Evaluation of science communication on social media: A content analysis of Facebook pages

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Abstract---Worldwide social media platforms are used for communication purposes apart from entertainment. One of the most widely used social media sites in the world is Facebook. With 2.85 billion monthly active users as of 2021, Facebook is the most popular social media network on the planet. This platform has now become an important avenue for raising awareness. The way society utilizes these platforms is a matter of study. There is a lot of research on how politicians and celebrities throughout the world used it for communication. On the other side, there is a scarcity of studies on the use of social media for science communication. With the growing importance of social media as a source of knowledge, it's become a matter of whether these online platforms can present science news in a way that even non-scientists can grasp. The present study is fruitful in gaining knowledge that how science communicators used Facebook pages as a tool to reach a massive following. The researcher selects the most popular science communication facebook pages from the Google web browser. Later, through purposive sampling researcher select six popular pages. The study is based on the method of content analysis. The study illuminate that people engage in a conversation on science and its related fields especially on space-related news. The dominance of male is persisted in science communication. The Facebook environment serves as an activity system for intellectual

engagement on a variety of topics via interaction through comments, sharing, likes and wall posts.

Keywords---Science communication, Facebook pages, Activity theory, Scientist, Content analysis, India.

Introduction

Science and technology are vital components of human civilization, and we come into contact with them on a daily basis. They are linked to societal change and have a direct impact on development and advancement. As a result, it is critical to communicate new scientific and technological discoveries to a broad audience, as well as to encourage broad awareness of current realities. In recent years, science communication has grown in popularity around the world. It is led by a diverse group of scientists, social scientists, and communications professionals who believe in the importance of broad communication of science and technology. Technology has revolutionized how the public engages in science, particularly data acquisition, interpretation, and dissemination, (Dwivedi S, 2017). "Science communication is a movement which has been gaining momentum across the globe in recent years. It is driven by a vibrant mix of scientists, social scientists, and communications professionals who believe in the importance of wide communication in the complicated world of science and technology", (Dwivedi S, 2017). Science communication is the process of informing, teaching, raising awareness of science-related topics, and instilling awe in scientific discoveries and arguments, (Illingworth & Allen, 2020). Science communication is a broad concept in reality, with similarly broad meanings in academic literature, (Bryant, 2003) (Sensu,2003; Gilbert and Stocklmayer, 2013 as cited in Welbourne & Grant, 2016). 'science' is defined as any topic that fits into one of the Scopus science subject areas of physical, life, health, or social sciences, with the exception of the 'Arts and Humanities' topic, (Elsevier, 2020).

Conventional Science communication Vs online science communication

Conventional science journalism has declined as a source of science news for the general public in recent years (Xenos, 2017), with a concurrent shift to internet platforms as a supplement and substitutes for traditional science news, (Anderson et al., 2010; Mueller-Herbst et al., 2020). Online settings have a crucial role in forming social bonds and disseminating knowledge. Nearly 67 percent of social media users obtain at least some news from social media, a figure that climbs to 75 percent among minorities, (Shearer & Gottfried, 2017). Adults that are interested in science prefer to acquire their knowledge from the internet rather than through traditional media, (Takahashi & Tandoc, 2016). India's science communicators have employed a variety of methods to reach out to the general public. As a result, the country has a lot of infrastructures, software, and human resources. Given the wide diversity of the country, each has its own significance and utility, (Patairiya, n.d). In this environment, a growing number of calls to action from both within and outside the field of scientific communication have emphasized the importance of scientists, communicators, and educators engaging with social media users about science, (Ashlin & Ladle, 2006; Bik et al.,

2015; Bik & Goldstein, 2013; Friedman, 2008; Ranganathan, 2013; Reddy, 2009; Wilcox, 2012) as cited in (McClain, 2019). A scientific language is required to convey science to a group of researchers; nevertheless, a linguistic facility is required to communicate science to the general public by engaging and disseminating the message. Any person or organization that wants to expand the reach of their goal and show the world the incredible outcomes they've achieved must have and maintain a digital presence, (Kappel & Holmen, 2019).

Science communication in INDIA

Science communication activities in India have gathered steam over the last two decades or so. Both governmental and nongovernmental platforms have worked to improve public knowledge of science. The goal is to enable science and scientific culture to penetrate India's socio-culturally varied society, transforming it into a nation of scientifically thinking and aware citizens, (Patairiya, n.d). In India, 2004 was the Year of Scientific Awareness, the most recent in a succession of important events that give some indication of the amount to which public scientific communication has spread in one of the world's most populous countries, (Mazzonetto, 2015). Yash Pal, one of the most important scientists constantly attempting to diffuse science said, "It is true that a lot is done to spread scientific knowledge in our country, but it is not enough". The process of "science awareness" dissemination must begin with contextualizing data and knowledge into the requirements of everyday living. We need to improve our communication by making it more engaging and participatory, (Mazzonetto, 2015). Science writing is still dry and boring, therefore it's no surprise that few science stories catch the attention of newspapers and magazines. The number of qualified science communicators and volunteer scientific organizations in the country is shockingly low, hardly enough to meet the needs of the country's enormous and diverse population, (Patairiya, n.d).

Why Is Social Media Important?

In today's world, cyberspace provides new avenues for science communication that encourage active social learning as well as collaborative education, (Lopez-Goni & S´anchez-Angulo, 2018). People have been taught about the value of science through the usage of social media. Goni & Angulo (2018) strongly recommended that "faculty and scientists integrate social networks into their daily routines in order to improve their personal brand, improve their skills, increase their visibility, share and communicate science to society, promote scientific culture, and even as a teaching and learning tool," (Lopez-Goni & S´anchez-Angulo, 2018). According to the research, social media could very well serve as one of Scheufele's (2014) "mediated realities," in which members of the public become aware of scientific challenges and their larger societal implications. In the past, scientists have been compelled to use the media to convey their discoveries and gain public support and financing, (Weingart, 1998). Yet, scientists rely on the media not only to communicate the impact and importance of their work, but the media also rely on certain scientists to make science topics more accessible and newsworthy, effectively creating a "mediated reality" between scientists, the media, and the public, (Scheufele, 2014). Scientists and institutions are increasingly relying on social media to interact with individuals,

notably Twitter, Facebook, LinkedIn, and blogs, but sites like Reddit and Instagram are less popular (Collins et al., 2016; Darling et al., 2013; Liang et al., 2014; Peters et al., 2014) as cited in (Mueller-Herbst et al., 2020). This shows that social media can serve as a mediated space for people to learn about science. Furthermore, while earlier research has found that a variety of social media platforms play an impact, Facebook appears to be particularly significant. Indeed, Facebook-only (i.e., Facebook-only) and multiplatform scientific-related pages are many and popular, with users frequently reporting seeing science news they wouldn't have seen anywhere else (Hitlin & Olmstead, 2018). This is backed up by the fact that, despite the growing prominence of other social media platforms, Facebook still has the most active members at 2.4 billion,(Clement et al., 2019). As cited in (Mueller-Herbst et al., 2020)**.** Few scientists think Facebook is a good way to communicate science online (Collins, Shiffman & Rock, 2016; Fauville et al., 2015 as cited in McClain, 2019). However, McClain (2019) has suggested that, due to its simplicity of use and the more intimate and personal character of the social networks formed there, Facebook could be an ideal platform for scientists to communicate with the public. In comparison to other social media platforms, Facebook has a higher number of users (66%) who get their news from the site, (Shearer & Gottfried, 2017). "Millions of people see science-related information on their Facebook feeds or elsewhere on social media, but the kinds of science stories people most likely encounter are often practical tips with "news you can use" or promotions for programs and events rather than new developments in the science, engineering and technology world", (Hitlin & Olmstead, 2018). Therefore a need exist to identify how these online platforms can present scientific news.

Review of literature

Goni & Angulo (2018) in their study highlights that Social media platforms are ideal for bridging the gap between research, teaching, and science dissemination. They can serve as a dynamic online showcase for research lines and publications, increasing the visibility of our knowledge around the world, (Lopez-Goni & S´anchez-Angulo, 2018).

Mcclain (2019) performed the first quantitative analysis of scientific picture virality via social media, examining the impact of imagery through quantification of likes, comments, and shares on Facebook postings. The study found that some taxa's iconography engages viewers more than others. The picture that delivered new information while also being aesthetically beautiful garnered +2 more likes and shares on average than other posts.

Jayashree (2018) investigated how scientists, particularly in India, might participate more actively for increased authenticity, accuracy, and knowledge among social media users on scientific issues by doing a case study on renowned agricultural scientist M. S. Swaminathan. Scientists can use social media to create public support for their research. Scientists can act with their expertise on social media. While it may not be realistic for a scientist to join in public discourse on a daily basis, social media offers opportunities and new ways to reach out to new audiences on a frequent basis. Sharing research is one thing; conversing about science and gaining a better knowledge of relevant concerns is quite another.

The case study by Pavelle and Wilkinson (2020) details a project that aimed to investigate how the digital environment can be used for science communication, specifically the role of social media and, in particular, short online videos, as an effective means of engaging the public with science, environment, and conservation messages, as well as data from an online public opinion survey. The study shows that successful science communication can happen when a person considers new ideas in order to inform or revise previously held beliefs. The vlogs were particularly effective at sharing the trip with a young audience, with all 129 survey respondents indicating that they would like to engage with science in this way again. For practitioners, social media sites can serve as a "stepping stone." Online video must be created in such a way that it fulfills an educational and entertaining narrative while maintaining scientific authenticity.

Mueller-Herbst et al., (2020) investigated the impact of social media on gene editing awareness by conducting a survey of 1,600 US citizens. Its findings imply that a social media platform has the power to facilitate learning and distributing new information due to its unique affordances. According to the findings of the regression study, Facebook potentially plays a role in raising gene editing awareness. When it comes to scientific communication, the study shows that social media serves as an important information space for science concerns and that it should be given equal priority to traditional media outlets.

Theoretical Framework: Activity Theory

Technology integration is important in understanding user group activities in the development of information systems; it also allowed for a multi-faceted analysis of the information and its users, as well as the dynamics that existed between them. The work of Vygotsky and his student Leont'ev from their study of cultural-historical psychology in the 1920s is the foundation of activity theory (Verenikina, 2001 as cited in (Hashim & Jones, 2007)). According to Vygotsky (1978), human engagement with the social environment is mediated by semiotic tools (language, text, speech) and signs, rather than being direct (symbols, numbers, formulas), (Bagarukayo et al., 2016).

The focus of Activity Theory is on "who is doing what, why, and how." The core of activity, according to Activity Theory, is the relationship between the subject (human doer) and the object (what is being done). The emphasis and aim of the activity are represented by the object, but the subject, a person or group participating in the activity, represents the subject's varied motives. An activity's intended effects are possible, but there may also be unexpected consequences, (Hasan & Kazlauskas, 2014).

What people appear to be doing, what they say they are doing, and what they actually do are frequently incompatible. For one person, what is merely a physical object is much more meaningful for another, (Hasan & Kazlauskas, 2014). Individuals or an organization are the (subject) that post (object) on their Facebook page. For the individual or an organization, it is just another post, with an intention that people may like, comment, engage in discussion, or share. This activity provides them with popularity. For the followers who like and follow the

particular Facebook page, the activity provides them with knowledge and information about new discoveries, inventions, innovations, and upcoming programs. But this outcome of an activity is different for every follower. For some, it is fruitful whereas for some it's just another post.

In the complex dynamic contexts of modern organizations, Activity Theory gives a comprehensive holistic picture of how people interact, i.e. carry out purposeful collective activities with the support of sophisticated instruments (information systems) (Waycott et al. 2005; Hasan 1999) as cited in (Hasan & Kazlauskas, 2014). The Facebook environment serves as an activity system for intellectual engagement on a variety of topics via private inbox conversations, forum discussions, and wall postings. The activity theory helps to explain how Individuals or groups who participate in collaborative activities (contributing some postings, commenting on peers' views, engaging in collaborative discussions) on Facebook make up the subjects who work together to develop knowledge and relevant learning objects.

Objectives

The main objectives of the study are:
1) To investigate & analyze the Facebook pages of science communication.
2) To examine the frequency of science communication posts on the Facebook pages.
3) To identify whether science communication Facebook pages are active or inactive.
4) To evaluate the dimensions of Science news on the Facebook pages.

Research Methodology

On the Facebook account researcher searched pages with key words "science & technology", "Science & Innovation", Science communication", "scientist group India", and "Science news". Through purposive sampling researcher selected 3 most followed pages of science communication and 3 Facebook pages of the government of India, related to science. The researcher selected the ten days: 11 Feb 2022 to 20 Feb 2022 and explore all the six pages of the given ten days and conducted the content analysis of the Facebook pages. Content analysis is the best suitable method of media research. Content analysis is a research technique for making replicable and valid inferences from texts (or other meaningful matters) to the context of their use, (Krippendorff, 2018, p.24). The researcher used both quantitative & qualitative approaches to analyze the Facebook pages. Researchers first categorize all the posts in different parameters namely 1. Health & Medicine, 2.Food & Nutrition, 3. Engineering 4. Environment, 5. Science News, 6. Space, 7. General and 8. Others & then generate the data through coding.

Justification of Sample

•For the content analysis of Facebook pages from general science communication facebook pages & Government Fb pages related to science communication (in English only) with a large number of followers.

- The term "follower" is used for the people who "like" a page using the thumbs-up icon.
- The selection of "science-related" pages is based on each page's self-declaration that it covers content related to science or any of the following science topics: health & medicine, food &nutrition, astronomy, physics, biology & animal science, neurology, chemistry, technology &engineering, energy& environment, geosciences, math, or social and behavioral sciences. The categories are broadly based on the National Science Foundation's definitions of main fields of scientific investigation.
- A Facebook-general page is one that is managed by an individual or organization that uses Facebook as a secondary means of disseminating information.
- There is no definitive list of science-related Facebook pages available on the internet (In reference to India).
- To create the list of popular pages analyzed in this study, the researcher searched for pages with a large number of page likes. The top 3 most popular pages from each group (3-3) were selected for this study. In an effort to better understand the scientific information that social media users encounter on these platforms researcher selected six Facebook pages.
- The researcher randomly selects 10 days for data collection (11 feb 2022- 20 feb 2022).

General Facebook pages

ISRO Science & technology – private group (190.4K members)- Created 8 years ago- Admin Radha Mohan-Owner-operator at Founder & Administrator of FB group - Basic Physics., Owner-operator at Founder & Administrator of FB cosmic page - Cosmological Astrophysics.
Science & Curiosity- Public group (91.6 K members)- created 3 years ago- a Group by Nitish Ray (no detail)
Science & technology- private group (101.7 K members) created 8 years ago- a group by Vishal Wakchaure-Senior Research Associate at Syngene International Limited

Government Organization Facebook pages
ISRO- Indian space research organization- verified- 2,437,595 people like & 2,587,918 people follow this. Page created – 19 December 2013
Vigyan prasar- verified page- 12,227 people like this & 13,917 people follow this. Page created – 26 June 2012.
DRDO- verified page- 296,143 people like this 368,130 people follow this- Page created 2 January 2015

Data analysis

These are some keywords of the data analysis which has been used in the content analysis of the post.
Parameters: 1.Health medicine, 2.Food Nutrition, 3. Engineering, 4. Environmental, 5. Science coverage (Biology, animal science, neurology, chemistry, energy, physics, geosciences, math, or social and behavioral sciences) 6. Space, 7. General (Not connected with specific science & technology topics) 8. Others (Totally irrelevant)

Pictures: 1.Picture with message, 2. Picture without message, 3.Relavant Picture, 4.Irrelevant Picture
Videos: 1. with Message 2. Without message 3. Irrelevant
Advertisement: 1. Webinar, 2. Conferences, 3. Admission, 4. Recruitment, 5.Business

General Facebook pages

1. ISRO Science and Technology

Date	Post	Comment	Like	Share	Picture	Video	Advertisement	Parameters
11 Feb	16	27	599	0	6-with message 1-Irrelevant	9-with message	0	1-Health 3-Enginnering 1-Enviromental 1-Science news Coverage 8-Space 1-General 1-other
12Feb	34	27	859	0	10-with message 4-without message	18-with message 1-without message	0	1-Health 9-Science news Coverage 23-Sapce 1-others
13Feb	35	236	3365	0	7-with message 9-without message	17-with message 1-without message	2-webinar	15- Science news Coverage 18-Space 2-General
14Feb	25	424	5100	0	12-with message 7-without message	3-with message 2-without message	0	1-Enginnering 7-Environmental 11-Science news Coverage 6-space

Date								
15Feb	14	43	1071		5-with message 4-without message	5-with message	0	1-Engineering 7-Science news Coverage 3-Space 2-General 1-Enviromental
16Feb	18	21	2336	0	4-with message 3-without message	11-with message	0	1-Enginnering 4-Science news Coverage 10-space 2-general 1-other
17Feb	18	27	1699	0	6-with message 3-without message	8-with message	1-conference 1-admission	1-Environmental 5-Science news Coverage 7-space 3-General 2-other
18Feb	46	9	587	0	11-with message 2-without message	3-with message 2-without message	3-webinar	32-space 3-engineering 7-Science news Coverage 2-other 2-Environmental
19Feb	14	11	575	0	6-with message 1-without message	7-with message	0	2-general 6-space 6-Science news Coverage
20Feb	18	4	494	0	8-with message 3-without message	5-with message 2-without message	0	7-space 1-enginnering 10- Science news Coverage
Total	**239**	**829**	**14986**	**0**	**115**	**94**	**7**	

Data Interpretation

The table above displays data from ten days of content analysis on the ISRO science and technology Facebook page. Researchers use the above table to determine the frequency of posts, likes, comments, shares, and post issues on the ISRO science and technology Facebook page. On the ISRO science and technology Facebook page, researchers discovered a maximum of 46 posts in a single day on 18 February, with 9 comments and 587 likes and no shares on the posts, and a minimum of 14 posts in a single day on 19 February, with 11 comments and 575 likes on that post. ISRO science and technology's Facebook page made 239 posts in ten days, with 829 comments, 14986 likes, and no shares. Another thing that the researcher describes is the number of images and videos on the total posts. Out of 239 posts, 115 contained images, 94 contained videos, and 7 contained various types of advertisements or promotions such as webinar, conference, and admission.

2. Science and Curiosity

Date	Post	Comment	Like	Share	Photo	Video	Advertisement	Parameters
11Feb	2	65	656	85	2-with message	0	0	1- Science news Coverage 1-other
12Feb	1	24	749	45	1-with message	0	0	1-general
13Feb	1	279	1100	114	1-with message	0	0	1- Science news Coverage
14Feb	0	0	0	0	0	0	0	0
15Feb	3	296	3900	308	3-with message	0	0	2- Science news Coverage 1-other
16Feb	4	477	1964	181	4-with message	0	0	3- Science news Coverage 1-general
17Feb	2	456	1238	105	2-with message	0	0	2-general
18Feb	1	384	615	70	1-with message	0	0	1-general
19Feb	0	0	0	0	0	0	0	0
20Feb	1	79	537	56	1-with message	0	0	1-general
Total	**15**	**1981**	**10301**	**1445**	**15**	0	0	

Data Interpretation

The table above displays ten days of content analysis data from the science and curiosity Facebook page. The above table enables us to evaluate the frequency of posts, likes, comments, shares, and post issues on the science and curiosity Facebook page. There were 15 posts with images and none with videos. Active participation on non-verified pages is also demonstrated by the fact that there were 1981 comments, 10301 likes, and 1445 shares on just 15 posts.

3. Science and Technology

Date	Post	Comment	Like	Share	Photo	Video	Advertisement	Parameters
11Feb	1	8	4	2	1-with message	0	1-admission	1-health
12Feb	3	0	6	0	3-with message	0	1-admission 1-recruitmnet 1-business	3-others
13Feb	0	0	0	0	0	0	0	0
14Feb	2	4	11	0	1-with message		1-recruitment	2-others
15Feb	2	5	13	0	2-with message	0	2-recruitment	2-others
16Feb	2	9	13	0	2-with message	0	1-recruitment 1-admission	2-others
17Feb	0	0	0	0	0	0	0	0
18Feb	1	2	5	0	1-with message	0	1-recruitment	1-others
19Feb	1	3	5	0	0	0	1-recruitment	1-others
20Feb	1	0	2	0	1-with message	0	1-recruitment	1-others
Total	**13**	**31**	**59**	**2**	**11**	**0**	**12**	

Data Interpretation

The table above displays ten days of content analysis data from the science and technology Facebook page. The above table allows researchers to determine the frequency of posts, likes, comments, shares, and post issues on the science and technology Facebook page. On the science and technology Facebook page, researchers discovered a maximum of 3 posts in a single day on 12 February, with zero comments, 6 likes, and 2 shares on the posts, as well as a minimum number of posts in a single day. Only 13 posts were made on the Science and Technology Facebook page in ten days, with only 31 comments, 59 likes, and two shares. Another thing the researcher describes is the number of images and videos on the total posts. Out of 13 posts, 11 were images, with no video, and 12 were advertisements or promotions ranging from business to recruitment to admission.

Government Organization Facebook pages

4. Vigyan Prasar

Date	Post	Com ment	Like	Share	Photo	Video	Advertisem ent	Parameters
11Feb	3	0	36	4	2-with message	1-with message	1-webinar 1-conference	1-enviormental 2- Science news Coverage
12Feb	5	1	84	27	4-with message	1-with message	1-conference	4- Science news Coverage 1-enviormental
13Feb	4	1	56	22	4-with message	0	0	4- Science news Coverage
14Feb	1	0	2	0	0	1-with message	0	1-health
15Feb	6	2	54	7	3-with message	3-with message	0	2-engineering 1-enviormental 3- Science news Coverage
16Feb	3	2	71	34	1-with message	2-with message	1-conference	1-engineering 1- Science news Coverage 1-general
17Feb	3	1	17	2	2-with message	1-with message	0	1-engineering 2- Science news Coverage
18Feb	2	4	67	25	1-without message	0	0	2- Science news Coverage
19Feb	3	4	136	38	3-with message	0	0	3- Science news Coverage
20Feb	7	10	106	41	7-with message	0	0	4- Science news Coverage 1-general 2-environmental
Total	**37**	**25**	**629**	**200**	**27**	**9**	**4**	

Data Interpretation

The table above shows ten days of content analysis data from the Vigyan Prasar officials' Facebook page. Researchers use the above table to determine the frequency of Vigyan Prasar Facebook page posts, likes, comments, shares, and post issues. On the Vigyan Prasar, Facebook page, researchers discovered a maximum of 6 posts in a single day on 15 February, which included 2 comments, 54 likes, and 7 shares, as well as a minimum of 1 post in a single day on 14 February, which included zero comments and 2 likes. Vigyan Prasar's Facebook page only published 37 posts in ten days, with only 25 comments and 629 likes and 200 shares. Another thing that the researcher describes is the number of

images and videos on the total posts. 9 posts contained images, 4 posts contained videos, and 4 posts contained various types of advertisements or promotions such as webinars and conferences.

5. ISRO (Indian Space Research Organization)

| Date	Post	Comment	Like	Share	Photo	Video	Advertisement	Parameters
11Feb	1	171	3700	430	1-with message	0	0	1-Science news Coverage
12Feb	0	0	0	0	0	0	0	0
13Feb	1	45	1200	68	1-with message	0	0	1- Science news Coverage
14Feb	2	2991	15300	1945	1-with message	0	0	2- Science news Coverage
15Feb	0	0	0	0	0	0	0	0
16Feb	0	0	0	0	0	0	0	0
17Feb	0	0	0	0	0	0	0	0
18Feb	0	0	0	0	0	0	0	0
19Feb	0	0	0	0	0	0	0	0
20Feb	0	0	0	0	0	0	0	0
Total	**4**	**3207**	**20200**	**2443**	**3**	**0**	**0**	

Data Interpretation

On the ISRO Facebook page, researchers discovered a maximum of 2 posts in a single day on 12 February, with 2991 comments, 15300 likes, and 1945 shares on the posts, as well as a minimum number of posts in a single day. ISRO's page did not post on a few occasions, and on others, only one or two posts were made in a single day. ISRO's Facebook page only had four posts in ten days, with 3207 comments, 20200 likes, and 2443 shares. Another thing that the researcher describes is the number of images and videos on the total posts. Three of the four posts were images, and there was not a single video. According to the data, the activities on the government's Facebook page are massive despite only four posts. People are actively engaging with the government-managed and verified pages.

6. DRDO (Defence Research and Development Organization)
Researcher did not find single posts between11 February to 20 February. Whereas there are posts on other days on DRDO facebook page.
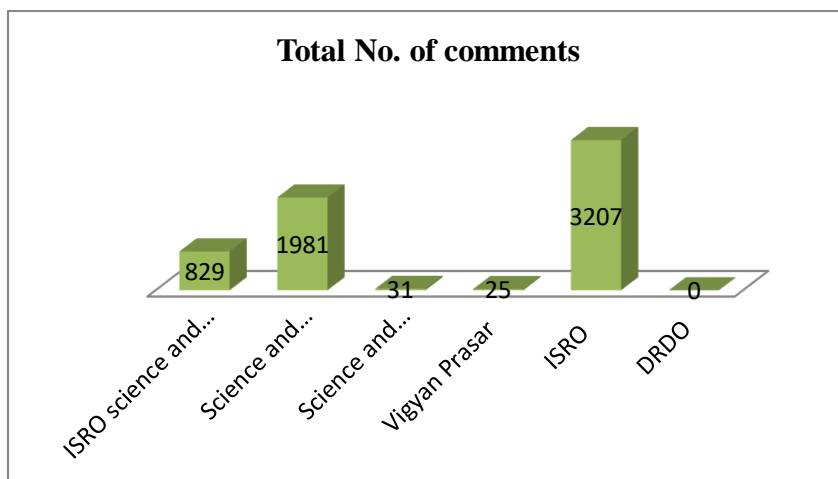
Graphs

1. Total number of post
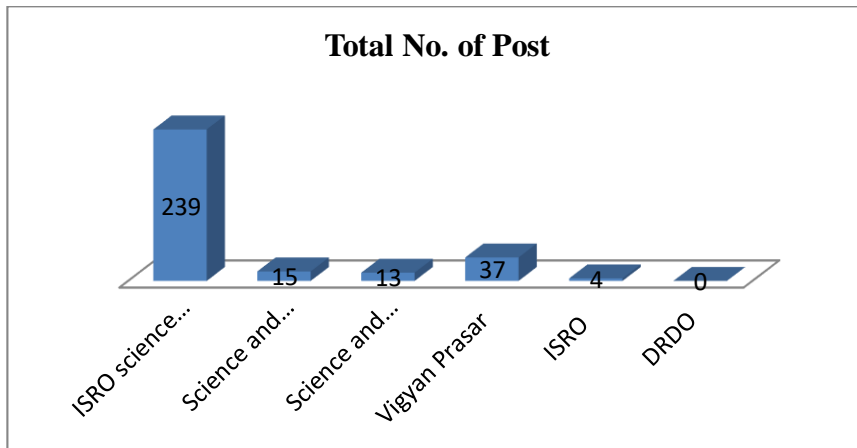
Data Interpretation: This graph depicts the total number of posts made by science groups on Facebook between 11 and 20 February. According to this graph, ISRO Science and Technology has the most posts (239), followed by Vigyan Prasar with 37 posts and Science and Curiosity with 15 posts. Science and technology made 13 posts, while ISRO made only four and DRDO made none between February 11 and February 20. ISRO Science and Technology leads in terms of posts, while government officials' Facebook pages have very few posts.
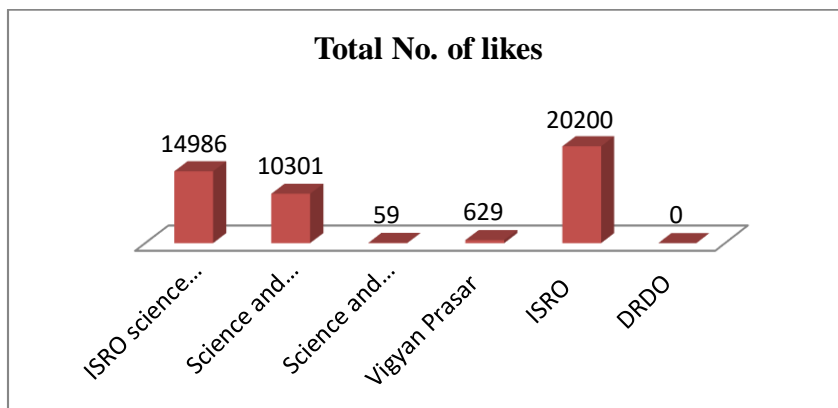
2. Total number of comments

Data Interpretation: This graph presents the total number of comments made on Science group posts on Facebook. According to this bar graph, the maximum number of comments on the post by ISRO is 3207, followed by 1981 comments on the posts of the science and curiosity group, 31 comments on the post of science
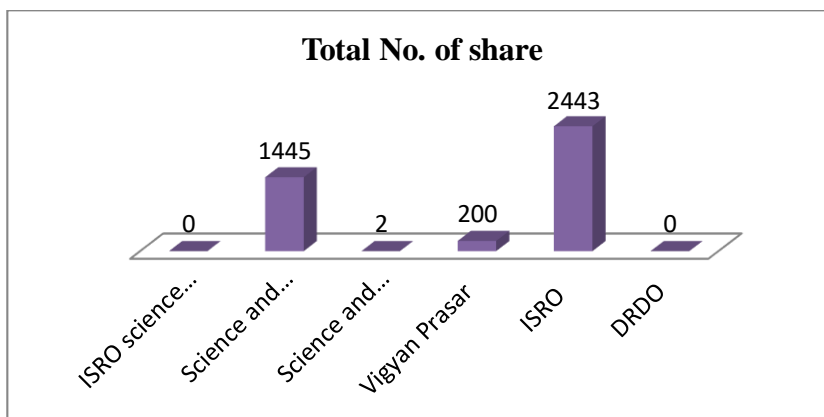
and technology, and 25 comments on the Vigyan Prasar post, with no comments on the DRDO posts. As a result of this data, the government official page ISRO has the highest number of comments on their posts between the selected days.

3. Total number of likes

Total No. of likes

14986   10301   59   629   20200   0

ISRO science...   Science and...   Science and...   Vigyan Prasar   ISRO   DRDO
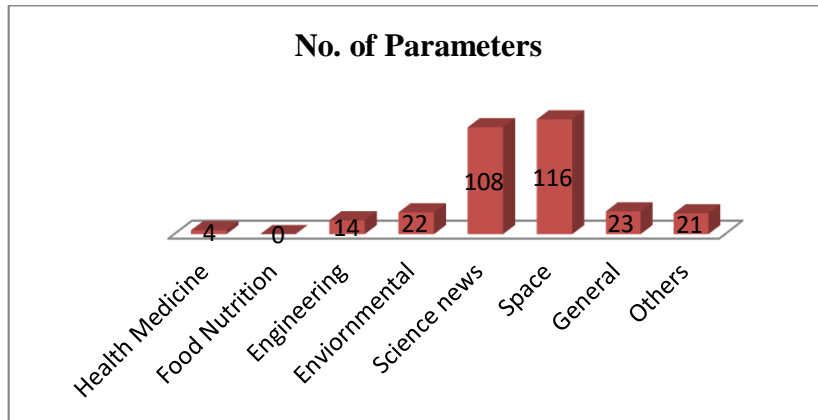
Data Interpretation: This graph displays the total number of likes on science communication groups' Facebook posts. According to this graph, the maximum number of likes is 20200 on the ISRO page, followed by 14986 on the ISRO Science and Technology group, 10301 on the Science and Curiosity group, and 629 on the Vigyan Prasar page, with no single like on the DRDO pages. According to this data, the ISRO official pages have the highest number of likes.

4. Total number of shares

Total No. of share

0   1445   2   200   2443   0

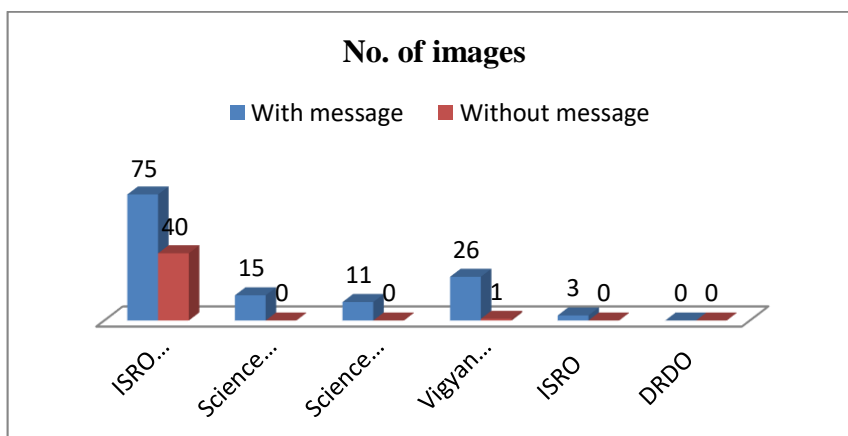ISRO science...   Science and...   Science and...   Vigyan Prasar   ISRO   DRDO

Data Interpretation: This graph indicates the total number of shares on science communication groups' Facebook posts. According to this graph, the most shares are 2443 on the ISRO page, followed by 1445 on the science and curiosity group page, and 200 on the Vigyan Prasar page. There is no single sharing on the ISRO science and technology group's and DRDO's pages. As a result of this data, the maximum number of shares consist of ISRO official pages.

5. Parameters

No. of Parameters

Health Medicine	Food Nutrition	Engineering	Enviornmental	Science news	Space	General	Others
4	0	14	22	108	116	23	21

Data Interpretation: This graphs show the post parameters that were classified using the aforementioned keywords. Total 308 posts divided into eight keywords from the six science communication groups. The fact that 116 posts fall into the space category and 108 posts fall into the science news category indicates that this post is sharing some kind of science information or science coverage through posts. The graph above mentioned 23 posts related to general information on science pages, 22 posts related to environmental concerns, 14 posts related to engineering or innovation, 21 posts related to other issues but posted on science groups, and researchers did not find a single post on food nutrition. According to this data, the majority of the posts on the science communication pages are about space, with science news coverage taking second place among the eight parameters.
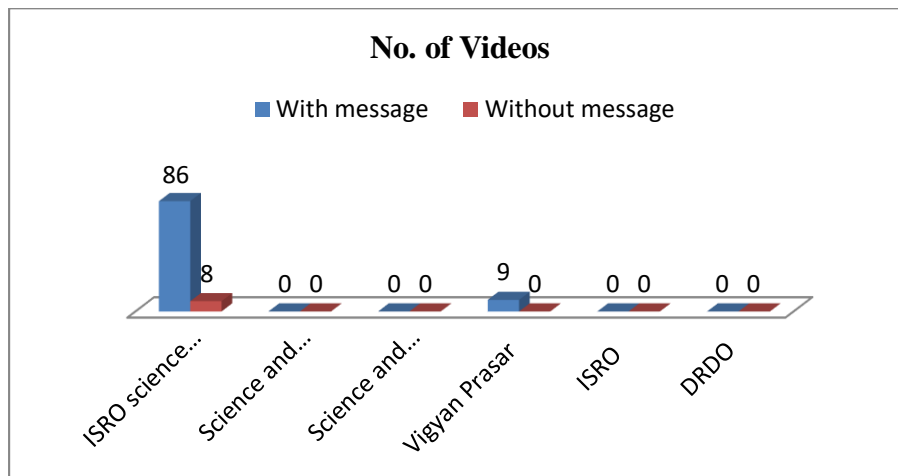
6. Total number of images

No. of images

■ With message ■ Without message

	ISRO...	Science...	Science...	Vigyan...	ISRO	DRDO
With message	75	15	11	26	3	0
Without message	40	0	0	1	0	0

Data Interpretation: The graph above shows that ISRO science and technology used the most images to communicate with their followers.

7. Total number of videos

No. of Videos

With message   Without message

86

8   0 0   0 0   9 0   0 0   0 0

ISRO science...   Science and...   Science and...   Vigyan Prasar   ISRO   DRDO

Data Interpretation: The graph shows that only ISRO science and technology had videos with messages on their Facebook page, whereas researchers found no single videos on other Facebook pages.

Findings & Results

• The majority of science-related Facebook pages concentrate their content on two areas, particularly "Space" and "Science news".
• Across this set of 6 pages, 4 aim to cover science across a range of scientific domains. Instead, one page is totally inactive and one page specializes in another topic that is not relevant to science.
• "Space" is the predominant topic on Facebook posts.
• Science communication Facebook pages specialize in science topics (health & Medicine- 4 posts, engineering- 14, environment -22, science (includes behavioral and animal science- 108 posts) and space with 116 posts); some include posts far afield from science. (General topic and another topic: 23 and 21 posts)
• The result indicates that people do engage in a conversation on science and its related fields (Space, environment, health and medicine, and engineering). The Facebook environment serves as an activity system for intellectual engagement on a variety of topics via interaction through comments, sharing, likes and wall postings.
• The average number of user interactions per post, which is based on the total number of shares, comments, likes, or other reactions, is a common indication of audience engagement. In 10 days, there have been 308 posts, with 6073 comments, 36904 likes, and 4,090 shares, indicating high audience interaction.
• Frequency of post - a total of 308 posts in 10 days by 6 Facebook pages, it means on an average 5 Facebook posts in every ten days by 6 pages.
• Out of all the selected pages, one page is found inactive as there is not a single post on DRDO run by a government organization (Between the time period of (11 Feb 2022 to 20 Feb 2022).

- The researcher also considers advertisement as one of the characteristics but does so separately because it encompasses a variety of forms. As a result, the researcher divides it into five categories: 1. Webinars, 2. Conferences, 3. Admission, 4. Recruitment, and 5. Business.
- Six of the 24 advertisements are for webinars, five are for conferences, four are for admission, eight are for recruiting, and one is for a business.
- No post found on "food & nutrition".
- Higher engagement is seen on posts focused on visuals with little additional information. In today's social media landscape, imagery is crucial. The use of graphics in Facebook posts is essential for increasing audience engagement.
- There are few posts, notably on government-run pages, indicating that they are less active than general science communication pages. In a ten-day analysis, there were 267 postings by three general Facebook accounts and only 41 posts by three government departments.
- All the three general Facebook pages are managed by men. The dominance of male persistence in science communication-related Facebook pages reflects that females are less interested in technical fields or a paucity of female science communicators could be a sign of a female viewership problem. Female science communicators could also opt-out of creating material.

Conclusion & Discussion

Three government Facebook pages had only 41 updates in ten days, one of which is completely inactive, despite the fact that it has 296,143 likes and 368,130 followers. Vigyan Prasar has the most posts with 37, whereas ISRO has only 4 only. Government Facebook pages devoted to science have millions of followers, yet discussion on these pages is far lower, resulting in reduced audience engagement. ISRO, on the other hand, only posts two times on 14 February, receiving 2991 comments, 15300 likes, and 1945 shares. This is far more than the number of comments on ordinary public Facebook pages. It suggests that people are considerably more interested in involvement on official pages, but that government websites are less communicative.

The general public science communication facebook pages are 7 years old on average with a massive following of 282.7 K members. The question that arises here is that do science communication pages managed by the general public provide factual information. As anybody (public group) or any member (private group) can post and share anything on these groups. Is it that they do not share any misleading information? This also requires research. In India, Facebook's user base is expected to reach 433.75 million by 2021, (Statista). People around the world are interested in knowing science-related information & there are various resources available in this digital world. In fact the data indicates the active participation of people through the number of likes, comment & share received on the facebook pages. But authentic sources are required so that people engaged in discussion get clear and factual information. Science communication Facebook pages managed by the general public differ from those run by the government. They are less active and interactive. Government should manage their already running pages in a way that will provide more chances for interaction & Discussion with common people. Science communication operations must be carried out and managed in a methodical, organized manner, Under one

umbrella organization, and in accordance with a clearly defined national strategy, (Patairiya, n.d). Scientists & researchers in India should use online platforms likewise west to enhance science & technological Program & activities. Prominent scientists including Stephen Hawking (3.9 million Facebook followers as of June 2017), Bill Nye (4.8 million), and Neil deGrasse Tyson (followed by 4 million) have used social media to promote their work, (Hitlin, P., & Olmstead, K. 2018).

Limitation

Due to time constraints researcher selected a small sample size. Here researcher examines & analyzes the Facebook post for ten days only. Hence a lot to be explored. To get a better understanding of science coverage on Facebook pages future researchers must choose a large sample size.

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