithm was set to Louvain. The network parameters were set accordingly for generated a suitable figure. The number of nodes was set to 50 and it was done without removing any isolated nodes. The repulsion force was set to 0.1 while the minimum number of edges was 2. The graphical parameters were inputted accordingly for making the figure graphically clear and precise. The opacity was set to 0.7, whereas the number of labels was set to 50. The node shape was selected as a dot, whereas the edge size was set to 4 and the label size was set to 5 for viewing the figures in a better way. These sizes are based on a proportional scale formulated by the software with the maximum size being 20. Figures 3 and 4 provide a bird’s-eye view of the important



Fig. 3 Word cloud (generated by RStudio software)

Fig. 4 Co-occurrence network based on keywords (generated by RStudio software)



keywords on which most of the research studies are being done in the area of social media and higher education. This helped in moving ahead with the research study.

While creating the thematic map and evolution, the field was selected as keyword plus and the number of words was kept in the range between 50 and 500 to ensure the maximum range for the best output. The number of labels for each cluster was kept at 2 and the minimum cluster frequency per thousand documents was kept at 5. The label size was set to 0.05 for viewing the thematic map in a better way. As already mentioned, the unit of size is based on a relative scale defined by the tool itself with the maximum size being 1. The thematic map is provided in Fig. 5. The axis is formulated based on density and centrality. The thematic map has been divided into four quadrants, namely the emerging or declining themes, motor themes, basic themes, and niche themes. The horizontal and vertical axes provided in the figure as dotted lines divide the thematic map into four quadrants. The basic themes comprised higher education, Facebook, impact, and model. The social media and online were found to be in between the two quadrants, namely basic and motor themes. The relevant clusters observed in the quadrant regarding niche themes were transition, diversity, students, and media. Again, it was observed that the cluster health and college students were located in between the niche and motor themes. An interesting observation about the motor themes was that all clusters in this quadrant were sharing their space with other quadrant-based themes. The emerging or declining themes comprised performance and framework. The thematic evolution is depicted in Fig. 6. The option regarding weight index was selected as an inclusion index weighted by word occurrences. All other were kept similar to the same inputted data for generating the thematic map. This analysis has been done based on the co-words network and clustering [67]. The thematic evolution helped in detecting conceptual sub-domains [68]. Therefore, the

figures were instrumental in providing the mapping-based visualization of the relevant research fields along with the sub-themes or sub-domains. The number of cutting points was set to 1 and the cutting year was selected as 2019 to explore the shift of themes before and during the COVID-19 pandemic. Figure 6 shows that from the year 2010 to 2019 the theme-based keywords comprised mobility, user acceptance, communication, students, integration, higher education, performance, model, information, social media, and culture, whereas from the year 2020 to 2022 it was observed that the theme-based keywords were higher education, social media, framework, system, impact, reviews, diversity, university students, health, culture, and fit. Here it can be observed that the words mentioned before the Coronavirus crisis are more toward acceptance of social media among students for communication and integrating performance models in higher education, but the themes mentioned in the timeline during the COVID-19 pandemic have shifted toward keywords like health, culture, fit, etc. This reflects the need to enhance wellness standards during such challenging times.

Based on the bibliographic data extracted, the co-words were also analyzed further by mapping the conceptual structure of the framework based on word co-occurrence. Figure 7 illustrates the results of the co-word analysis. This analysis was conducted by selecting the multidimensional scaling technique. It is basically a dimensionality reduction technique. The clustering observed in Fig. 7 helped in understanding the research documents having common concepts along with the conceptual structure for the same. The results in Fig. 7 are plotted in a 2-D map where the label size was set to 10. Here 1 unit of the horizontal X-axis and vertical Y-axis is equal to 0.1 in the map provided in Fig. 7. The algorithms used for performing this analysis are Porter's stemming and other natural language processing algorithms [63, 66]. It can be observed in the figure that words like prevalence, association, university students, and

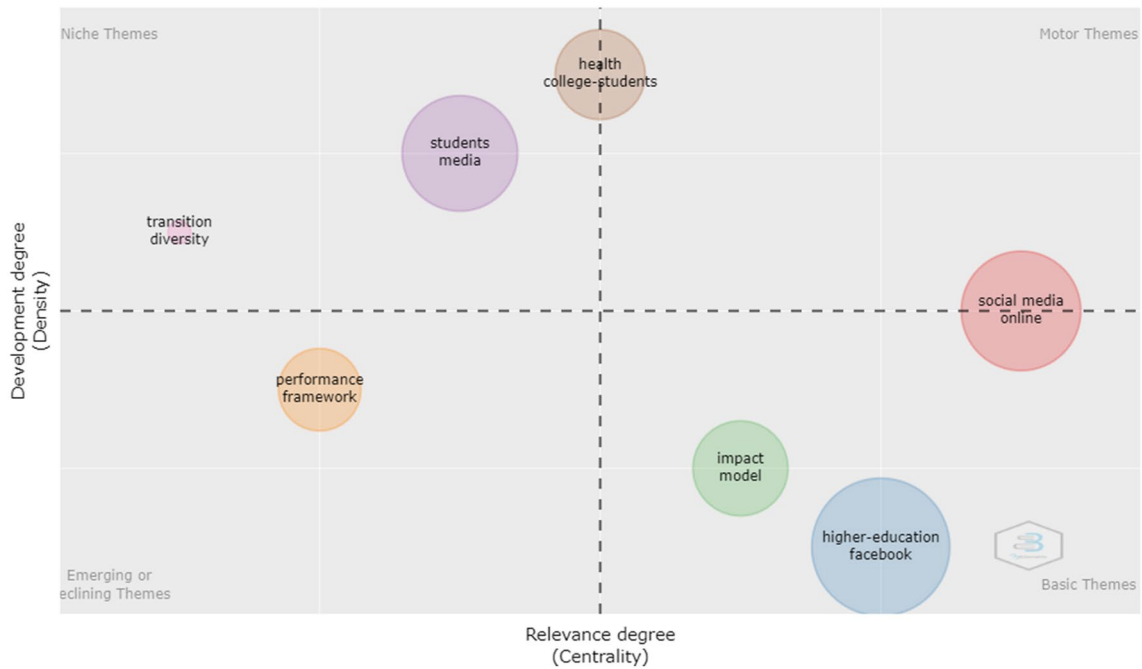


Fig. 5 Thematic map (generated by RStudio software)

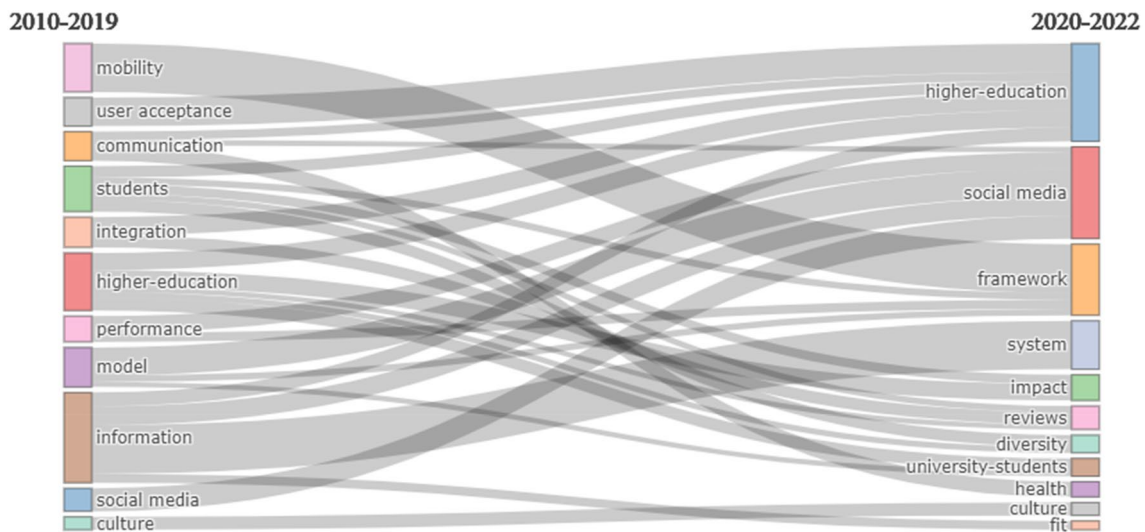


Fig. 6 Thematic evolution (generated by RStudio software)

school have clustered together. Some of the relevant words like health, technology model, user acceptance, information technology, self-efficacy, motivation, academic performance, networking, university, college students, etc. have teamed up together.

Figure 8 depicts the graphical representation of the countries across the world pursuing the maximum number of research studies in the area of social media and higher

education. It should be noted that in the figure provided, 1 unit of the vertical Y-axis is equal to 20 research publications, whereas 1 unit of the horizontal X-axis represents a country or region. It can be observed in the figure that the top countries working in this research area were found to be the USA, China, England, Australia, Malaysia, Spain, Poland, Canada, Taiwan, and Brazil. Here it can also be observed that a very smaller number of research studies have

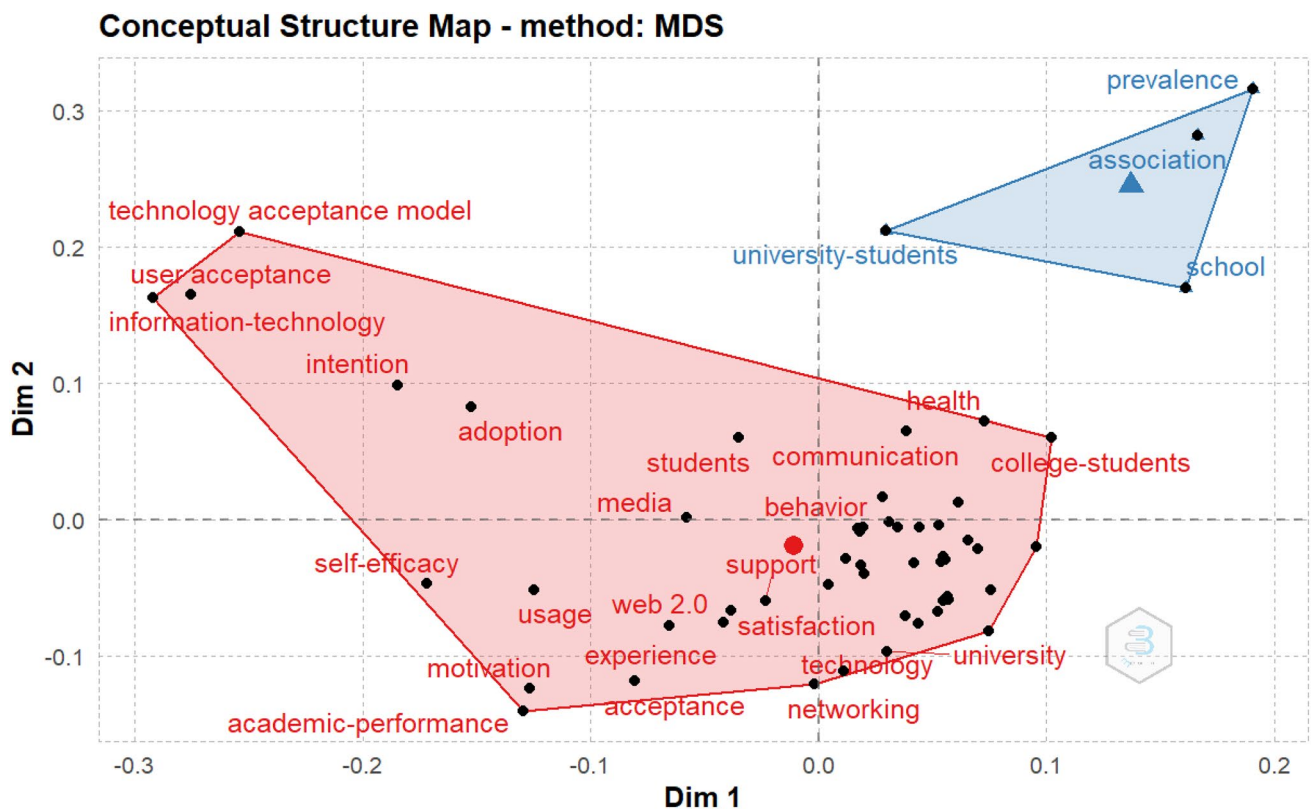


Fig. 7 Co-word analysis-based map regarding conceptual structure using multidimensional scaling technique (generated by RStudio software)

been done by Indian researchers. The collaboration network based on countries across the world is depicted in Fig. 9. The label size was set to 4, whereas the edge size was set to 5. The isolated nodes were not removed to explore the countries pursuing research on their own rather than collaborating with other countries. It provided a bird's-eye view of the countries pursuing research in the domain along with the connected network among other countries for pursuing collaborative research in the global arena. It was observed that most of the countries collaborated to perform research on social media and higher education. Figure 9 shows that many countries like South Africa, Serbia, Israel, Jordan, Denmark, Tanzania, Sri Lanka, etc. are isolated nodes because these countries are pursuing research on social media and higher education without collaborating with other countries.

Figures 3, 4, 5, 6, 7, and 9 are generated with the help of the Biblioshiny interface, RStudio, and its package named Bibliometrix, whereas Figs. 2 and 8 are generated in the WoS platform itself. After the rigorous analysis of the information extracted from the WoS platform and the manual exploration of other research databases, it was observed that there has been a steady increase in the number of research publications from the year 2020, i.e., during the COVID-19 pandemic. Therefore, it was found that the research community across the world started analyzing social media and

higher education with higher priority because of the growing need during such trying times of the Coronavirus crisis. But a notable research gap found while performing this analysis is that less research studies had been conducted in India on this domain in comparison to other developed or developing countries across the globe. Therefore, this study also helped in digging deeper insights to explore novel findings on social media in higher education institutions in India. So, the preliminary study explored relevant research studies across the world while pursuing the review of the literature and bibliometric analysis, but eventually attempted to focus on India while conducting the statistical analysis of the data collected by the primary survey-based questionnaires.

4.2 Mind mapping

A preliminary framework-based flowchart was developed with the help of brainstorming sessions and mind mapping techniques. The online tool named Diagrams.net (earlier named Draw.io) has been used because it is a widely used platform to create interactive flowcharts and diagrams. Mind mapping is a commonly used technique to visualize problems and solve educational issues [69, 70]. It helped in checking the impact of social media on various stakeholders of higher education. The participation of the experts,

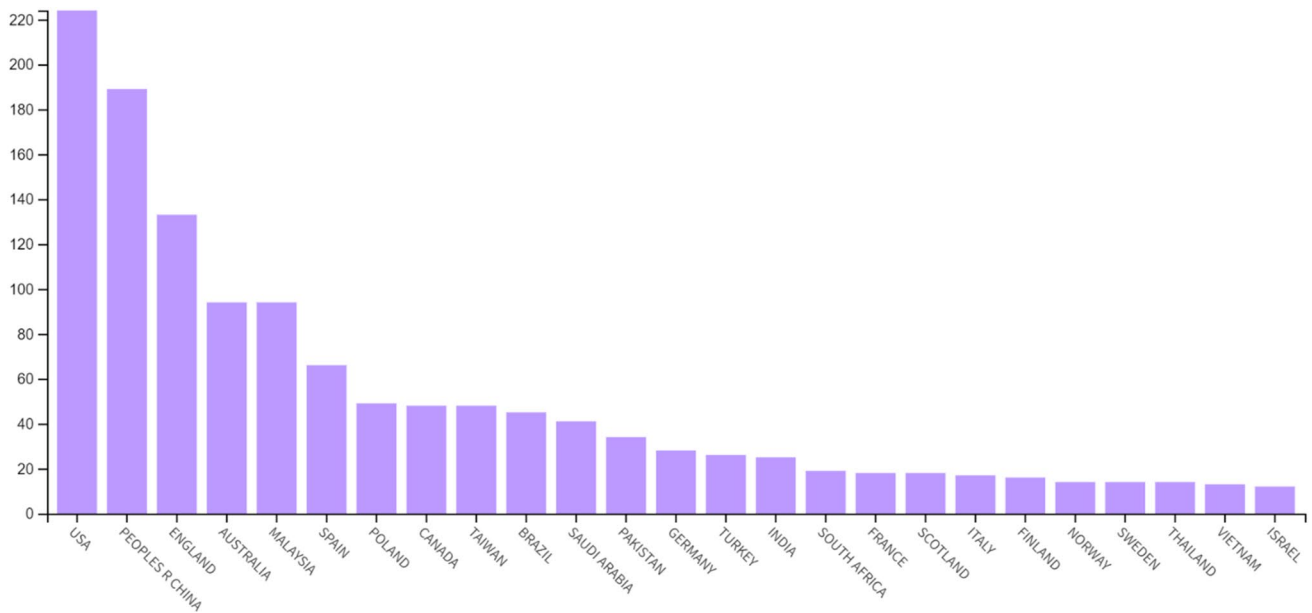


Fig. 8 Bar chart representing the countries pursuing research on social media and higher education (Source: WoS)

academicians, students, research scholars, staff, administrative officers, faculties, teachers, and external entities was completely voluntary. The primary data needed for the study were collected with the help of Google Forms, Zoom, Google Meet, Facebook, Twitter, WhatsApp, and LinkedIn to maintain social distancing norms and travel restrictions. The mind mapping flowchart depicted in Fig. 10 was drawn with the help of an expert panel-based brainstorming session and the questionnaire-based primary survey. The mind map offers a panoramic view of the various social media usages by different types of stakeholders in the educational environment.

It was found that various stakeholders had different needs for social media and used it extensively. The students used social media for admission, grievance and conflicts, placements and recruitment, outreach activity, teaching–learning and discussions, public relations and networking, and impression management. The teachers or faculties used social media for grievance and conflicts, project management, outreach activity, teaching–learning and discussions, public relations and networking, and impression management. The administrative officers, staff, and other employees used social media for admission, publicity and branding, e-procurement, project management, grievance and conflict management, placements and recruitment, outreach activity, public relations and networking, and execution management. External entities like students’ parents or guardians, third-party vendors, collaborative industries, government agencies, and other sponsored bodies used social media for project management, grievance and conflicts, admissions, e-procurement, and public relations and networking.

4.3 Statistical survey

Data were collected from all types of stakeholders with the help of a Google Forms-based questionnaire during the COVID-19 pandemic. The stakeholders considered in the study are students, teachers, administrative officers, staff, and other employees of higher education institutions in India. Moreover, external entities like guardians or parents of students, vendors or third parties, government agencies, industries, experts, and sponsored bodies were also considered in the study. A total number of 584 responses were collected while conducting the primary survey. The results were analyzed in IBM-SPSS software along with the help of Microsoft Excel. The data collected were found to be reliable and ethical. The Cronbach Alpha value for all constructs was within the acceptable range, i.e., more than 0.7. The respondents were informed about the survey, and data were collected according to their consent after taking the required permissions.

Some of the relevant questions asked while conducting the primary survey were as follows:

- Which social media platforms do you use?
- Which stakeholders' cluster do you belong to?
- Kindly specify your social media usage for day-to-day educational purposes.
- Which purposes are found to be most popular within higher education institutions and exhibit maximum social media impact?
- Please rank social media usage on the basis of judging its impact on higher education institutions;

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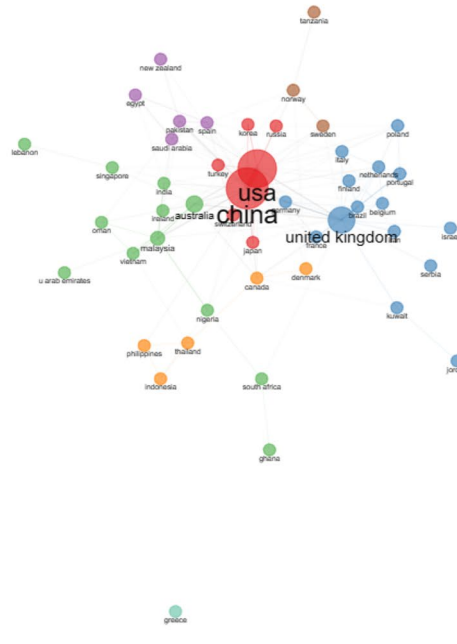


Fig. 9 Collaboration network based on countries across the world (generated by RStudio software)

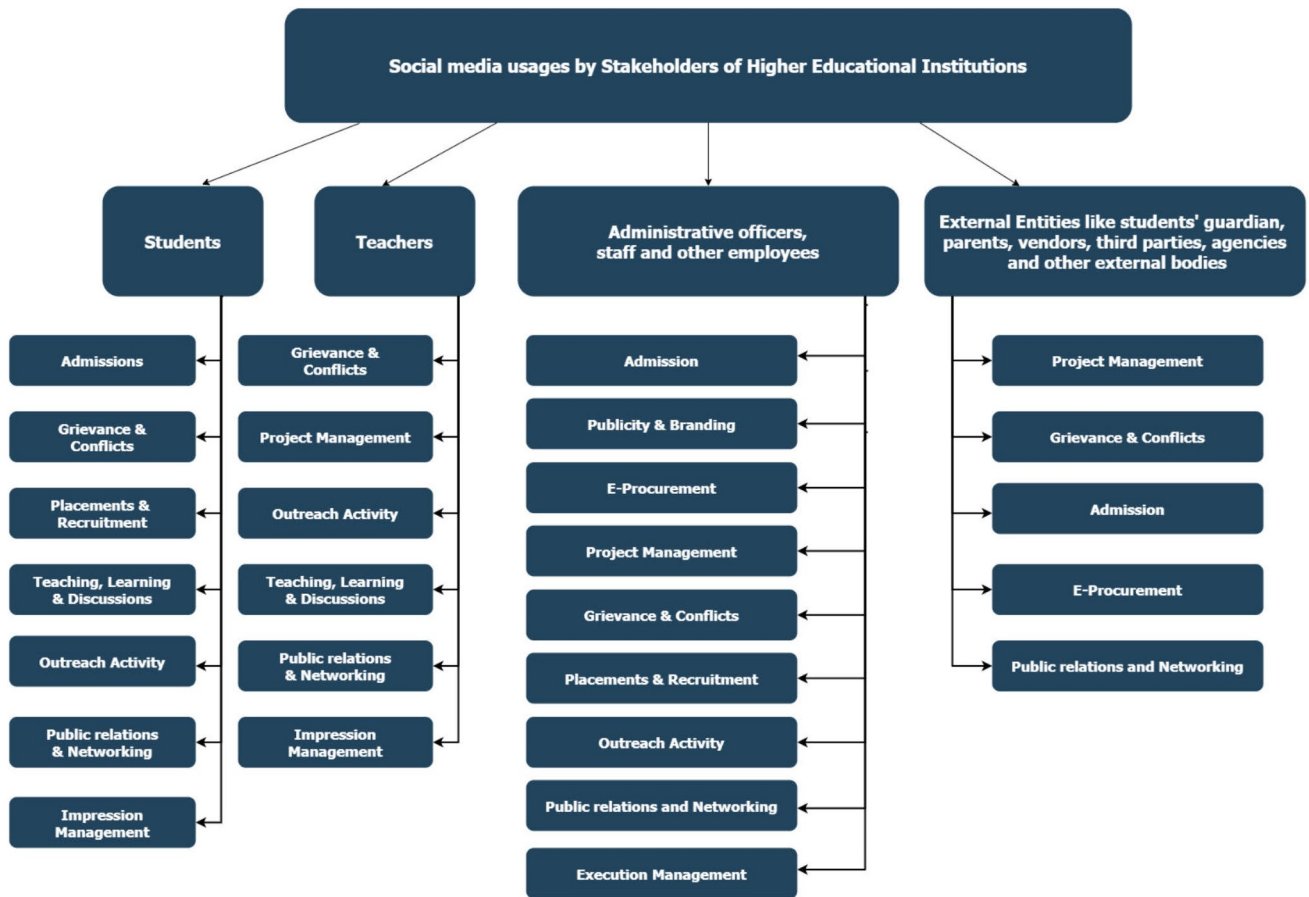


Fig. 10 Mind map of social media usages by various stakeholders of higher educational institutions (generated by Diagrams.net tool)

- Does social media usage have a substantial impact on higher educational institutions?
- Do you feel that the impact of positive social media usage in higher educational institutions can be increased or maximized?
- Do you feel that the impact of negative social media usage in higher educational institutions can be reduced or eliminated?
- From the following options (all social media usage), select the impact of social media usage in terms of positivity, negativity, and neutrality in the educational environment;
- Remedial measures that can help in resolving the negative impact of social media usage and inculcate positivity?

The age group of the respondents is provided in Table 1. Most respondents were from 18 to 25 years of age, 26 to 35 years, and 36 to 45 years of age sequentially. So, the majority of the stakeholders in higher educational institutions were aged between 18 and 45 years because it comprised mostly of students and teachers. Very few respondents were below 18 years and above 60 comprising some external entities or others. The data regarding the distribution of respondents on the basis of stakeholders in higher education are provided in Table 2. Most of the respondents were students, research scholars, teachers, and faculties because they constitute to be the major stakeholders in higher education institutions. It was found that there were 369 male respondents, i.e., 63.2% of the responses, whereas there were 215 female respondents which comprised 36.8% of the respondents. Figure 11 shows the pie chart for showing the percentage of respondents' distribution in using major social networking platforms in higher education institutions. It was observed that the respondents preferred using social networking platforms, namely WhatsApp, YouTube, Facebook or Meta, LinkedIn, Instagram, Twitter, and ResearchGate. The sequence of the social networking platforms mentioned in the previous sentence is in order from highest to lowest usage among the stakeholders in higher education institutions in India. The question asked in the primary survey-based questionnaire to extract responses regarding usage of social networking platforms used the checkboxes option in Google Forms so that the respondents could select more than one option and mention other social media platforms as well. Therefore, Fig. 11 shows that 96.10% of the respondents preferred using WhatsApp, 81.20% of the respondents used YouTube, 72.10% of the respondents used Facebook or Meta, 66.80% used LinkedIn, 65.40% used Instagram, 33.90% used Twitter, whereas 31% used ResearchGate also. But very few respondents also used Telegram, Snapchat, Reddit, etc.

Table 1 Age group of respondents

Age group	Number of respondents	Percentage of respondents (%)
Below 18 years of age	3	0.5
18–25 years	277	47.4
26–35 years	175	30
36–45 years	90	15.4
46–60 years	31	5.3
Above 60 years of age	8	1.4
Total	584	100

Table 2 Distribution of responses on the basis of stakeholders in higher education

Stakeholder	No. of responses	Percentage of respondents (%)
Students or research scholars	330	56.5
Teachers or faculties	155	26.5
Administrative officers or staff or other employees	47	8
External entities or others	52	9
Total	584	100

It was found that the majority of the respondents, i.e., 72% of the stakeholders agreed that social media usage had a substantial impact on higher educational institutions. Moreover, it was observed that 74.5% of the respondents felt that the impact of positive social media usage in higher educational institutions can be increased or maximized, whereas 58.2% of the stakeholders felt that the impact of negative social media usage in higher educational institutions can be reduced or eliminated. Most of the stakeholders agreed to the fact that social media platforms are used for various purposes in higher education like teaching–learning and discussions, public relations and networking, outreach activities, grievance and conflicts, placements and recruitment, project management, impression management, admissions, publicity and branding, execution management, and e-procurement. The majority of respondents found teaching–learning and discussions, and public relations and networking to be most popular within higher education. They also agreed to the fact that these two social media usages were used for day-to-day educational purposes and exhibited maximum social media impact on higher educational institutions. The study also found that most of the stakeholders responded that all social media usage had a positive impact on higher education institutions except grievance and conflicts. It was also found that the majority of the respondents agreed that

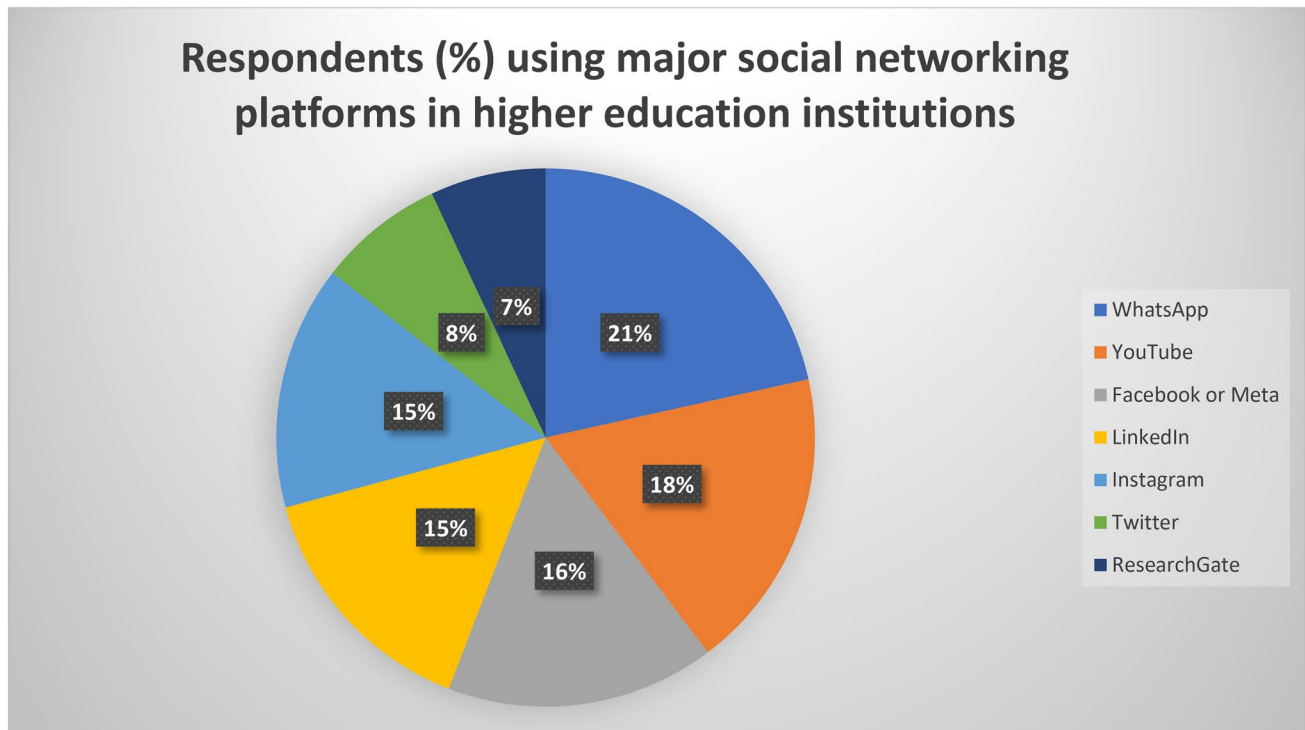


Fig. 11 Pie chart regarding the distribution of respondents using various social networking platforms in higher education institutions

awareness drives, counseling sessions, sentiment analysis, mood recognition, social media management, continuous monitoring, and surveillance can be some of the remedial measures that can help in resolving the negative impact of social media usages and inculcate positivity in the higher education environment.

4.4 Analytic Hierarchy Process (AHP)

This subsection investigates the ranks and weights with the help of AHP. The analysis focused on finding the ranks of social media usage with the help of the analytic hierarchy process (AHP). So, in this analytic process, the priority and ranks of various social media usages were found with the help of a tool named the AHP-OS calculator [60]. The AHP-OS is a widely used online tool to perform analytic hierarchy process efficiently [63]. The factors were extracted with the help of secondary data, whereas they were analyzed on the basis of the primary data collected. Various social networking platforms and Google Forms proved to be instrumental while collecting the relevant responses. The Delphi method and questionnaire-based survey responses were the primary sources of data. The relevant research articles explored while performing the review of the literature and leading research databases were the secondary sources of the data. The priority method of the AHP process was implemented to analyze the aspects of the criteria. The research work done in this

study is limited to calculating the priority of social media usage with the help of the weighted ranking-based AHP method. A ranking framework-based question was incorporated into the survey questionnaire to extract relevant feedback on social media usage among the stakeholders in higher education institutions in India. The primary data extracted from the primary survey-based questionnaire and responses from the majority of the respondents were inputted accordingly. There were 11 social media usages, namely teaching–learning and discussions, grievances and conflicts, outreach activities, publicity and branding, admissions, placements and recruitment, execution management, public relations and networking, e-procurement, project management, and impression management, which were used as the criteria for calculating the AHP priority. The study pondered on finding the weighted ranks of the social media usages and not on computing the alternatives. So, there were a total of 55 pair-wise comparisons in which the input for the AHP priorities was provided based on the responses collected from the questionnaire. The resulting weights were based on the principal eigenvector of the decision matrix given in Table 3. The numbers 1–11 given in the decision matrix in Table 3 and the abbreviations provided in Fig. 12 are the social media usages whose indexing of numbers and full forms of abbreviations are provided in Table 4.

Table 4 presents easy understanding of the indexing of the numbers provided on the matrix in Table 3 and

Table 3 Decision matrix for the resulting weights based on the principal eigenvector

	1	2	3	4	5	6	7	8	9	10	11
1	1.00	3.00	2.00	8.00	7.00	4.00	9.00	2.00	9.00	5.00	6.00
2	0.33	1.00	1.00	5.00	4.00	2.00	6.00	0.50	7.00	2.00	3.00
3	0.50	1.00	1.00	6.00	5.00	2.00	7.00	1.00	8.00	3.00	4.00
4	0.12	0.20	0.17	1.00	1.00	0.25	2.00	0.14	2.00	0.33	0.50
5	0.14	0.25	0.20	1.00	1.00	0.33	2.00	0.17	3.00	0.50	0.50
6	0.25	0.50	0.50	4.00	3.00	1.00	5.00	0.33	6.00	1.00	2.00
7	0.11	0.17	0.14	0.50	0.50	0.20	1.00	0.12	2.00	0.25	0.33
8	0.50	2.00	1.00	7.00	6.00	3.00	8.00	1.00	9.00	4.00	5.00
9	0.11	0.14	0.12	0.50	0.33	0.17	0.50	0.11	1.00	0.20	0.25
10	0.20	0.50	0.33	3.00	2.00	1.00	4.00	0.25	5.00	1.00	1.00
11	0.17	0.33	0.25	2.00	2.00	0.50	3.00	0.20	4.00	1.00	1.00

Authors’ self-compilation from the data generated by the AHP-OS tool. Refer to Table 4 for understanding the meanings of the numbers provided in the first row and first column of the decision matrix

Table 4 Number-based indexing and full forms of abbreviations regarding social media usage in higher educational institutions

Number	Abbreviations	Social media usages
1	TL	Teaching–learning and discussions
2	GC	Grievance and conflicts
3	OA	Outreach activities
4	PB	Publicity and branding
5	AD	Admissions
6	PM	Placements and recruitment
7	EM	Execution management
8	PR	Public relations and networking
9	EP	E-procurement
10	PJ	Project management
11	IM	Impression management

abbreviations in Fig. 12. Table 5 provides the resulting weights for the criteria on the basis of the pair-wise comparisons inputted in the AHP-OS tool eventually. Table 5 also provides the ranks of various social media usage along with their priorities respectively. As already mentioned, the number of comparisons was found to be 55 because of 11 social media usages. The consistency ratio (CR) was found to be 0.018 or 1.8%. The principal eigenvalue was found to be 11.278. It was also observed that the eigenvector solution had 5 iterations with $\delta = 5.4e-9$. So, the graph with consolidated results of the AHP process is depicted in Fig. 12. It can be observed that the vertical Y-axis denoted the priority on a percentage scale, whereas the horizontal X-axis denoted the abbreviations regarding the various social media usages in higher education institutions. It should be noted that 1 unit of the Y-axis is equal to 3% of the priority percentage, whereas 1 unit of the X-axis represents each social media usage in short form or abbreviation. Table 4 can also be referred to for

understanding the full form of abbreviations provided in the horizontal X-axis. So, Fig. 12 shows a graphical representation of Table 5 along with relevant information for better understanding.

Therefore, after performing the statistical survey and AHP, it was found that the maximum priority and ranking among social media usages in higher education was found to be from these social media usages, namely

- First rank or highest priority—teaching–learning and discussions;
- Second rank or second-highest priority—public relations and networking;
- Third rank or third-highest priority—outreach activities;
- Fourth rank or fourth-highest priority—grievance and conflicts;
- Fifth rank or fifth-highest priority—placements and recruitment;

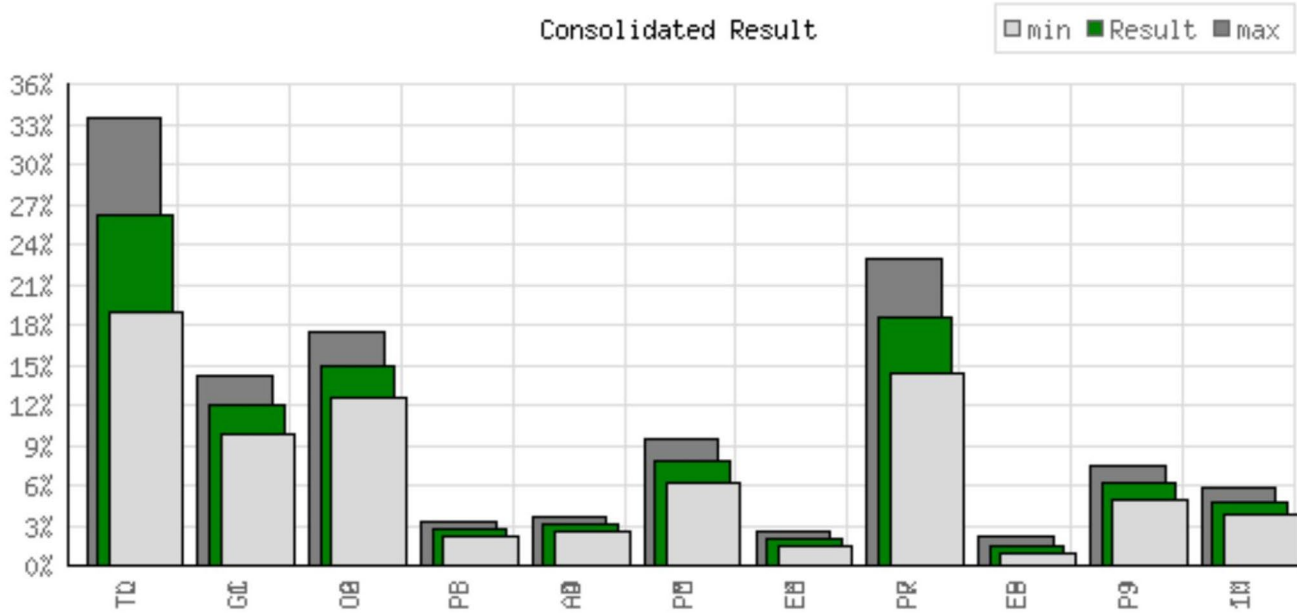


Fig. 12 Consolidated result of AHP in form of a graph (generated by the AHP-OS tool. Refer to Table 4 for understanding the meaning of the abbreviations provided in this figure)

Table 5 Resulting weights for the criteria based on the pair-wise comparisons along with the ranks and priority for all social media usages

Social media usage	Priority (%)	Rank	(+) (%)	(-) (%)
Teaching–learning and discussions	26.2	1	7.3	7.3
Public relations and networking	18.6	2	4.3	4.3
Outreach activities	15.0	3	2.5	2.5
Grievance and conflicts	12.0	4	2.2	2.2
Placements and recruitment	7.9	5	1.7	1.7
Project management	6.2	6	1.3	1.3
Impression management	4.8	7	1.0	1.0
Admissions	3.1	8	0.6	0.6
Publicity and branding	2.7	9	0.6	0.6
Execution management	2.0	10	0.6	0.6
E-procurement	1.5	11	0.5	0.5

Authors’ self-compilation from the data generated by the AHP-OS tool

- Sixth rank or sixth-highest priority—project management;
- Seventh rank or seventh-highest priority—impression management;
- Eighth rank or eighth-highest priority—admissions;
- Ninth rank or ninth-highest priority—publicity and branding;

- Tenth rank or tenth-highest priority—execution management;
- Eleventh rank or lowest priority—e-procurement.

It can be observed that social media and higher education are essential areas to ponder upon. Various social media usages are being exploited by the stakeholders of higher education institutions, but with different priorities. The study was conducted during the trying times of the Coronavirus crisis. The following section discusses the limitations that were faced while conducting the research along with some directions for further research.

5 Limitations and future scope of research

The review of the literature exhibits the potential of social media usage for various learning and development purposes, but the usage of technology is still very much limited. A research study found that there are fewer in-depth studies on higher education learning and teaching have been done [71]. There is a need for a more empirical study to be done for investigating the actual “added” benefits of social networking sites as compared to the use of traditional learning management systems (LMS). It was also witnessed that many of the research studies were focused on data that were self-reported in studying the technological effect, and this is a major limitation of the current literature review. Moreover,

it has been observed that most of the relevant studies in the domain were discussing the advantages or positivity, but fewer studies were found on negativity. But sometimes criticism can help in finding problems to eradicate them and improve accordingly. It is important to address and investigate the actual usage and learning outcome in more depth. About all this, the computer science instructors may know the technology in a better way compared to the faculty of other fields. The SNS adoption is lagging among faculties from other fields. Some queries may arise regarding the specific reason, topics that are hard to describe in texts, and the faculty members' security concerns. Therefore, a thorough inquiry is needed to address these limitations and solve the relevant issues.

There are some limitations to this study. More secondary data from all research databases around the world can be extracted for further analysis. The study collected primary data through online mediums virtually from many parts of the country during the COVID-19 pandemic for ensuring travel restrictions and social distancing norms. More responses can be collected around the world after the Coronavirus crisis and travel restrictions are over. This can help in developing the study in a better way to get enhanced results. Moreover, the software RStudio and its package Bibliometrix had their constraints so the study was done accordingly. Bibliometric analysis was found to be sufficient for carrying out the study, but the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) was not used extensively because it was not mandatory to implement PRISMA while performing bibliometric analysis [72]. There is plenty of future scope for research in this area. The researchers can enforce a creative social media technological strategy to tackle and enhance the educational environment in colleges. The better the peaceful behavioral culture in educational institutes the better would be the students' growth and their teachers' development. If a country can improve the physical and mental ability of the stakeholders, then in the future it would result in overall growth and development of the country. Because students are the future of any society or country. Therefore, social media should be strategically channelized so that there is a maximum increase in positivity in higher education institutional culture and environment. While assessing the impact, the challenge that came out was that only a few social media applications have been kept in mind, whereas some new social networking applications could not be accounted for. This research study can help in creating the platform for the achievement of the United Nations Sustainable Development Goal regarding quality education [73, 74]. The conclusive findings and relevant recommendations of the study are provided in the following section.

6 Conclusion and recommendations

Social media has been considered as a tool for entertainment purposes, but the changing landscape has made social networking platforms useful for higher education institutions. Their priorities have now been transformed into one of the key elements, i.e., efficiency. When it comes to efficiency factors, they offer some advanced tools and techniques which help every part of society to get involved in different types of formal or personal activities. Information and communication technologies (ICT) can help higher education in various ways [65] and can be instrumental in the amalgamation of social networking platforms. ICT infrastructure-based social media usage can assist all the stakeholders of higher education institutions around the world. The present research paper discusses the various impacts of social media on higher educational institutes in India. It is very important to overcome this problem of negative social media usage. Maximizing improvement upon the positive results will help in diminishing the negative aspects of social media. Moderating and monitoring access to social media is one excellent strategy that can be implemented. The effects of negativity can be reduced by checking and decreasing the amount of time spent on social network sites. Ample time should be provided for face-to-face social interaction and counseling drives if needed. All this will help people to reduce the negativity of social media usage among the stakeholders which will, in turn, benefit society. Moreover, higher education institutions should continuously monitor the usage and posts of various stakeholders. They can set some rules and protocols for social media usage. The moderators and administrative stakeholders can stop or avoid posts that can give rise to strikes, conflicts, and agitations. The educational stakeholders should be made aware of the protocols so that the circulation of harmful posts can be prevented. This will help in enhancing the learning culture and ambiance of the institutes. Learning analytics can help in understanding the patterns of the students [75]. The implications of the study can be magnified if social media usage is monitored and managed properly among all educational institutions across the world. Social media management along with continuous improvement in the social networking mechanisms of higher education institutions is the need of the hour. The educational strategies and plans for managing social networking platforms already mentioned in the study can be formulated, implemented, and evaluated accordingly. This study can be helpful for the enhancement of the positive impact of social media while minimizing the negative consequences in the higher education environment.

The brainstorming sessions helped in performing mind mapping to shortlist the notable social media usages in higher education. The Delphi method was conducted by

discussing social media usage among subject matter experts and major stakeholders in higher education institutions. The primary survey-based questionnaire helped in performing a statistical survey to extract novel insights and crucial findings. The research study found that social media had a massive impact on most of the stakeholders of higher educational institutions. Social media usage was maximum among the students, but moderate usage of social media has been observed in teachers, administrators, staff, other employees, and external entities who used social networking platforms as and when needed. With the help of a literature review, brainstorming sessions, the Delphi method, and a questionnaire survey, conclusive evidence was found on the major social media usages in the educational environment. Furthermore, bibliometric analysis and AHP were found to be suitable approaches to move forward. So, after rigorous analysis, the novel result regarding the maximum impact of social media usage on higher education was found to be from teaching–learning and discussions, and public relations and networking. Analytic hierarchy process (AHP) found the priority-based ranks of various social media usages in higher education institutions and helped in justifying the novelty of the research study.

The conclusive findings of this research study have been noted along the lines of the research gaps, questions, and objectives already mentioned in the previous sections of the study. Therefore, the findings are as follows:

- It was observed that the research fraternity across the world pursued more studies on social media and higher education during the COVID-19 pandemic;
- The major social media usages in higher education institutions during the Coronavirus crisis are teaching–learning and discussions, grievances and conflicts, outreach activities, publicity and branding, admissions, placements and recruitment, execution management, public relations and networking, e-procurement, project management, and impression management;
- The prioritized ranking sequence of social media usage according to the perception of the stakeholders in higher education institutions is as follows: teaching–learning and discussions, public relations and networking, outreach activities, grievance and conflicts, placements and recruitment, project management, impression management, admissions, publicity and branding, execution management, and e-procurement (the order of the social media usages' ranking is mentioned sequentially, i.e., first to last comprises top to low priority among the same);
- Some strategic measures like e-awareness drives, counseling sessions, sentiment analysis, mood recognition, social media management, continuous monitoring, real-time surveillance, social media awareness, con-

tinuous survey-based feedback evaluation, avoidance of cyberbullying, and social media moderation can help in achieving the objective of maximizing positive social media usage and minimizing negative social media usage toward neutrality for overall growth and development of higher education institutions.

This study concludes that social media have a substantial impact on higher education institutions. The consequences of social networking platforms were witnessed during the COVID-19 pandemic because it was instrumental in the transformation from physical classroom coaching to online pedagogy. Efficient e-learning platforms with effective social networking pedagogy can be helpful in enhancing the productivity of learners and teachers. Social networking platforms are widely used among most developed and developing countries along with a few underdeveloped countries across the world. Before the pandemic, some universities attempted to implement virtual campuses [76]. The Coronavirus crisis has played an invisible hand to transform classroom coaching methods toward online pedagogy by forcefully making the stakeholders explore new avenues for e-learning development [77]. But the higher education institutions had to be closed forcefully and shift to online pedagogy due to the drastic impact of the COVID-19 pandemic [78, 79]. Even most government services are being provided through online mode due to the current situation [80]. It has been observed in a research study that the incidents surrounding the social, educational, environmental, cultural, political, and economic aspects do have a substantial impact on the stakeholders of higher education institutions, which can create an immediate effect on the sentiments and moods of the people or entities relevant to the situation. These consequences can also be observed in the educational environment [81]. This research study also found that the majority of the higher education stakeholders responded that most of the social media usages had a positive impact on higher education institutions except for grievances and conflicts. Positive information is a piece of information that generates positivity among the sentiments, whereas negative information generates negativity among the moods of the individuals. But neutral information generates no reaction or neutral effect on social media users. Moreover, it has already been observed that the dissemination of negative information on social media is faster than positive or neutral information [82]. It has also been observed that countries with a huge number of individuals enrolling in higher education institutes have sustainable avenues for social, environmental, and economic development [83]. Various modular frameworks can be instrumental in the integration of higher education and ICT [84]. Social media usage will increase drastically to achieve the new normal during such trying times of the Coronavirus crisis.

Social media will play a key role in addressing accessibility and acceptability issues among the stakeholders of higher education institutes. E-awareness among the users of social networking platforms can help in improving usability also. Quality education can be achieved by rigorous improvement of educational strategies and increasing accessibility to all sections of society. Students can be motivated by the usage of technologies for advanced visualization [85] and social media analytics. Accessibility issues can be resolved technically by creating effective digital content for all types of ages because such risks of digital exclusion have been witnessed among adolescents and other sections of society also [86]. The present study may pave the way to implement effective measures to achieve sustainable development with the help of social media in higher education universally by maintaining harmony in the learner-centric environment along with stakeholders' enhancement.

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Declarations

Conflict of interest No potential conflict of interest was reported.

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