STEM Leaders

Cultivating Effective STEM Leaders: Challenges and Opportunities

What We Know: The Stem Leader Profile

- On average, the individual STEM professional profile tends toward cognitive—not interpersonal—strengths.
- Interpersonal relations and self-awareness are common developmental needs.
- Despite difficulties leading and understanding subtle dynamics within project teams, STEM leaders have a high capacity and strong motivation to learn.
- STEM leaders are tough critics and are less likely to be satisfied with their own accomplishments than other professionals are.
- STEM leaders require empirically sound data to demonstrate benefits and utility of approaches, especially nontechnical initiatives such as leadership development.

Sources: Cohen and Cohen, 2012; Parker and Welch, 2013; Sansone and Schreiber, 2006

The National Science Foundation commissioned ICF International to conduct a literature review on the topic of STEM leadership development. Although a fair amount is known about the profile of STEM leaders as a category and about the typical issues they face in the course of their managerial and scientific work, further exploration can help identify the human capital initiatives best suited for this population. Maximizing the effectiveness of STEM professionals as leaders of people—in addition to their seminal role as intellectual leaders—poses challenges and opportunities for any organization.

What We Know About STEM Leaders

A set of attributes comprise the STEM leader profile and provide the foundation for developmental experiences: Research documents the STEM leader profile and specifies qualities characterizing this group of individuals (see insert). All human capital initiatives, including training and education opportunities, must be designed and delivered with the profile of the typical STEM leader in mind.

On-the-job, in-role developmental approaches best serve STEM leaders: The optimal way, and in many cases the only way, organizations successfully provide leadership development to STEM leaders is through an emphasis on *day-to-day leader development* enacted largely through interactions between leaders and their direct reports within the context of performing work responsibilities. Directing resources toward on-the-job interventions with STEM professionals can effectively modify, change, or develop STEM leadership competencies. These kinds of activities can be effectively supported if STEM leaders are guided and rewarded for being advocates for—and consumers of—such in-role experiences. Cultivation of leader competencies transpires when current STEM leaders identify on-the-job opportunities and *developmental assignments* (e.g., special projects or initiatives, task forces, committees,

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and teams) for aspiring STEM leaders. Of even more importance are incentives and senior leadership support (via modeling) for the incumbent STEM leader to recognize the inherent developmental opportunities within every job and take the initiative to act on those opportunities (e.g., obtaining necessary support from supervisors and other stakeholders when needed). Successful performance in developmental assignments can serve as a requirement for positions of higher leadership responsibility. Human capital leaders can configure critical activities and functions to provide developmental assignments to STEM leaders early (and throughout) their careers.

An organizational climate of development is necessary for STEM leaders to thrive: Effective STEM leader development occurs most often when a *climate for development* permeates the organization. The need for STEM leaders and federal agencies to encourage and reward leaders for being supportive and approachable runs counter to STEM leaders' experiences in career fields typically characterized by independent action and personal self-achievement. A climate of development emphasizes communication and interaction, cooperation, feedback, evaluation, participation, reflection, and coaching. Treating mistakes as learning opportunities rather than personal failures characterizes thoughtful intellectual risk-taking. Leaders who disclose their own personal setbacks to build transparency set the tone for valuing development within the organization.

Structured executive and leadership coaching programs benefit STEM leaders: With the use of in-role development and on-the-job learning, STEM leaders benefit from concurrent participation in structured *executive and leadership coaching programs* that are staffed by experienced coaches with expertise in interpersonal and social competence development. Coaching—in tandem with in-role development efforts—can guide STEM leaders to identify and execute developmental activities, and also support in-depth learning regarding effective, real-time communication and team dynamics. In addition to formal coaching, organizations can identify STEM leaders strong in cross-boundary collaboration and pair them with other STEM leaders to provide mentoring or peer-to-peer coaching. Relationships among STEM leaders also can serve as an opportunity to refine STEM leaders' feedback skills. Providing feedback is one of the most important elements of effective leadership but also is a potential area of weakness based on the STEM leader profile. To maximize the value of peer coaching, organizations should provide targeted, behaviorally based follow-up training to pursue developmental goals.

Realistic job previews can effectively prepare STEM leaders for managerial roles: Another technique with promise for contributing to STEM leader development is the use of *realistic job previews*—high-fidelity views on the realities of the STEM leadership role and day-to-day responsibilities. Providing potential or future STEM leaders with a preview of the demands of leadership and implications for readiness creates smoother transitions into government positions as well as into positions of higher levels of authority. These previews typically present the common strengths and developmental needs of STEM leaders in a given organization (i.e., an organization's custom STEM leader profile) in relation to the STEM leader population at large.

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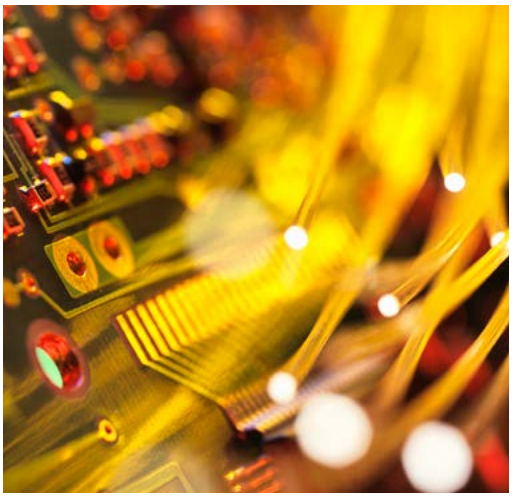

STEM leaders honor evidence and data: Because of their intellectual proclivities, STEM leaders place high value on measurement, objective metrics, and data. Thus, formal assessments are an effective tool to help STEM leaders understand their developmental strengths and needs. Leadership assessments are useful as the foundation for identifying foci for coaching activities. By extension, structured action planning also helps leaders demonstrate coaching's tangible impacts. STEM leaders are likely to see the value of 360-degree assessments and individual leadership assessments designed and developed by reputable industrial and organizational psychologists. Organizations should offer a mix of instruments to enable training and development representatives and executive coaches to work with STEM leaders and select the most optimal assessment based on identified developmental goals. Creating a means by which all STEM leaders receive a periodic, objective developmental assessment of their leadership abilities and results will emphasize how leadership development approaches are grounded in the scientific method and therefore increase buy-in.

Developmental experiences are most productively organized around critical STEM competencies and associated skills: Organizations with STEM leaders inherently possess *core competencies of the successful STEM leader,* whether those competencies are articulated overtly or exist informally. Such competencies should be transparent and serve as the foundation of any developmental initiative. Development of interpersonal and social competencies, multifunctional team leadership, and organizational boundary spanning skills (i.e., political savvy) should play a dominant role.

What We Need to Know to Support STEM Leaders

Developmental approaches need to be synchronized among federal agencies, academic institutions, and private companies: During the course of their careers, many STEM leaders move among academic institutions, research organizations, private industry, and the government. A shared model or framework for STEM leader development should be exchanged to inform the development of a pool of qualified and experienced STEM leaders. This *integration with feeder institutions* can help ensure goals are in alignment and STEM leaders have an integrated developmental pathway regardless of their current organization. One inherent challenge of this approach is maintaining an ongoing dialogue with these various entities to ensure excellent service to the STEM community and achieve economies of scale for the best outcomes.

STEM leaders must tailor leadership approaches to various situations, including research project phases, program funding negotiations, and strategic discussions regarding research portfolios: The long-standing utility of situational leadership is once again seen in organizations with STEM leaders. *Matching leadership approaches to various situations* is imperative to success. STEM leaders need to develop the flexibility to move among leadership approaches instead of using a single approach for leadership- and management-related tasks.

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For example, formative phases of the research project lifecycle require different tasks of STEM leaders, their direct reports, and other team contributors, compared with latter stages of the project lifecycle. Effective STEM leaders need fitness in adapting leadership approaches as a given research project evolves.

Building a strong learning goal orientation within project teams and among STEM leader peers can strengthen an organization's climate for development: STEM leaders can encourage and cultivate a learning mindset or *learning goal orientation* in themselves and their colleagues. STEM leaders can vicariously reinforce a learning goal orientation in their subordinates by sharing their own intellectual curiosity and passion for learning, and by focusing on the relationship between effort and individual development. This approach primes STEM leaders at all levels (as well as nonscientists) to benefit from developmental experiences.

Achieving traction with developmental efforts can occur when senior STEM leaders place expectations on more junior STEM leaders to set and pursue developmental goals: Senior STEM leaders must place expectations on aspiring or current STEM leaders to engage in *developmental goal setting* by identifying their developmental needs and associated action plan(s). When senior STEM leaders personally model goal setting, they reinforce its critical function. STEM leaders can be guided to emphasize collaboration and team-based goals to enhance collective action and responsibility as a means to counteract the individualistic science culture.

Structured opportunities to practice giving and receiving feedback are vital for STEM leaders to build managerial capacity: As an adjunct to the formal assessments discussed above, *informal, observation-based assessments* performed by STEM leaders themselves can serve dual purposes. First, exposing STEM leaders to a solid, concise methodology (including rating guidelines and well-constructed rating scales) for performing observation-based assessments of peers and direct reports can help leaders learn how to observe effectively, a foundational skill for providing effective performance feedback. Second, results from such assessments to STEM leaders can provide valuable real-time evidence of their relative strengths and areas for improvement.

What's Next? Evolving Our Human Capital Initiatives

To continue fostering STEM leader development to meet the nation's needs, members of the STEM community should consider the following trends and their implications:

- Acknowledge patterns of constrained or declining public sector and research resources that likely will continue. Develop initiatives focused on creating a leadership cadre that can successfully engage in interdisciplinary work in an era of constrained resources.
- Explore the implications of the trend that academia (the source of most STEM leaders) has increasingly shifted toward a reliance on contingency faculty, thus creating the next generation of STEM leaders with less organizational work experience.

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Create developmental initiatives that address the challenges posed by federal agency work environments that are characterized by bureaucracies with extensive policies and procedures, fixed position descriptions, internal management chains, and strong external oversight.

- Examine meaningful differences across various "types" of STEM leaders and career phases. Encourage research to draw evidence-based conclusions about unique characteristics of STEM leaders and the demands facing them.
- Continue examining and addressing challenges of women and minorities in academic STEM settings. Leverage existing research on the importance of managed development and succession programs, international collaboration, and multidisciplinary teams.
- Acknowledge how STEM leaders commonly interact with other scientists who are more comfortable serving as individual contributors than within a team environment and with nonscientists from diverse backgrounds. Evolve development methods focused on expanding STEM leaders' conflict management abilities and on building a team culture of autonomy and accountability.

For more information, contact:

Rebecca Harris Mulvaney
rebecca.mulvaney@icf.com +1.703.934.3582

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