To: STEM PUSH Network HUB Leadership

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Re: STEM PUSH Social Media Web Scraping

This report undertakes a baseline analysis to examine the discussions and trends surrounding the STEM PUSH Network, along with associated keywords, across social media platforms. In response to the growing interest in understanding STEM PUSH's impact beyond its immediate network, this document aids leadership in strategizing ways to expand its reach. This memo strives to furnish valuable insights into public perceptions, responses, and interactions concerning the STEM PUSH Network and its associated projects. Through a comprehensive analysis of content, including posts, comments, and engagements on well-known platforms including Twitter, LinkedIn, and Instagram  from May to June 2023, the STEM PUSH external evaluation team seeks to enhance comprehension regarding the extent of awareness, backing, and wider influence generated by the STEM PUSH Network.

**STEM PUSH Social Media Network Web Analysis Process**

In May and June of 2023, the external evaluation team for STEM PUSH undertook a baseline analysis to gather insights on how the public perceives, responds to, and engages with the STEM PUSH Network and its related initiatives across designated social media platforms. To conduct this analysis, they identified particular keywords for searches on Twitter, Instagram, and LinkedIn. The chosen keywords for these searches include:

* STEM PUSH
* STEM PUSH (Pathways for Underrepresented Students to Higher Education) Network
* STEM PUSH Alliance
* STEM PUSH Network
* STEM PUSH Network Hub
* STEM PUSH Network Alliance
* STEM PUSH Network, University of Pittsburgh
* STEM PUSH Alliance, University of Pittsburgh
* NSF INCLUDES Alliance 1930990: The STEM PUSH Network
* NSF INCLUDES Alliance 1930990
* Pathways for Underrepresented Students to Higher Education
* Pre College STEM Programs (PCSPs)

To gather data from these platforms, the team initially considered using [web scraping](https://en.wikipedia.org/wiki/Web_scraping) techniques with libraries like Beautiful Soup in Python. However, it was discovered that the social media platforms employed [Infinite Scrolling](https://evgeniiray.medium.com/infinite-scrolling-in-web-ultimate-guide-b698124b3172), a technique where new data gets loaded by scrolling the page,  making it necessary to switch to [Selenium](https://www.selenium.dev/), a web automation tool, to navigate and retrieve data.

Three separate Excel workbooks were prepared, for each social media platform to organize and store the collected data. Each workbook contained multiple worksheets corresponding to the identified keywords, allowing for a systematic categorization of the gathered information.

For Twitter, the team leveraged the advanced search functionality provided by the platform's search engine. This allowed for the extraction of tweets containing the exact information related to the STEM PUSH network. The data collected from Twitter included the author of the post, the post description, the hashtags used, and the number of reposts, likes, and comments. Similarly, the team used Selenium for LinkedIn and Instagram to automate the browsing process. The collected data from LinkedIn and Instagram included the author of the post, the post description, and the number of likes and comments.

To analyze social network posts a thematic analysis was conducted. To begin we ingested and processed data from social media posts to extract key details. Next, we analyzed posts by identifying keywords and central ideas. Posts from each social network were then grouped based on shared themes revealing common themes across posts.

By employing this methodology, the STEM PUSH external evaluation team aimed to perform a comprehensive foundational analysis of conversations and reactions linked to the STEM PUSH network. This data will furnish essential baseline insights into post frequency, user sentiments, and the general degree of engagement and responsiveness across the specified social media platforms.

**Findings**

The following sections present baseline findings from LinkedIn, Twitter, and Instagram, along with concise summaries highlighting the key insights obtained from each of these social media platforms.

*LinkedIn*

LinkedIn is a web and mobile-based social media platform with a focus on business and employment. Currently owned by Microsoft, it serves as a hub for professional networking and career advancement. Jobseekers can showcase their CVs, and employers can post job openings. The platform enables both workers and employers to create profiles and connect, mirroring real-world professional relationships. LinkedIn also offers features like organizing offline events, joining groups, writing articles, publishing job postings, sharing photos, and videos, among other functionalities.

After analyzing the identified keywords, it becomes evident that LinkedIn boasts the highest number of posts, reaching a total of 67, contributed by 50 different authors. This observation suggests that LinkedIn is the most active platform among the social media platforms examined (Twitter, LinkedIn, and Instagram).

Post reactions serve as a means for subscribers to engage with posts. LinkedIn stands out with the highest average reactions per post, amounting to 59. This indicates that LinkedIn users show a higher level of interaction with the content compared to users on other platforms.

A group of men working on a computer

Description automatically generated

Figure 1 on LinkedIn is a post shared by Aaron Cortes Minor, a member of the STEM PUSH Network. In the post, he expresses, "We are more than honored to be part of such a great initiative with STEM PUSH Network." This post garnered 24 reactions and received 2 comments.

LinkedIn Post Analysis Findings:

* Fostering Collective Action: Recognizing Ongoing STEM Challenges via Social Media: Recognizing the imperative for a collective approach in using social media to address disparities in STEM and raise awareness, it's evident that there is a notable awareness of ongoing dialogues and issues. The baseline social media analysis revealed conversations regarding women's involvement in STEM fields on LInkedIn. While these conversations may not directly relate to the Network's work, they do illuminate how LinkedIn is being used to identify ongoing STEM challenges.

Supporting posts: 16

* Highlighting relevant contributions and expertise: Stephanie Espy, an active contributor mentioned in the research, consistently shares success stories in STEM to inspire others. Additionally, she focuses on raising awareness about gender inequality in STEM. Referencing Stephanie Espy's contributions underscores an understanding of the significance of role models and the aspiration to inspire and support others through shared success stories and addressing critical issues.

Supporting posts: 3

* Showcasing support from external entities: LinkedIn posts revealed notable support for the STEM PUSH initiative from various areas, such as Charlotte, and universities like Northern Illinois. This illustrates the network's expanding influence beyond its current ecosystem engagement.

Supporting posts: 10

* Addressing socioeconomic disparities in STEM education: LinkedIn posts have brought attention to conversations addressing the imbalances in student participation in STEM education, particularly between higher-income and low-income schools. Given STEM PUSH's mission to address these disparities, the ongoing discussions on LinkedIn offer a platform for STEM PUSH to advance its initiatives.

Supporting posts: 12

* Highlights:
  + Jeremy Mellito posted about the potential of PBL (Project-based learning) and STEM-based learning as the future, distinguishing them from traditional teaching methods.
  + Bernard Akawsee shared the success story of Mwangala M with the #stem tag, gaining 332 likes and 5 reposts.

*Twitter*

Twitter, now undergoing rebranding to X, is an internet-based social media and social networking service operated by the American company X Corp. On Twitter, users can share texts, images, and videos, commonly referred to as "tweets". Registered users have the ability to post, like, repost, comment, and quote posts, as well as send direct messages to other registered users.

The analysis of Twitter for the identified keywords revealed 50 tweets authored by 33 individuals, indicating a moderate level of activity on the platform. Twitter exhibits the lowest average reactions per post, amounting to 4.2. This suggests that Twitter users generally display lower engagement levels in comparison to users on LinkedIn and Instagram.

Figure 2 displayed below is a tweet authored by STEM PUSH Network. In this post, the Network highlights recent work by one of its members, Darin Gray, who published an article on representation in STEM. The tweet garnered 2 retweets, 4 likes, and 164 views.

A screenshot of a social media post

Description automatically generated

Twitter Analysis:

* Engagement and Expansion: The STEM PUSH Network actively seeks participants for its third cohort, signifying a growing and enthusiastic community. With goals of expanding the Network, it will be able to provide greater support for Black, Indigenous, and Latina/o/estudents pursuing undergraduate STEM programs.

*Number of supporting posts: 8*

* Awareness of Challenges: The Education Trust's observation about low enrollment in Advanced Placement STEM courses highlights a crucial challenge in the education system. Acknowledging this issue and expressing a willingness to contribute to improving STEM access and participation underscores a commitment to equity and inclusivity in education. Given the discussions taking place on Twitter regarding the issues within the education system and the imperative of enhancing STEM accessibility, leaders of the STEM PUSH initiative can leverage this platform to exchange narratives about their participants and the actions they are taking to tackle these issues.

*Number of supporting posts: 4*

* Commitment to Communication: The STEM PUSH Network's consistent monthly newsletters demonstrate their dedication to keeping members informed about the latest updates and opportunities. Emphasizing the significance of effective communication and staying up-to-date with developments in STEM education aligns with the network's values.

*Number of supporting posts*: 2

* Advocacy for Sensible Immigration: In a tweet, @MrCopolo underscores how sensible immigration policies can positively influence STEM education by highlighting the significance of varied viewpoints and skills in this domain. Endorsing immigration policies that encourage the advancement and creativity within STEM fields illustrates a broader understanding of the importance of diverse talent and global collaboration. By striving to enhance Black, Indigenous, and Latina/o/e involvement in STEM through Pre-College STEM initiatives, STEM PUSH is actively working towards enriching the range of perspectives within the STEM landscape.

*Number of supporting posts*: 1

* Highlights:
  + Twitter user @Mrcopolo advocates for an increase in sensible immigration, pointing out that without it, only 20,000 people would have graduated with STEM PhDs, which is less than half of the number of STEM PhD graduates in China.
  + The STEM PUSH Network page posted an invitation for PCPs to join the 3rd cohort.

*Instagram*

Instagram, a social networking service owned by Meta Platforms, enables users to share photos and videos. It permits media uploads that can undergo editing through filters and can be categorized using hashtags and associated with a location via geographical tagging. Users have the option to share their posts publicly or exclusively with preapproved followers. The platform facilitates browsing of other users' content based on tags and locations, providing access to trending content, the ability to like photos, and the option to follow other users, thereby adding their content to a personalized feed.

Instagram exhibits the lowest number of posts, comprising only five entries contributed by four different authors. This indicates that it might not be as widely used for posting compared to platforms like LinkedIn and Twitter. Instagram demonstrates a considerable level of user engagement, as evidenced by its moderately high average of 16.4 reactions per post. This indicates that users on the platform actively interact with the content shared by others, contributing to a vibrant and engaging community.

A screenshot of a social media post

Description automatically generated

Figure 3 is a post sourced from Instagram, attributed to the user "asujbmshp." The content of the post reads, "Happy pi day," and it has garnered a total of 32 likes.

Instagram Analysis:

* Active engagement in the STEM education community: In our web scraping, we have identified pages such as Remake Learning (@remakelearning) that play an active role in promoting discussions related to STEM education. They consistently arrange Twitter meetings, fostering knowledge exchange and collaboration among educators, researchers, and stakeholders. This reflects STEM PUSH’s dedication to actively engaging with the STEM education community and staying informed about the latest developments and ongoing conversations within the field.

*Number of supporting posts*: 2

* Collaborative partnerships with reputable organizations: Based on our findings, Instagram has served as a platform for members of the network to share about their work with the Network. Pitt Bio Outreach (@pittbiooutreach) expressed contentment in collaborating with the Network. This serves as evidence of STEM PUSH’s proficiency in establishing and nurturing significant partnerships with its collaborators.

*Number of supporting posts*: 1

*External Websites*

Below, you will find noteworthy insights gathered from various websites that provide crucial additional information about the keywords:

* Social Media Today reports that TikTok has launched a STEM-related content stream, underscoring the increasing interest in STEM education, as evidenced by over 110 billion views of STEM-related hashtags to date.
* NASA's funding initiatives are geared towards supporting minority institutions in preparing students for STEM careers, reflecting their commitment to promoting inclusivity and diversity in the STEM field.
* Organizations like the PSEG Foundation and Naval Research are providing grants to expand STEM pathways and create opportunities for underrepresented students, demonstrating efforts to address the disparities in STEM education and career prospects.

**Recommendation**

Within the subsequent recommendation section, we outline a series of insightful suggestions derived from an in-depth analysis of our web scraping findings. These recommendations can be used to guide strategic decisions and enhance the Alliance’s understanding of the digital landscape

* Boosting Instagram Presence for STEM PUSH Initiatives. Based on web scraping data, there's a significant gap in STEM education-related posts and keywords on Instagram compared to other platforms. To boost outreach, it's imperative to proactively strengthen STEM PUSH initiatives on Instagram. This proactive measure harnesses the combined social media power to address STEM disparities and raise awareness effectively.
* Continue to Enhance STEM PUSH's Social Media Reach. With the Alliance goals of broadening STEM participation and contributing to knowledge in NICs, disseminating effective PCSP structures and strategies, and promoting emerging evaluation methodologies for NICs and equity-focused initiatives, STEM PUSH should further enhance its presence on social media. By adeptly utilizing their social media platforms, the Alliance can initiate and engage in discussions, enabling the Alliance to harness the collective power of social media to tackle STEM disparities and elevate awareness.