Summer 7-15-2015

THE ROLE MENTORSHIP IN SUPPORTING AFRICAN-AMERICAN STUDENTS' ENTRY INTO STEM CAREERS

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2015 HAWAII UNIVERSITY INTERNATIONAL CONFERENCES
S.T.E.A.M. & EDUCATION JUNE 13 - 15, 2015
ALA MOANA HOTEL, HONOLULU, HAWAII

S.T.E.A.M & EDUCATION PUBLICATION:
ISSN 2333-4916 (CD-ROM)
ISSN 2333-4908 (ONLINE)

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Synopsis:

This presentation will share the findings of a paper that explored the role of mentorship in promoting African-American students' entry into STEM careers. Research shows that African-Americans students are disproportionately represented in STEM careers. Their underrepresentation often means that they are unable to fully access career and employment opportunities in STEM. Mentorship has been identified as an integral part of career development. Programs designed to connect these students with industry professionals who can support early interest and motivation in STEM are often lacking. The presentation will explore strategies that schools and other institutions may consider when designing a mentorship program to address the needs of African American students. This presentation maybe of interest to policymakers, educators and community based organizations who are seeking to develop STEM mentorship programs.

The Role Mentorship in Supporting African-American Students' Entry into Stem Careers

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Abstract

African-American students are under-represented in STEM careers. The National Center for Education Statistics (NCES) reported in 2009 that African-American students received 7% of STEM bachelor's degrees, 4% of master's degrees and 2% of Ph.Ds. Mentorship programs are identified as one strategy of improving African-American students' outcomes in STEM careers. The researchers reviewed articles which examine strategies to improve STEM academic and career success. This review focused on exploring the role of mentorship programs in addressing the underrepresentation of African-American students in STEM careers. Despite references to the role of mentorship, the literature reviewed lacked a structured approach for the design and implementation of successful mentoring programs. The American School Counselor Association (ASCA) *National Model: A Framework for School Counseling Programs* is suggested as a useful tool in the design and implementation of STEM mentorship programs for African-American students. The suggestions of this paper may be of interest to policymakers, educators and community based organizations who are interested in increasing African-American participation in STEM careers.

The Role of Mentorship in Supporting African-American Students Entry into Stem Careers

The underrepresentation of African-Americans in STEM careers continues to be an issue of major concern. At the foundation of this problem, U.S. colleges are cited as the leading places of the American education system where discouragement happens. College professors are often identified as the individuals most likely responsible for this discouragement (Bayer Corporation, 2010). Additionally, the literature noted that STEM industries often send the message that racial/ethnic minorities are not needed. The promotion of STEM academic and career outcomes often requires long term planning before the college years (Dorsen et al, 2006). Elementary, middle and high schools are therefore identified as key players. A review of the literature strongly supports the use of mentorship in addressing African-American underrepresentation in STEM careers fields (Maton et al, 2004). The literature also suggests the need to consider ways in which both race and gender serve to limit STEM participation (Bayer Corporation (2010). In the case of gender, it is noted that women make up 51 percent of the workforce, yet hold less than 25 percent of college-educated STEM jobs. The Bayer Corporation (2010) found that the issue of gender equity is a constant problem, which fosters this underrepresentation of women in the STEM careers. The persistence of gender stereotype was identified as a factor that prevents women and minorities from entering STEM fields. The lack of parity for those who choose careers in STEM industries was also noted. The Report contended that female respondents affirmed that their underrepresentation in STEM was due to societal attitudes, which promote the idea that STEM careers are not for girls or minorities. More than three-quarters (77 percent) of the surveyed respondents stated that a significant number of women and underrepresented minorities are missing from the U.S. STEM workforce today because they were not identified, encouraged or nurtured to pursue STEM studies at an earlier age. Successful entry into STEM

careers does not put an end the problems of women and minorities; two-thirds (62 percent) of respondents said that their underrepresentation continued to affect their success in their organizations. Nearly three-quarters (70 percent) of the chemists/chemical engineers say it is harder for women to succeed in their field than it is for men, while more than two-thirds (67 percent) think it is more difficult for minorities to succeed than it is for non-minorities (Bayer Corporation, 2010).

The National Science Foundation (2015) report noted that women earned 57% of all bachelor's degrees and about half of all science and engineering bachelor's degrees since the late 1990s. The reported further contended that despite considerable progress over the past two decades, the gap in educational attainment separating underrepresented minorities from whites and Asians remains wide. Underrepresented minorities are less likely than whites and Asians to graduate from high school, enroll in college, and earn a college degree. Asians are more likely than whites and underrepresented minorities to earn a college degree in a science and engineering field. Furthermore, even when these groups have successfully met the requirements for employment, women and underrepresented minorities in academic employment continue to differ from their male, white, and Asian counterparts in rank, tenure, salary, and federal support. In summary, gender and racial stereotyping have been identified as key factors that have limited women and minority participation in STEM. On the issue of race for example, Warren et al (2010) highlighted the importance of using an ‘intercultural process’ to carefully examine the ways in which African-Americans and underrepresented groups are prepared for STEM careers at all levels of the educational systems. They concluded that inequalities may manifest in the ways in which students are taught math and science. The “intercultural process” requires a careful examination of how racial inequalities are reflected in curriculum design, instruction and

other educational processes. Knowledge and understanding of the 'intercultural process' can serve to enhance efforts to develop programs that are more responsive to the needs of African-American students. This process may require careful examination of curriculum design and instructional practices. A consideration of student teacher interactions in math and science classes or students' interactions with college and career counselors may also be important.

Important Factors that Mentorship Program Should Consider

The review of literature on African-American underrepresentation in STEM suggests that programs designed to increase their participation should consider a wide range of factors. Programs that are developed to serve the needs of students should be comprehensive in design; they should seek or aspire to address all relevant factors that may impact student outcomes (ASCA, 2012). Programs should also be developmental in focus; services provided to mentees should consider their age and levels of maturity (ASCA, 2012). Mentorship programs should also take into account the significance of race, socioeconomic status, environmental and cultural factors (Cheryan et al, 2009; Herrera & Hurtado, 2011). Gender has been identified has a key factor that determines STEM success (Crombie et al, 2003; Duch et al, 2012; Hasse, 2002; Madil et al, 2012; Reigle et al, 2011; Sadler, et al, 2012; Weber, 2012). Mentorship program may therefore consider addressing the specific needs of mentees taking gender into consideration. Consistent with their focus on race and gender STEM programs should reflect social justice and multicultural awareness in addressing the needs of African-American students\mentees (Crisp & Taggart, 2009).

STEM mentorship programs may consider partnership with individuals and organizations (Cantrell & Ewing-Taylor, 2009). Partnership may take various forms, for example middle or high schools may partner with a local college science department.

Families have a significant role to play in supporting minority success in STEM fields (Cole & Espinoza, 2008; Maton & Hrabowski, 2004). In addition to families, program developers may utilize other community resources to support their objective (Gonzales et al, 1996). Accessing these resources may involve establishing partnership and agreements that increase the range and quality of services offered (ASCA, 2012). The literature also reflects the important career development interventions to support STEM success (Feller, 2009; Schmidt et al, 2012). Academic instruction and teacher education are also identified as critical components of a comprehensive STEM mentorship program (Kuenzi, 2008; Kirchhoff & Lawrenz, 2011). Programs are also encouraged to utilize experiential learning models to support mentees' learning and motivation (Dorsen et al, 2006). The effective use of summer months to support experiential and other learning models are also encouraged (Jeffers et al, 2004). The identification, training and matching of both mentors and mentees are also critical parts of the process. Atkinson & Mayo (2010) discussed the potential value of incentives for institutions that promote STEM success. Mentorship programs may also consider incentives for students and families. Lastly, programs should aspire for accountability, ensuring that they are able to determine the effectiveness of their services (ASCA, 2012).

The ASCA Model and Mentorship Programs

The American School Counseling Association was established in 1952 and has served to provide a unified response to the changing demands of the American Society. ASCA has responded to the demands for the school counseling profession to address issues of social inequity, multiculturalism, social injustice and professional accountability. *The ASCA National Model: A Framework for school counseling programs* (2012) outlined a common vision for school counselors nationally. The model highlighted academic, personal social and career

development as critical domains that school counselors use to address student needs (ASCA, 2012, Cobia & Henderson, 2007; Hatch and Bowers, 2003).

In support of a comprehensive approach to the design of mentorship programs, the ASCA Model will serve as an important template. The Model sets out a framework for designing and implementing school counseling programs. Programmatic, comprehensive, and accountable interventions, which enlist the support of important stakeholders, are also encouraged. The ASCA Model (2012) emphasized that programs that are designed for students should be comprehensive and carefully outlined. The Model consists of four major components, these are; foundations, delivery systems, management systems and accountability. These major components are discussed in terms of their relevance to STEM mentorship programs.

Additionally, the model emphasizes importance of data driven interventions that are geared towards addressing the actual needs of students/mentees. Data suggesting low levels of African-American participation in STEM therefore becomes a justification for the implementation of a STEM mentorship. A focus on data allows program organizers to identify opportunity gaps and create services to address them. Principles of social justice and multiculturalism is emphasized by the ASCA Model, which requires action on the part of school counselors, teachers, and other professionals so as to address issues of inequities and gaps that are apparent in the STEM field. Furthermore, the ASCA Model emphasizes the importance of leadership, advocacy, and collaboration in the delivery of comprehensive services to address the equities that plague the educational, economic, and political systems. The subsequent section that follows will carefully outline the main components of the ASCA Model and consider its relevance to design of mentorship programs.

Foundations

The foundations of a school counseling program or in our case a mentorship program as displayed in ASCA Model is the first and most critical component. The program foundations include the beliefs, philosophies and mission that will serve as a guide for all its activities. It is best to see the development of a program's foundation as a process that explores beliefs and attitudes about students. This process may require program developers to examine fundamental questions related to the low number of African American students and their success as future mentees. These beliefs may relate to the ability to achieve academic success in STEM or their rights to access equal resources alongside their white counterparts. Foundations may explore beliefs related to African-American learner and STEM careers. Program developers may also explore their belief and values related to gender and STEM outcomes for African American male and female student/mentees. The goal of the process is to be explicit about the beliefs and values that will potentially guide the program. The process of deeply exploring beliefs, values and philosophies related to STEM and the African-American learner is also meant to bring about shared beliefs and values that are reflected in the programs' mission and vision statements. Programs that partner with school should also seek to align their mission statements with that of the school. The exploration of beliefs, values, and philosophies will therefore produce written statements. These statements are expected to be shared by all mentorship personnel and should impact all services and interventions of the program. Mentorship programs may also address three developmental domains of their mentees' academic, personal social and career development. They may also establish competency standards for all mentees, as set out in the *ASCA National Standards for Students, Common Core Standards* or *The National Office of School Counselor Eight Components of College and Career Readiness*. The use of existing competencies that are relevant to the goals of the mentorship is consistent with the ASCA

Model's emphasis on not reinventing the wheel (ASCA, 2012). Additionally, the Model highlights the importance of a team based approach, cooperation and flexibility. A sample mission statement of a mentorship program may for example emphasize the program's desire the maximize opportunities for both male and female African-American in STEM or to close achievements and opportunity gaps that exist between African-American students and their white and Asian counterparts.

The program foundation is critical because it sets out the principles that guide the development, implementation and evaluation of all intervention, activities or services. The foundation addresses shared beliefs about the abilities of all mentees, students or program participants. It may also address mentees' rights to the best academic, personal social and career development programs to support holistic development. Taking time focus on developing the foundations of the program will be critical to any programmatic approach to increasing African-American participation in STEM careers. The foundation of such programs provides context or justification for developing a program for addressing this issue. Critical ideas related to multiculturalism and social justice may also be incorporated in the foundations of the program.

Delivery Systems

Delivery systems identify the services that will be offered by the mentorship program. These services are designed to meet the objectives and goals set out in the program foundations. In the development of a mentorship program organizers will carefully use a data driven strategy to highlight the specific needs of African-American male and female mentees. It is also conceivable that individual mentorship programs may target either male or female African-American mentees. The services will target specific needs of both male and female African-American students in an effort to increase the participation in STEM fields. Mentorship program

organizers may seek to identify the academic, personal-social and career developmental needs of mentees that will increase their participation in STEM fields. Program services are therefore required to be developmentally focused; that is taking into account the age and levels of development of mentees. Mentorship programs may be designed for students in k-12 systems as long as they are developmental in focus. Services may include, but are not limited to, tutoring, counseling (individual and groups) career counseling, college admissions counseling, academic advising, family engagements, family consultation, field trips, college tours, job shadowing, and individual or group mentoring matching.

Program wide interventions such as career fairs, college tours, invited guests or credible messengers may also be explored. Credible messengers may take the form of male and female African Americans who have made various contributions to STEM fields. Services may also be geared towards providing support for STEM teachers. Opportunities for collaborating with educators on curriculum design and instructional strategy may also be explored. A consideration of the importance multicultural competent teaching practices that acknowledge the 'intercultural process' that impact impacts STEM education will be useful (Warren & Rosebery, 2011).

It will be critical for organizers to provide services based on the ongoing assessment of students/mentees' needs. These assessments provide important data that is used to determine actual services. The process should also be characterized by intentionality, where all services and activities are designed to meet specific student needs and program goals.

Management Systems

ASCA Model requires a clearly outlined management system for school counseling programs and for our purposes mentorship programs. The management system implemented may cover such areas as management agreements, the establishment of an advisory council, use of

data, use of time, action plans, schedules and calendars. Mentorship programs that partner with schools will need to have written agreements with school principals. Partnerships with community organizations may also need written agreements that define the nature of the relationship as well as the relative roles of the responsibilities of each party. Agreements may address such issues as, how the program will be implemented, who will be in charge of the implementation and who will manage the delivery of services.

ASCA Model recommends the establishment of an advisory council. The members of the council are expected to share the beliefs and philosophy established in the program's mission statements. In the interest of collaboration it is recommended that members of the council represent important stakeholders from the school, family, community and other organizations that can support the program in meeting its objectives. The structure of the council, meetings, and voting procedures should also be outlined. For mentorship programs that partner with schools establishing a school liaison will be critical. The advisory council may provide public relations services as well as volunteer/mentor development. The management system will rely on the use of data in providing services and determining the effectiveness of those services.

Accountability Systems

Accountability systems address whether or not the services being provided to mentees have actually been effective. The completion of results reports, program audits and the assessment of mentorship program personnel are all important activities that are meant to ensure accountability. The results report for example is meant to provide organizers with information about the program. ASCA suggests three types of reports, however mentorship programs may design reports based on their own need for specific program information. Reports that document

program results, the STEM curriculum results, efforts at closing the gap results and the program's impact over time results, are all recommended by the ASCA Model (2010).

Mentorship programs that have a guidance curriculum to support student's knowledge of STEM careers as well as personal social competencies related to STEM success should produce results report. Effort to motivate students to pursue STEM careers or to apply effective time management and study strategies to improve academic performance should be documented. ASCA recommends that mentorship programs produce a report that documents the results of its services and activities over time. These results reports are critical to answering question about program effectiveness. These results are particularly focused on student/mentee outcomes because ultimately all services, both direct and indirect are geared to improve their academic and career participation in STEM fields.

Accountability addresses the importance of program organizers being able to uphold the beliefs, philosophies and mission statement set out in the program foundation. Here, it is recognized that programs may fail in their attempts to provide appropriate services to address the real needs of students/mentees. A fully articulated and executed accountability system forces program organizers the think critically about their program's impact on African-American students' academic and career outcomes in STEM.

Conclusion

There is a widespread concern about the performance of the United States in STEM. Advancements in science and technology have long been associated with economic, political and global prestige (Atkinson & Mayo, 2010). Elementary, middle, high and university school systems have all been identified as having a critical role to play in improving STEM outcomes. Supporting any child in achieving STEM academic and career success is a long term process.

Providing the appropriate academic, personal-social and career development supports are critical parts of this process. Race and gender continue to be important factors that shape human experiences in America. Effective mentorship programs should be open to examining how classroom instruction and teacher student interactions may have served to perpetuate African-American underrepresentation in STEM. Efforts to support both male and female African-American students cannot be separated from historical and present forms of racial and gender oppression that has plagued the society. African-American underrepresentation in STEM is an American problem. Mentorship programs can be viewed as interventions that are concerned with the promotion and or, prevention of specified outcomes (DuBois et al, 2011). A programmatic approach that succeeds in increasing African-American STEM outcomes will benefit the national efforts to maintain America's reputation as a global leader in STEMS. At the same time, this success will address the social inequities associated with African-American underrepresentation in STEM careers.

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