

Earth-Science Outreach Using an Integrated Social Media Platform

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INTRODUCTION

Public outreach is an important aspect of every scientist's job description, but, unfortunately, it is often the aspect that is most neglected. Barriers that prevent scientists from engaging in effective public outreach include the pressing demands of administrative responsibilities, a lack of training, misaligned incentives, and/or a lack of administrative support (Andrews et al., 2005). However, funding agencies still often require evidence for the broader impacts of research results for continued access to public funds. New approaches are needed that encourage participation, provide a greater return on time invested, and offer quantifiable metrics on their impact.

In response to these challenges, many people use the Internet to communicate science to a wider audience (Fig. 1). Web-based science outreach efforts often struggle without a focused goal and/or well-defined audience, or suffer from low visibility within a particular platform (e.g., blog, Facebook, Twitter). If one desires to have an impact on public discourse and opinion, it is essential to engage in multiple outlets, given the fractured and diverse nature of the information ecosystem (Bik et al., 2015; Bik and Goldstein, 2013). This means expanding beyond blogs and websites, and including social media sites like Twitter, Facebook, Instagram, and other digital media (e.g., viral videos, mobile apps, podcasts). When used effectively, social media engagement doesn't replace scholarly output or "dumb down" science; rather, it boosts awareness, increases curiosity, builds community, and points readers to in-depth research of which they may not otherwise have been aware. In this article, we present a

		Participation	
		Low	High
Reach	High	popular media	integrated social media platform e.g. <i>TravelingGeologist</i>
	Low	individual Twitter/Instagram accounts specific research programs	academic conferences

Figure 1. The impact-participation matrix illustrates the goals of science outreach (i.e., high "impact" and wide "participation"). *TravelingGeologist* provides an open platform for anyone to contribute (and therefore maximizing participation from scientists) and has broad reach by utilizing an ISMP that spans the online ecosystem (thereby maximizing audience size/diversity).

five-year multi-national case study using "*TravelingGeologist*" (TG), an integrated social media platform (ISMP) focused on inspiring new scientists using field-based research narratives. Garnering >50,000 followers across multiple web-based platforms and >100 contributors, we conclude that lessons learned from TG can help scientists broaden their impact and participation in outreach efforts.

EXAMPLE OF A SUCCESSFUL ISMP: TRAVELINGGEOLOGIST

TG is an example of a successful, not-for-profit, web-based ISMP serving as a public outlet for earth scientists engaged in field-based research. TG allows researchers to give a high-level synopsis of research goals and findings, publish photographs of field locales, and tell "behind the scenes" stories about the fieldwork of their research project, all with the expressed purpose of (1) attracting and inspiring budding scientists; (2) sharing results of research to the public; and (3) fostering scientific communication

and interdisciplinary collaboration. TG leverages social media for dissemination and as a springboard for generating discussion; e.g., using Twitter to point readers to new and interesting papers, using Facebook to prompt a discussion on a controversial scientific topic, and using Instagram to provide in-the-field photographs and discussions of ongoing research.

Currently, TG has >100 contributors from >70 institutions and 14 countries. Its blog platform has >50,000 readers with average posts gaining >1000 page views. Readership currently comes from >180 nations and encompasses a wide range of education levels and employment status (Fig. 2). Over 50% of the followers on Instagram and >30% on Facebook come from lower/middle-income countries (Fig. 2). We highlight the relationship between different social media platforms and engagement with different countries and education levels in Figure 2. Reaching a wide audience beyond national and socio-economic borders elevates and strengthens the scientific community.

Survey results collected from TG readers ($n = 172$; see Fig. 2) found differences in platform preference, engagement level, and impact of interactions. Undergraduate students ($n = 47$) were more likely to follow Instagram (45%) and, together with high school students ($n = 3$), were least likely to visit the website, suggesting a preference for learning in a social context. Students and researchers ($n = 54$) wanted to participate in future fieldwork after engaging with TG. Female respondents ($n = 82$) felt more connected in finding role models than male respondents ($n = 90$). University-employed individuals ($n = 25$) were more likely than government/industry-employed individuals

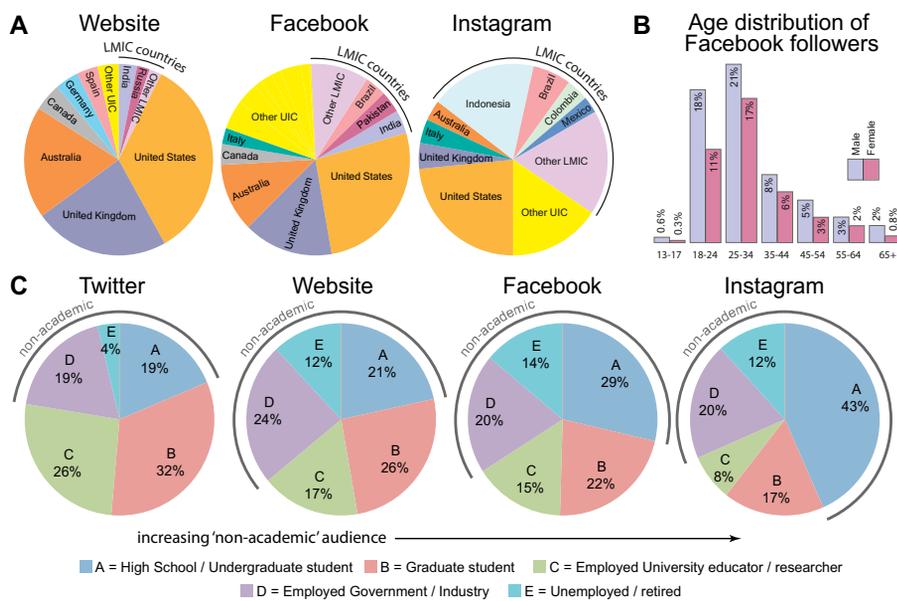


Figure 2. (A) Geographic distribution of website traffic and Facebook/Instagram followers. LMIC—lower-/middle-income countries (as defined by the World Bank); UIC—upper income countries. (B) Age/gender distribution of followers of TravelingGeologist on Facebook; e.g., 11% of females and 18% of males are 18–24 years old. (C) Chart of the current education/employment situation for survey respondents made up of TravelingGeologist readers.

($n = 43$) to report greater gender diversity at TG than in their institution, suggesting an important role for social media in supporting gender diversity in academia.

We attribute the success of TG to some key principles that should be employed by any group wishing to use social media as a successful outreach tool:

1. TG has a **focused goal**; i.e., inspiring the next generation of scientists by targeting young people interested in adventure travel and science. Field-based research and teaching is an effective way to recruit students to the geosciences (e.g., Moore, 2015). Additionally, adventure and travel narratives inherent to field-based science, when shared effectively, offer an alternative, low-cost approach to boosting the visibility of and interest in science careers. This is a specific audience niche, and focus enables building a recognizable social media brand (e.g., Bik et al., 2015).
2. TG is a **single unified platform** that uses multiple web-based platforms: Twitter, Facebook, Instagram, and TravelingGeologist.com. These platforms offer different levels of outreach. Twitter offers links to external sources, pithy commentary, or simple announcements, but each post/comment is limited in length. Facebook

- can expand conversation to lengthy discussions with photos and videos. Instagram offers quick, ephemeral outreach using photographs requiring minimal engagement (“double tap”). TravelingGeologist.com is less socially interactive but offers a permanent and in-depth outreach presence through contributor-produced georeferenced articles. These articles are short and non-technical. While not neglecting the science, articles delve into the human stories behind the research. By using multiple platforms, TG is able to reach a wider audience.
3. With TG, **content is not generated by a single researcher**, therefore lessening pressure for content generation. This lightens the load for any one person and providing more diverse content.

Earth scientists are invited to participate by submitting an article (500–2000 words) and photographs (with captions) from field-based research (recent or historical). Submitted material is reviewed and edited by volunteer staff and queued for publication.

ASSESSING ENGAGEMENT IMPACT FROM OUTREACH EFFORTS

A final key aspect of using an ISMP to enhance outreach is measuring success easily. Followers, readership, downloads, and engagement are quantifiable with accessible

and transparent metrics (see GSA Data Repository Fig. DR1¹ for statistics and growth from 2012 to 2017). The ultimate challenge of any ISMP is evolving as new technologies and media emerge that change the landscape of social interactions.

CONCLUSION

Science outreach with an ISMP provides an opportunity to more efficiently engage with a diverse body of students and aspiring scientists around the world in order to foster a global network of current and future scientists. TG provides a case study on diversifying outreach efforts across a variety of social media platforms. This model is not unique to TG and can be applied to any scientific subdiscipline. Our hope is that funding agencies and sponsoring institutions will see value in this type of public outreach and incentivize social media outreach among scientists.

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REFERENCES CITED

- Andrews, E., Weaver, A., Hanley, D., Shamatha, J., and Melton, G., 2005, Scientists and public outreach: Participation, motivations, and impediments: *Journal of Geoscience Education*, v. 53, p. 281–293, doi:10.5408/1089-9995-53.3.281.
- Bik, H.M., and Goldstein, M.C., 2013, An introduction to social media for scientists: *PLoS Biology*, v. 11, no. 4, e1001535, doi:10.1371/journal.pbio.1001535.
- Bik, H.M., Dove, A.D.M., Goldstein, M.C., Helm, R.R., MacPherson, R., Martini, K., Warneke, A., and McClain, C., 2015, Ten simple rules for effective online outreach: *PLoS Computational Biology*, v. 11, e1003906, doi:10.1371/journal.pcbi.1003906.
- Moore, S.L., 2015, GeoFORCE: Inspiring the geoscientists of tomorrow through field experiences: *The Leading Edge*, v. 34, p. 1210–1212, doi:10.1190/tle34101210.1.

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¹GSA Supplemental Data Item 2017209, growth statistics of the TravelingGeologist integrated social media platform, is online at www.geosociety.org/daterepository/2017/.