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The Digital Classroom: How to Leverage Social Media for Infectious Diseases Education

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Social media (SoMe) platforms have been increasingly used by infectious diseases (ID) learners and educators in recent years. This trend has only accelerated with the changes brought to our educational spaces by the coronavirus disease 2019 pandemic. Given the increasingly diverse SoMe landscape, educators may find themselves struggling with how to effectively use these tools. In this Viewpoint we describe how to use SoMe platforms (e.g., Twitter, podcasts, and open-access online content portals) in medical education, highlight medical education theories supporting their use, and discuss how educators can engage with these learning tools effectively. We focus on how these platforms harness key principles of adult learning and provide a guide for educators in the effective use of SoMe tools in educating ID learners. Finally, we suggest how to effectively interact with and leverage these increasingly important digital platforms.

Keywords. social media; medical education; digital strategy; infectious diseases; virtual learning.

In recent years, medical education has increasingly embraced digital tools for teaching [1, 2]. Instead of textbooks, many learners prefer portable, easy to digest, and accessible digital resources. This trend has been accelerated by the coronavirus disease 2019 (COVID-19) pandemic, which has ignited a wholesale restructuring of learners' academic schedules and clinical learning environments [3]. Physical distancing spurred educators and training programs to find novel approaches to traditional educational activities such as inpatient rounds, outpatient clinics, didactics and conferences. Many of these changes may reshape the learning space permanently after the pandemic recedes [4].

This trend has been particularly evident in the growing role that social media (SoMe) has played in delivering medical education. A somewhat amorphous term, SoMe refers to platforms such as Twitter, podcasts, and other forms of digital media that facilitate social networks. Many medical specialties (including emergency medicine, general medicine, and nephrology) have widely adopted these tools for medical education and have created pathways to recognize them for career advancement [5–8].

While a growing number of infectious diseases (ID) practitioners engage with these tools on a personal basis [9, 10], little

has been written about the effective use of SoMe for medical education within our discipline. In this Viewpoint, we provide an overview of SoMe platforms, propose best practices for the use of SoMe in health professions education, and suggest how to effectively interact with and leverage these increasingly important digital platforms.

SOCIAL MEDIA USE IN ID EDUCATION

A major benefit of SoMe platforms is that many of them inherently facilitate interactive and bidirectional learning. Through social networks, learners and educators can access and easily share learning resources. Twitter, in particular, has emerged as an important virtual venue where trainees and educators connect, teach, and learn. Like other platforms, Twitter provides engagement metrics (e.g., impressions, engagement rates, and likes) that enable educators to track the impact of their content. In addition, it eliminates geographic, institutional, and hierarchical barriers that exist outside digital networks, increasing access to experts and leaders in the field with whom learners and educators would otherwise not interact [11]. This easy access allows for enhanced networking and community building.

Many other SoMe platforms similarly offer an opportunity for ID educators to create and share content among users but are more static and less interactive (predominately unidirectional). These platforms, such as podcasts, blogs, and video sites (i.e., YouTube, Vimeo, and TikTok), offer the opportunity to disseminate content in a variety of formats. Although they are less interactive, they allow content to be free, portable, and globally accessible.

Each platform has important strengths and limitations related to educational content and other general use (Figure 1). Importantly, educational content posted on SoMe lacks a formal peer-review process to ensure accuracy and validity, allowing for potential spread of misinformation to the ID community and public. Real-time peer review by experts on SoMe to evaluate misleading information may lead to higher-quality content, and a more structured peer-review process could be of benefit to the medium [12]. In addition, because much of the ID educational content on SoMe revolves around clinical care and patient cases, it is critical to avoid sharing identifying patient information.

THE ID EDUCATOR AND SOCIAL MEDIA

Engagement Overview

There are a number of potential avenues for educators interested in using SoMe to teach learners. While others have described a hierarchy of SoMe engagement [13], it may be more appropriate to view this as a menu of options, with specific activities being used depending on the goals of the educator and learner (Figure 2). In this section, we offer a roadmap for ID educators to engage in SoMe, focusing on how to familiarize oneself with the medium, engage in a community, and create content for learners. We also provide a summary of the types of SoMe engagement with associated best practices (Figure 3).

Joining the Digital World

Educators can begin to use SoMe with relatively little effort or time investment. A low-barrier entry point into the digital world can include familiarizing oneself with the available content and then disseminating it to learners.

Much as medical educators have traditionally kept up with material relevant to their field, the SoMe-interested educator can be an avid consumer of digital content (Figure 2). A growing number of SoMe platforms are used by ID specialists.
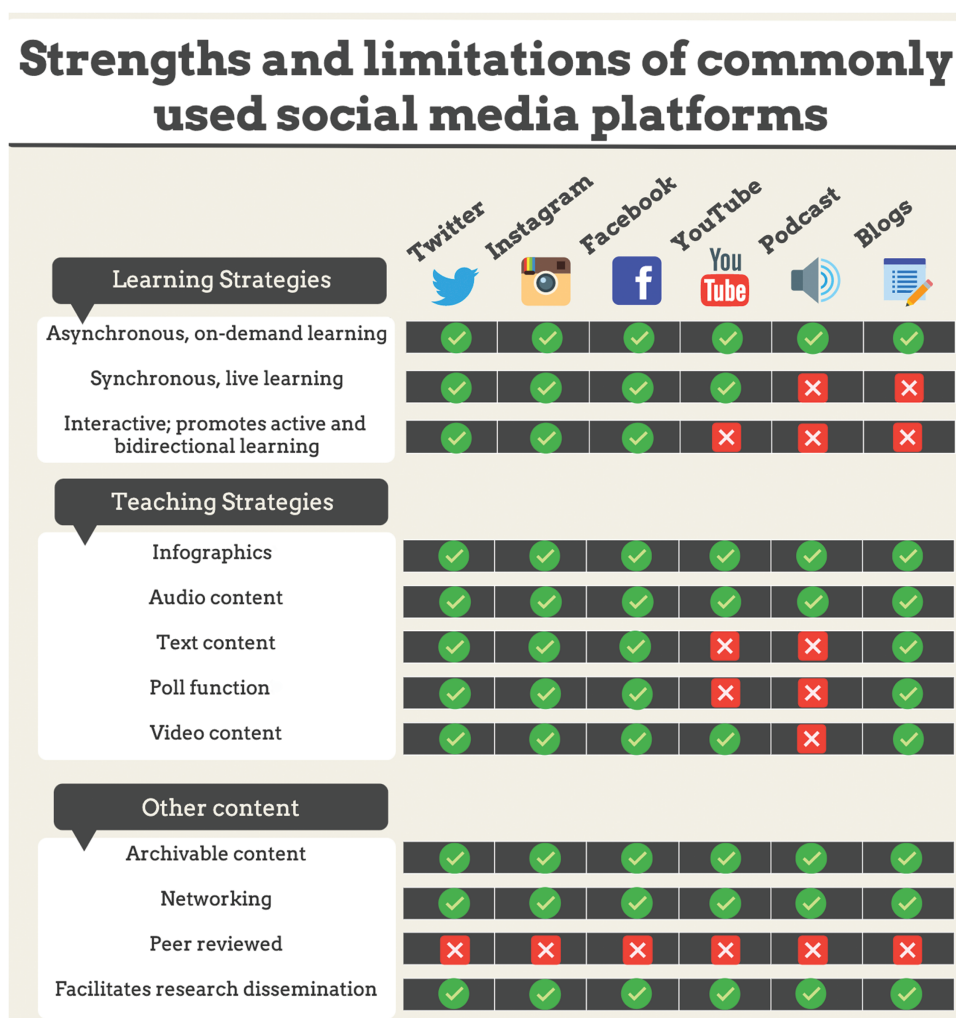

Strengths and limitations of commonly used social media platforms

Learning Strategies	Twitter	Instagram	Facebook	YouTube	Podcast	Blogs
Asynchronous, on-demand learning	✓	✓	✓	✓	✓	✓
Synchronous, live learning	✓	✓	✓	✓	✗	✗
Interactive; promotes active and bidirectional learning	✓	✓	✓	✗	✗	✗
Teaching Strategies						
Infographics	✓	✓	✓	✓	✓	✓
Audio content	✓	✓	✓	✓	✓	✓
Text content	✓	✓	✓	✗	✗	✓
Poll function	✓	✓	✓	✗	✗	✓
Video content	✓	✓	✓	✓	✗	✓
Other content						
Archivable content	✓	✓	✓	✓	✓	✓
Networking	✓	✓	✓	✓	✓	✓
Peer reviewed	✗	✗	✗	✗	✗	✗
Facilitates research dissemination	✓	✓	✓	✓	✓	✓

Figure 1. Strengths and limitations of commonly used social media platforms. An infographic is a concise and clear visual representation of information that explains a complex topic, provides an overview of a subject matter, or summarizes content. A poll function can be used in creating multiple-choice questions.

Social media engagement

Figure 2. Methods of social media engagement. This can be seen as a menu of options, with choice of specific activities depending on the goals of the educator and learner. For "consume," practitioners can view content, like posts, or follow a hashtag. Hashtags (signified by the # symbol) allow indexing of content, making it easily searchable. For "disseminate," educators/learners can promote content, curate content for their own curricula, or share content (e.g., retweeting on Twitter). For "discuss," practitioners can comment on posts or ask questions and join virtual chats or journal clubs. Finally, for "create," both educators and learners can create video or audio podcasts, design infographics, or post clinical pearls on social media platforms.

Summary of the types of SoMe engagement with associated best practices

CONSUME
- Follow content creators
- Bookmark, save, curate contents of interest
- Follow hashtags

CREATE
- Deliver concise teaching points: post clinical pearls, infographics, board-style multiple choice questions using poll function
- Deliver minilectures: Post "tweetorials"; adapt in-person "chalk talks" for video-sharing platforms
- Deliver longer-form contents: create blogs, podcasts, videos
- Create hashtags
- Add links to additional learning materials

DISCUSS
- Post a comment about a topic
- Post a question to the community
- Join online journal clubs & chats
- "Tag" content experts to invite them in the discussion
- Participate in SoMe activities during national conferences

DISSEMINATE
- Share content of interest (individual or curated)
- Direct learners to SoMe resources to support topics discussed on rounds

Figure 3. Summary of the types of social media (SoMe) engagement with associated best practices. Hashtags (signified by the # symbol) allow indexing of content, making it easily searchable. Tagging (signified by the @ symbol) calls the attention of a social media account holder (e.g., content expert). An infographic is a concise and clear visual representation of information that explains a complex topic, provides an overview of a subject matter, or summarizes content. "Tweetorial" is a term used in Twitter to refer to a series of posts (tweets) that are connected to each other to form a tutorial or a minilecture about a topic.

One could identify and follow content creators of interest on Twitter, podcasts, and blogs; this often exposes the consumer to relevant content and introduces them to other ID educators in the digital world in something of a "snowball effect." Many platforms (e.g., Twitter) have a bookmarking feature that allows the user to save and collect posts of interest.

Once educators become familiar with the scope of digital content, they can harness it for teaching learners through strategic promotion and dissemination of targeted digital material (Figure 2). Many SoMe platforms have an option to share content, often with the option to add commentary, reflections or questions. By doing this (i.e., "retweeting" on Twitter or sharing on other platforms), educators are able to highlight important teaching points and ultimately reach a larger audience than would be traditionally available to them through the amplifying effect of SoMe.

SoMe-oriented educators can also enhance their in-person teaching by directing trainees to relevant SoMe content that elaborates or reinforces teaching points discussed on rounds or in other educational settings. Such activities can leverage the learning theories of technology-enhanced learning and promote self-directed learning (Figure 4). In this way, educators familiar with digital content can continue to serve in the time-honored role of curator and distributor of knowledge, similar to how they have traditionally shared articles related to patient care.

Engaging in a Community

A major benefit of SoMe is that it provides an opportunity for educators to engage in a global community of learners, teachers, and content experts in a way that was previously limited to in-person conferences and meetings. This feature of SoMe can expand educators' reach beyond their physical classrooms and help them network with like-minded teachers outside their institutions.

There are many practical ways to engage with different SoMe communities. These are perhaps most relevant for interactive, bidirectional platforms such as Twitter. Questions, teaching points, or comments posted on Twitter provide the opportunity for others to reply to and engage in a discussion with the post creator (Figure 2). In addition, the use of "hashtags" (signified by the # symbol) allows for individual comments and conversations to be indexed under certain topics (e.g., #COVID19), making them easily searchable. Such interactions may build on the original teaching point or highlight additional perspectives.

Separately, a number of organizations host formalized discussions on Twitter, in which both experts and novices can participate in online conversations about specific topics. In contrast to traditional, institution-based conferences, world-renowned experts can be easily invited into the discussion by simply "tagging" them in the chat (i.e., posting their Twitter handle). Some of these discussions occur in the form of live, synchronous
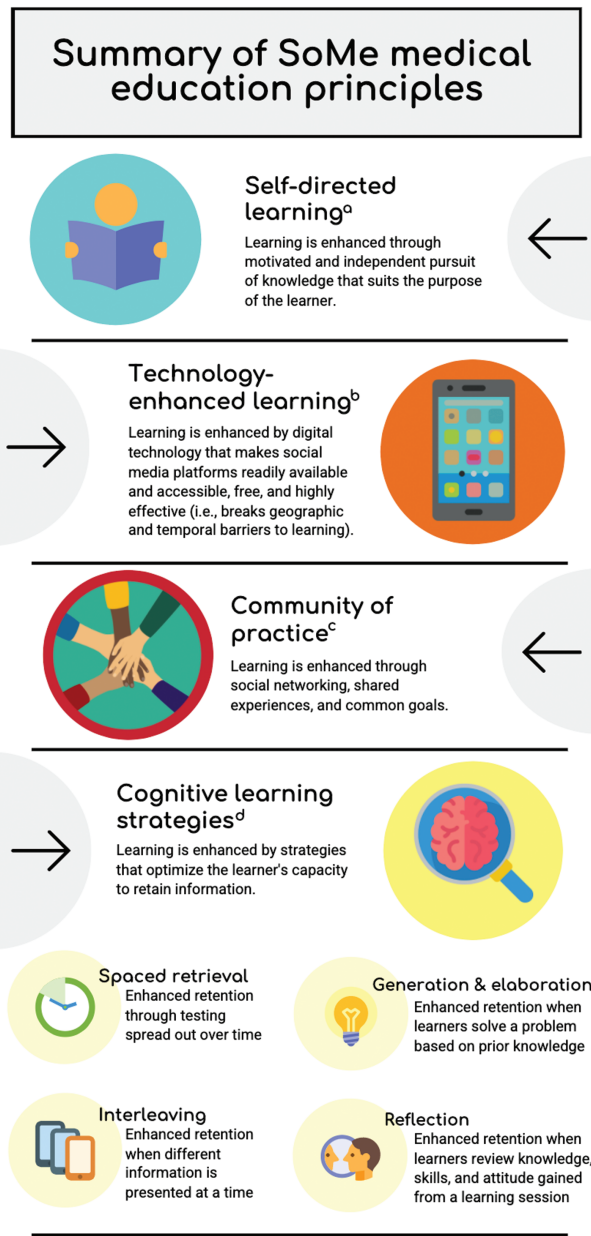

Figure 4. Summary of social media (SoMe) medical education principles, including self-directed learning [14], technology-enhanced learning [15], communities of practice [16], and cognitive learning strategies [17].

Twitter chats that take place at a prespecified time, such as #ASPchat (discussions on antimicrobial stewardship), whereas others are asynchronous. An increasingly common format is the creation of online journal clubs. Analogous to in-person journal clubs, these discussions highlight recent articles or advances in the field. @IDJClub is an example, where trainees can learn information on new topics, develop skills to critique the literature, and discuss how such advances may influence clinical practice. SoMe journal clubs can also be a powerful tool to promote post–peer-review discussion of articles, as they provide tangible archived feedback to authors and investigators [18].

SoMe has also changed the way that the ID community engages in national conferences. For example, posting key points on Twitter during a conference leads to real-time dissemination of important information to nonattendees. In addition, these online discussions allow for attendees to connect, reflect, and engage as a community, further amplifying the networking element of in-person conferences. To illustrate the positive impact of promoting conference material on SoMe, authors attending IDWeek2020 sought to evaluate engagement of users, social networks, and topics discussed on Twitter at the virtual conference to understand the characteristics of the new online format. With the migration of IDWeek2020 to a virtual platform, dissemination of conference material on social networks enabled individuals to engage and network far beyond what has been achievable during in-person meetings [19].

In addition to the benefits of networking and discussing content on SoMe, such online communities (Figure 2) can help contribute to a group's learning and sense of identity. This draws on the educational theory of communities of practice, which refers to groups of individuals bound together by a common personal or professional endeavor, wherein members learn and grow from their communal interactions [16]. Through social networking, common goals, and shared experiences, members of a communities of practice are thought to advance their learning more readily as part of the group than they could as individuals. SoMe readily promotes this sense of community and can continue to foster communities of practice among ID educators (Figure 4).

Creating Content
Finally, ID educators can create and disseminate content on SoMe (Figure 2). While this may be intimidating to some, many educators create and deliver in-person learning points daily. With relatively little effort, such content and skills can be adapted for SoMe. Below we provide suggestions on how to create and deliver content based on whether one's goal is to deliver a concise teaching point (e.g., a clinical "pearl"), a minilecture (e.g., a "chalk talk"), or longer-form content (e.g., a lecture).

Educators may want to highlight or reinforce a specific teaching point, similar to inpatient rounds. Posting a pearl on a SoMe platform is a typical way to do this. It is becoming increasingly popular for educators on clinical service to share teaching pearls from rounds via Twitter. Faculty at the University of California San Diego created the hashtag "#IDDailyPearl" for post daily teaching pearls with links to relevant literature [20]. These posts often include links to articles or additional references to provide material for further self-directed learning. Other SoMe educators put their energy toward creating graphics and tables to simplify complex topics. The use of SoMe for such teaching points extends the educator's reach far beyond the learners they would otherwise interact with on rounds, with relatively little effort [20].

Another way to emphasize a specific teaching point is by posting multiple-choice style questions featuring brief clinical vignettes with associated questions, using polling functions. The @WuidQ Twitter account is a good example of this approach, in which such questions have been used to highlight learning points relevant to the ID boards [11]. Using polls promotes retrieval practice, which results in more durable learning and retention [21]. Adding links to additional learning materials at the end of a post, such as journal articles, podcasts, or blogs, provides the opportunity for individuals to pursue further self-directed learning on the topic.

If one's goal is to adapt a minilecture on a particular subject (similar to an in-person chalk talk), there are a variety of options for the SoMe-interested educator to explore. A common format on Twitter is to create a minitutorial spread over a series of connected tweets (thereby bypassing this platform's character limit). Often described as "tweetorials," these teaching threads have become increasingly used for the delivery of medical education [22, 23]. Similarly, concise, well-practiced, in-person chalk talks can be adapted for and released on video-sharing sites, such as YouTube.

Educators interested in more in-depth teaching (similar to what they may have created for an hour-long lecture or article) may opt for longer-form platforms, such as podcasts, blogs, or video-sharing sites. While a discussion about how to start a podcast is beyond the scope of this article, it should be noted that podcasts are being increasingly used by both learners and educators to effectively deliver content. One example is "Febrile: A Cultured Podcast," a free and open-access ID podcast that supplements its on-air teaching with multimedia show notes and visual aids. There are also a number of online medical blogs that host novel content (Paul Sax's "HIV and ID Observations" is a notable ID example). As with shorter videos, longer prerecorded lectures can easily be uploaded to video-sharing sites like YouTube [24–27].

Regardless of the format educators choose, their use of SoMe for teaching can integrate theory-supported educational practices, such as spaced retrieval, elaboration, and reflection [17] (Figure 4). The amplification power of these platforms will also allow them to reach a far greater audience than otherwise possible with traditional in-person teaching tools. As a result, they will be able to reach new learners, get constructive feedback from educators at other institutions, and increase their profiles as education leaders.

With education implementation, an equally important part of content creation is development of a formalized evaluation process. Using Kirkpatrick's 4-level training evaluation model (reaction, learning, behavior, results) [28] many of the Twitter metrics previously mentioned (e.g., engagement rates and likes) fall under the category of reaction (level 1). Educators strive to reach higher levels with their educational content by creating learning objectives and outcomes that

are specific and straightforward to measure. Although some studies have demonstrated improvements in knowledge acquisition (level 2) and behavioral changes (level 3) [29], it is difficult to study the sole effectiveness of SoMe owing to variation in learners' usage of SoMe and the structure of medical education, where content repetition is seen in didactics and clinical rotations.

RULES OF ENGAGEMENT WITH SOCIAL MEDIA

While formal rules of etiquette for educators joining the digital world are largely absent, we have anecdotally observed best and worst practices for SoMe engagement. We recommend that educators proactively consider how to build their audience by identifying specific educational or professional goals they would like to advance through SoMe. They can then develop a personal brand that aligns with those goals. By personal brand, we mean the educator should have a primary audience in mind (e.g., medical students or the general public), a tone/style that is appropriate for that audience, and a specific topic or topics on which they want to focus (e.g., antimicrobial stewardship or promoting vaccination). Practically speaking, educators may wish to concentrate initially on developing expertise using one particular format (e.g., tweetorial, board/multiple-choice question, or short-form didactic video). From there, they can engage by consuming, disseminating, discussing, and creating content that fits their personal brand (Figure 2).

When planning an audience-building strategy, we caution educators to focus on their educational goals—and ultimately the mission of advancing high-quality patient care—rather than allowing the acquisition of influence or followers to become an end unto itself. Colleagues on SoMe readily recognize certain patterns of behavior, such as bullying trainees and colleagues in an attempt to be seen as an expert or "thought leader" or intentionally adopting contrarian points of view to garner attention by placing themselves at the center of controversy. Such unprofessional behavior not only endangers educators' reputations but can also erode public trust in the ID profession more general. We suggest that all users of SoMe become familiar with mission-based tweeting if using Twitter [30].

Part of curating a positive and mutually beneficial experience on SoMe is identifying individuals in the community who engage in the toxic behavior described above and using the platform's muting (meaning that one no longer has to see someone's content) or blocking functions (meaning that in addition to being muted, the muted person can no longer see or interact with one's content). While it is tempting to feel the need to prove oneself correct in every public online debate, we encourage educators to confine their usage of SoMe to positive and constructive interactions that advance their professional goals.

Although teaching via a real patient case on SoMe platforms can be effective and reach a large audience, these case presentations can lead to patient privacy concerns. We recommend that educators acquaint themselves with recently published guidance for the posting of patient-related content on SoMe platforms, such as deidentification of patient information, the use of patient images, and proper citation [31]. In addition, plagiarism and ownership of educational content in SoMe has become an important issue. When developing content, we recommend adding the creator's SoMe handle on the graphic and/or including an ownership statement.

LEVERAGING THE WORK

SoMe platforms allow educators to engage in and disseminate scholarly work to a wide audience. Twitter has nearly 200 million daily active users [32], far greater reach than many medical journals. Several publications have demonstrated that Twitter-based dissemination of scholarly work increases reading and citations [33–35]. However, describing SoMe engagement on a curriculum vitae or its use for a promotional track has not been universally adopted across institutions. Instead of the H-index, other metrics—such as the Altmetric, which takes into account traditional citations, traditional media references, and SoMe references—may provide a better platform to leverage for a promotion for the provider engaging in SoMe. Prior work has described documentation of SoMe engagement as scholarship [5–7].

With respect to specific scholarship around medical education, there were 33 abstracts in the ID Medical Education category at IDWeek2020, of which 4 involved SoMe or virtual learning. One notable example is the impact of @IDJClub with >9000 followers from >100 countries, which was highlighted as an oral abstract in IDWeek2020 and is also included in this supplement [36]. While educators are increasingly modifying their content for distribution on SoMe, further consideration is needed regarding the evaluation and production of such novel forms of scholarship. Applying established standards for the evaluation of scholarship, such as those proposed by Boyer and Glassick, could provide more formalized methods for evaluation and improvement of educational content on SoMe [37]. Evaluative criteria in their work included the presence of clear goals, adequate preparation, appropriate methods, significant results (as it applied to the goals), effective presentation, and reflective critique. Further work on applying such standards to SoMe content could help validate this as a novel form of scholarship. Furthermore, particular demographics are attracted to SoMe and engage with it, with women and people of color traditionally less represented among podcast creators and listeners [38–40]. Consequently, this may contribute to a risk for inequities in career advancement as SoMe contributions become more commonly cited forms of scholarship.

CONCLUSIONS

As with other emerging technologies, SoMe is rapidly evolving, with users continuously identifying new applications and ways to engage learners. The views in this article reflect the experiences of the authors, which may not characterize the true scope of SoMe use in the larger medical education community. Despite a growing literature around the use of SoMe in medicine, more high-quality research is needed to determine the most effective methods for using these tools for education.

Going forward, we hope that the ID SoMe community will continue to grow, developing and evaluating effective methods of delivering medical education. Those new to SoMe may find this Viewpoint helpful as they seek to learn the basics of the various platforms, whereas those already using SoMe personally or professionally may learn helpful strategies for best using these tools to reach learners. As the use of SoMe for education grows, we can continue to harness the amazing potential of these tools to serve our learners, gain skills as contemporary educators, and grow as a community.

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