

Increasing Woman Participation in GIScience Research: A GMU CISC Perspective

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Introduction

Less than 20% of the professionals in Science, Technology, Engineering, and Mathematics (STEM) are women as reported by many different studies. At CISC, we try our best to increase women participation in GIScience research, a STEM domain, by deliberately recruiting woman students, designing programs that fit into their needs and providing them a pathway for becoming STEM professionals. Since CISC's establishment in 2006, we have a 100% rate of woman Ph.D. graduates and over 50% of woman graduate with master degrees. This position paper introduces our experiences for increasing woman participation in GIScience research and development.

Practice

The intelligent spatial computing for energy/water science (CISC) center's research is focused on utilizing spatiotemporal principles to optimize distributed computing for enabling geographic science discoveries and application buildings, especially in energy/water sciences (Yang et al. 2011b). The research focus fits into the heart of STEM and the GIScience research. It is pretty hard to recruit and maintain minority students. For example, the first Ph.D. student dropped because of the hard work involved. We systematically investigated our approach in cultivating students. We improved our strategy by emphasizing the communication with students, working more deliberately with each of them from the admission, to their graduate and starting of their career. So far, we have four Ph.D. graduates and all are woman: 1) the first one is a manager for a company's GIS department; 2) the 2nd one accepted a faculty position; 3) the 3rd one is being interviewed for several faculty positions; and 4) the 4th one starts to look for faculty positions. There are three out of six master degree graduates are female. All of them are working in GIS related companies and agencies.

Lessons Learned

There are several lessons learnt in the process of increasing woman to participate in GIScience research and development:

1. Providing attractive **hands-on experiences and examples** to demonstrate the success when recruiting student to increase the students' interests in GIScience as reported by Bachnak et al. (2006).
2. Setting up **summer internship or other programs** for woman students to participate and collaborate with students on real research to build their interests as found by Wechsler et al. (2005).
3. Maintaining a **networking capability** (Margle et al., 2010) for students to be fully engaged so that they are aware of different aspects of GIScience research and development cross universities through organizations, such as American Association of Geographers (AAG), University Consortium of Geographic Information Science (UCGIS), and Earth Science Information Partnership (ESIP).
4. Educating through the activities about what are and how to build **the skills and strategies to survive and excel** in professional career and academia for their potential GIScience career (Mavriplis et al. 2005).

5. Providing **continuous encouragements, supports, workshop-based activities, role modeling, and mentoring** to help maintain a balance in a minority environment (Gray and Hemminger 2004).
6. Maintaining a **continuing connection between students and working professionals** to help students better position themselves and seek accessible advice when needed and this would normally help them to graduate into a STEM career (Single et al. 2002).

Discussions

The lessons learnt are different aspects that were also found successful by other professors and professional organizations as cited. It should also point out that it's a systematic approach in that the miss of any of the six points may trigger a student to drop a career in GIScience research and development. The continuity, reliability, clear objective statement, and guidance from all aspects including professors, collaborators, and industry or government professionals are essential to maintain a final success of graduating a woman professor and profession in GIScience research and development.

We are testing and practicing how some of the latest advancements in GIScience domain including geospatial cyberinfrastructure (Yang et al. 2010), VGI and social media (Goodchild 2007), spatial cloud computing (Yang et al. 2011a), and the utilization of spatiotemporal thinking and computing (Yang et al. 2011b) cloud help us to better design and facilitate increasing woman participation in GIScience as well as how woman scientists could help advance GIScience from different aspects in a more interesting fashion.

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References

1. Bachnak R., K. Caruso, J. Esparza, M. Méndez, 2006. Science, engineering, and technology as career paths to minority students, ASEE Annual Conference and Exposition, Conference Proceedings, 7p.
2. Goodchild M., 2007. Citizens as sensors: the world of volunteered geography, GEOJOURNAL, 69 (4), 211-221.
3. Gray R., T. Hemminger, 2004. A hands-on navigation technology workshop to support the math options for girls program, Proceedings of the Annual Meeting - Institute of Navigation, pp. 250-256.
4. Margle J., J. Gomez-Calderon, Y.C. Hsu, A. Freeman, D. Sathianathan, R. Engel, 2010. Toys and Mathematical Options for Retention in Engineering (Toys'n MORE) broad impact- The campuses, ASEE Annual Conference and Exposition, Conference Proceedings, 8p.
5. Mavriplis C., R. Heller, C. Sorensen, H.D. Snyder, 2005. The "FORWARD to professorship" workshop, ASEE Annual Conference and Exposition, Conference Proceedings, pp.6537-6549.
6. Single P.B., C.B. Muller, C.M. Cunningham, R.M. Single, W.S. Carlsen, 2002. A three year analysis of the benefits accrued by women engineering and science students Who participated in a large-scale E-mentoring program, ASEE Annual Conference Proceedings, pp. 5015-5026.

7. Wechsler S.P., D.J. Whitney, E.L. Ambos, C.M. Rodrigue, C.T. Lee, R.J. Behl, D.O. Larson, R.D. Francis, G. Holk, 2005. Enhancing diversity in the geosciences, *Journal of Geography*, 104 (4), 141-150.
8. Yang C., Goodchild M., Huang Q., Nebert D., Raskin R., Bambacus M., Xu Y., Fay D., 2011a. Spatial Computing - How can geospatial sciences use and help to shape cloud computing, *International Journal of Digital Earth*. (4), 305-329.
9. Yang, C., Raskin, R., Goodchild, M.F., and Gahegan, M., 2010, *Geospatial Cyberinfrastructure: Past, Present and Future*, *Computers, Environment, and Urban Systems*, 34(4):264-277.
10. Yang C., Wu H., Huang Q., Li Z., and Li J., 2011b, Using spatial principles to optimize distributed computing for enabling the physical science discoveries, doi: 10.1073/pnas.0909315108.