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GPS Groups: A Peer-Problem-Solving Approach to Mentorship***ABSTRACT***

GPS Groups (Goals and Problem-solving for Scientists) is a peer-mentoring organization that facilitates problem-solving among minority scientists from a wide range of research fields (e.g. women in STEM). The GPS model consists of a confidential peer-mentorship group where individuals come together to discuss professional concerns, engage in analytical problem-solving techniques, and develop individualized plans of action in a supportive, yet exacting environment. Each member is expected to act as a sounding board, reference point, and source of perspective for the rest of the group. Due to the commitment to confidentiality, the group provides a safe environment to ask questions, show weaknesses, test ideas, and give and receive critical advice. Here we present the founding principles of GPS and directions for establishing local GPS groups. These guidelines have been developed experientially – the first GPS group was formed in the Washington, D.C.-Baltimore area, and consisted of four women scientists who were all postdoctoral researchers. The initial group has had startling success. After two years, three of the four original members applied for and accepted tenure-track faculty positions, and three women had second or third children, while still maintaining their career trajectories. The benefits of GPS groups, however, extend far beyond professional development or promotion. Individuals are empowered to change perceptions, enhance self-confidence, and increase their external influence.

Introduction

It has been well documented that women, blacks, Hispanics, and Native Americans not only constitute underrepresented minority (URM) groups in STEM (Science, Technology, Engineering, Mathematics) disciplines, but that their retention rate in the pipeline is dismal. While 50% of STEM bachelor degrees and 38% of postdoctoral positions are awarded to women, only 6 to 29% (depending on discipline) of faculty positions are held by women (The National Academies, 2010). Similar two-fold reductions are seen in other URM groups as well (Nelson & Brammer, 2010). The individuals who obtain faculty positions often report feelings of isolation and workplace bias, coupled with low expectations of their scientific ability and performance. Closing the gap between education and retention requires significant changes, both at departmental and institutional levels. The identification of mentors has traditionally been highlighted as an essential element in maintaining URM individuals in STEM fields. Here, we argue that peer problem-solving groups provide a level of support and personal growth unattainable in traditional mentorship models, and that participation in such groups can play a significant role in retaining URM individuals in the academic pipeline.

Peer mentorship has been used successfully outside academic environments. First proposed in N. Hill's (1937) classic book *Think and Grow Rich*, peer mentorship was facilitated in a "mastermind" setting for business entrepreneurs, which Hill defines as a place for "the coordination of knowledge and effort of two or more people, who work toward a definite purpose, in the spirit of harmony." Because scientific research in many ways can be considered entrepreneurial, application of a mastermind model in academic environments can have similar positive effects.

The analogous model presented here is a revision and extrapolation of a group problem-solving approach described in *Every Other Thursday: Stories and Strategies from Successful Women Scientists* by E. Daniell (2006). In this book, several women in Berkeley, California (including members of the National Academy of Sciences, researchers, professors and industry scientists) met every other Thursday for over 25 years, and credit the group for their many professional and personal successes.

Although the model presented below would benefit all scientists, the main focus of the group – known as GPS (Goals & Problem-Solving for Scientists) – is to cater to women and other URMs. The first such GPS group was formed in June 2009 in the Washington, D.C.-Baltimore area. Its founding

members (and authors of this paper) were all postdoctoral fellows in the physical and biological sciences at the time of the group's inception. Due to its remarkable success (see §4), GPS has expanded with new chapters and splintered into new groups as members have accepted new positions elsewhere in the country. Here we present the basic mechanics, facilitation, benefits and results of a GPS group.

A GPS Group is Many Things

A GPS group is a confidential peer-mentoring group where individuals come together to discuss professional concerns, engage in analytical problem-solving techniques, and develop individualized plans of action. The private and close-knit nature of the GPS group ensures that members can thoroughly explore concerns in an atmosphere that is both supportive and exacting. Members are required not only to resolve their own conflicts, but also to act as a sounding board, reference point, and source of perspective to others. Through both short-term and long-term assessments, members report professional and personal enrichment, as well as an increased sense of personal power, confidence and external influence.

GPS was founded in part to provide peer-mentorship for underrepresented scientists – women, racial and ethnic minorities, LGBT members and scientists with active family lives are all excellent examples. Individuals in these groups often experience a sense of isolation in the workplace, which can be combated through membership in a GPS group. Such a group helps with identifying and conquering workplace bias and self-esteem issues, including the “imposter syndrome” (Clance 1985). Additionally, female GPS members also report that vetting concerns with other women helps relieve much of the competition often experienced among women in the work place, a phenomenon Stone (2007) referred to as “horizontal hostility”.

GPS groups can be effective throughout a scientist's professional career. Although the inaugural GPS group involved postdoctoral fellows, all members acknowledge the benefit of peer-mentorship in the next stages of their career. Discussion with senior scientists confirms the desirability and need for such groups to exist at every stage of one's career (also demonstrated in Daneill's book). We argue however that the GPS model is most important during transitional stages, such as the move from postdoctoral positions to faculty positions or from tenure-track to tenured positions. It has proven effective at combating the losses of the “leaky pipeline” common during these leaps on the academic ladder (Pell 1996).

GPS Group Formation and Facilitation

The goal of GPS is utilitarian: it exists to solve problems that individual members face in their professional environment involving, but not limited to, professional development, goal setting, productivity, conflict resolution, mentoring, scientific writing, interview skills, work-life balance, and harassment. To achieve this, GPS groups should maintain the following rules of engagement:

1. Selection of members: A group consisting of four to six people is ideal. Recruitment of new members must be unanimous, and new members should fit the criteria outlined by the original members with regard to peer similarities. We found that it was extremely useful to have members from disparate fields of studies (See § 3.1 for more details).
2. A commitment to meet every other week. Given the need for a true time commitment, meeting more frequently may not be feasible and yet meeting less frequently diminishes the continuity of discussions. One of the primary benefits of the GPS group is to leave each meeting with the expectation that one will be held accountable for following through on outlined solutions. Showing up at each meeting must be a top priority (with reasonable exceptions, of course). Members should treat GPS meetings the same way that they adhere to other professional commitments. GPS members have attended meetings on the eve of proposal deadlines, job interviews and with newborns in tow. This type of commitment, while perhaps initially difficult, engenders a feeling of mutual respect among members and ensures the long-term viability of the group.
3. A commitment to complete confidentiality. This creates a safe and comfortable environment to ask questions, show weaknesses, test ideas, and give critical advice. Adherence to confidentiality is

- absolutely essential. Breaking this rule weakens the foundational trust within the group necessary for collective and individual success.
4. **Restricted times:** Each meeting should be 2 to 3 hours in length, depending on the members' preferences. Meetings start with a 30-second "check-in" during which each member states her (or his) points of discussion for the meeting. Each member requests an amount of time she predicts will be sufficient for a thorough discussion of her issue(s) of choice. The group decides how strict they need to be to stay on track, but this step helps gauge the seriousness of the topics for that meeting, i.e. a member who only wants to speak for 5 minutes probably has a less pressing or more easily solvable issue than someone who allocates 20 minutes of the meeting.
 5. **Choosing topics of discussion:** Members should focus discussions on problems where they seek an active resolution, or on issues relevant to all members. This is critical, as GPS meetings are not merely "venting sessions" – participants must then be willing to do the work needed to overcome pertinent issues. In the event that a member does not have an issue to be addressed, his/her role is still critical for the group. During those times, he/she fulfills the peer-mentorship component of GPS.
 6. **Honest feedback:** The ability of members to both give and receive feedback makes the GPS model a mentoring success. Peer-mentorship means that individuals are likely to be more receptive to internal critical review than in the context of a traditional mentoring relationship. It is not enough to simply meet and discuss problems – it is essential that members be exacting and honest in their feedback. The hardest, but most rewarding part of GPS, is pinpointing personal weaknesses, and then having the support of a close-knit group to work through those weaknesses. This is impossible if members are not committed to honest exchange.
 7. **Protocols for the beginning and end of each meeting:** As with any group, inter-personal conflicts can arise. If such an issue between two or more members is left over from the previous meeting, it should be discussed first thing during the next meeting (before the "check-in" time) in order that the meeting continues comfortably and productively for everyone. At the end of each meeting, members should list concrete goals to be achieved before the next meeting. This strengthens the sense of collegial accountability and is often the cornerstone for the next meeting. Additionally, a useful suggestion found in Daniell's book (2006) is having group members give and receive compliments to each member with grace, respect and pride. This is a valuable life skill often overlooked by a polite declination of a compliment, an unfortunate, yet socially pressured, practice.

Group Homogeneity and Heterogeneity

The effectiveness of GPS is dependent on a certain level on homogeneity within the group. For example, the efficacy of a GPS group is most likely diminished if its members consist of both genders, as people interact differently when members of the opposite sex are present (e.g. Smith-Lovin & Brody 1989, Mabry 1985). This defeats the aim of a truly open and free group environment.

Similarly, having a group of individuals at similar career levels is important, especially if in the same field, department or institution. This can assuage questions of conflict-of-interest such as: Will the senior members ever need to write letters of recommendation for junior members? Will she be involved in promotion or tenure decisions for a junior GPS member? Also, it is likely that senior members will act as mentors to the junior members and not vice versa. This would violate the peer-mentorship ideal. Learning to trust and validate your own feelings, opinions, and actions by giving advice to others is critical to GPS success, where participants must be both mentors and mentees in order for the system to thrive.

GPS does not replace the traditional mentor/mentee relationship, but it works in partnership for personal and professional development. A senior mentor provides key insights into professional development based on experience and advanced information. However, a senior mentor may have a different vision for a junior's career than the mentee, and may not incorporate all of the personal

parameters needed to make a decision. Also, showing weakness is rarely a good idea in front of a senior mentor who will also likely be the person writing letters of reference for the mentee. A GPS group runs into neither of these problems. Being able to show and acknowledge self-doubt in a safe place is critical to getting past those hindrances.

For these reasons, maintaining a group of single gendered members and of roughly the same status is strongly recommended. However, one area where homogeneity may cause friction is when there are overlapping research interests among the members. For example, if all members are astrophysicists studying exoplanets, there is a strong likelihood that the members will find themselves competing with each other for jobs and grants, forcing an environment within the group that may not be fully honest and supportive.

Heterogeneity in research interests also provides a number of benefits and lessons that can be drawn from cross-disciplinary interaction. For example, disciplines traditionally have different approaches to everything from intellectual property ownership to publication timetables to dealing with maternity leave and family care at conferences. Awareness of alternative approaches encourages the adoption of more equitable policies in the workplace across STEM fields.

Experience, Growth and Success

The inaugural GPS group started with E. Shkolnik seeking women who mirrored her personal and professional experiences and goals. For her, this translated to female postdoctoral researchers working in the physical sciences who had hopes of attaining a tenure-track academic position. She also recruited women who already had children, as having young children was a significant part of the challenges she faced in the workplace. She needed to combat the “motherhood penalty” not experienced by childless women in academia (Whittington, 2011).

This group began meeting bi-weekly in June of 2009. The members included two astrophysicists, one biologist, and one geochemist (the authors of this paper). By all measures, this first GPS group was successful, as the following results suggest:

- Three of the women applied for and are now in tenure-track academic positions in their fields of choice.
- Three of the women have had successful second or third pregnancies in this time and managed to avoid the leaky pipeline.
- Each woman is committed to beginning another GPS chapter in her local city, which mirrors her current career status.
- The problem-solving skills acquired in the GPS group have been successfully applied by the members to their other personal and professional relationships.
- GPS has propelled members to apply for fellowships/jobs/conferences outside of their normal bounds of motivation and confidence. This paper, written by scientists for a social science conference, is just one example of how the inter-disciplinary nature of GPS provides its members a window into new fields and thus the confidence to cross disciplinary lines.

The success of every GPS group is built on the success of its individual members. The first group was successful because each member built on her strengths and made it a priority to reduce her weaknesses. These changes were possible in large part because of the peer-mentorship model – seeing how one’s advice positively impacts others leads to enhanced self-confidence when it comes time to make key judgments about personal situations. Each woman has come away from GPS more empowered, more confident, and more focused.

Expansion of the GPS Model

The many benefits of participating in a GPS group have precipitated several outcomes. First, the authors have come to the realization that fostering a large-scale environment where women can come together to network is essential – not just for professional development, but also to provide a platform for advertising the advantages of being in a GPS group. To this end, we have organized several Wine & Cheese evenings with female scientists in the greater D.C.-Baltimore area. In these social settings, spontaneous networking and subsequent word-of-mouth has led to new GPS groups forming in the area, including the first all-male group. We plan to continue such networking on a biannual basis.

Second, GPS is currently expanding nationally as the founding members diverge both professionally and geographically, regenerating themselves into new homogeneous groups reflecting the new stages in their careers.

Third, an online presence at GPSgroups.com is being built. Here, people will have access to peer-problem solving resources, as well as a meeting place for individuals in STEM fields to find each other and form their own GPS group in their city. This database will initially focus on women, with the later expansion to other underrepresented groups in STEM fields.

Summary

GPS groups are a model for mentorship through peer problem-solving, with the following essential elements:

- Autonomy
- Self-selection
- Status equality
- Confidentiality
- Commitment
- Action

GPS groups fill the gap left by traditional mentor/mentee relationships by providing members with the space for professional and personal growth in a safe, confidence- building, highly critical, but highly supportive environment. The benefits of GPS membership exceed career advancement – they affect every relationship, including the one with self – and as such, being part of this group is one of the most important commitments that each of us has made. It is anticipated that the GPS model will continue to sprout new chapters and promote the success and advancement of underrepresented STEM minorities in the near-term future. To help achieve this, we are creating an online problem-solving resource at GPSgroups.com.

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