



Recruiting and Retaining Girls and Women to Pursue STEM Careers and Play Sports: Comparing Challenges and Lessons Learned

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ABSTRACT

Recruiting and retaining girls and women is a shared concern in the United States across physical education, physical activity, and sports (PE/PA/Sport); as well as science, technology, engineering, and mathematics (STEM). An examination of gender equity research was conducted by the two authors, one of whom is an expert in STEM education, and one of whom is an expert in physical education pedagogy. This led to the supposition that there exist three common divides between men and women: (a) exposure and image, (b) instruction/coaching, and (c) socio-cultural. The common threads of these divides that impede female participation are surprisingly quite similar across PE/PA/Sport and STEM. In this paper the common reasons for non-participation, and even aversion, are examined. Following this, lessons of success from each of the disciplines is applied to the other. Finally, it is conjectured how the practice of examining this shared issue aids both disciplines.

KEYWORDS

equity; gender equity; female participation; STEM education; physical education;



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OVERVIEW

The two fields of physical education, physical activity/sport (PE/PA/Sport) and science, technology, engineering, and mathematics (STEM) education are at first glance quite disparate. Yet the areas of physical education and STEM education share a dilemma in the United States that has beset both fields. Despite great strides in recent decades, leaders in both PE/PA/Sport and STEM education still struggle to recruit and retain girls and women. In the realm of PE/PA/Sport, although young girls are increasingly prompted to participate in sports and are encouraged to engage in moderate-to-vigorous physical activity and sport programs, studies have reported that girls drop out of most organized sports programs at a rate six times greater than boys (De Lench, n.d.) and that significantly fewer girls engage regularly in moderate-to-vigorous physical activities and sports than boys (Riddoch et al., 2004; Riddoch & Boreham, 1995). Correspondingly, in STEM education, although women complete degrees in several science fields at a rate on par with men, in some fields, such as computing science, men lead women in earning undergraduate degrees by a nearly nine to one ratio (National Center for Women and Information Technology, 2011).

The intent of this paper is to provide a reflective comparison of how, in the United States, the two fields of PE/PA/Sport and STEM education have addressed the issues of recruiting and retaining girls and women. By examining what is a shared concern across these two different disciplines it is believed that each can learn and gain from one another's successes and continued challenges, and that these lessons may be applied internationally. The comparisons across these two disciplines are organized in this article into three steps. First, the issue of attracting girls and women into ongoing participation in PE/PA/Sport programs and STEM careers is carefully described. Next, considerations are given to common ground issues that research findings in both fields have pointed to as being sources of disparity between male and female participation. These issues are examined as three distinct categories of "divides" found between boys and girls and between men and women: 1) exposure and image, 2) instruction/coaching, and 3) socio-cultural. Finally, pragmatic deliberations are provided regarding two specific cross-discipline example lessons that may be learned and applied.

DEFINING THE SHARED CHALLENGE

Comparing the fields of STEM and PE/PA/Sport in the context of gender participation poses an immediate challenge because the two fields are structured so differently. While men and women work side by side in the STEM workplace, PE/PA/Sport is often segregated by gender. Also, while it can be argued that the disparities of gender proportion in both STEM and PE/PA/Sport are related to societal perceptions of appropriate sex-based roles, PE/PA/Sport differs from STEM

due to the tremendous media coverage given to athletes as compared to scientists and engineers. Because of this, sports can be claimed not just to be a reflection of societal views of masculinity and femininity, but also, more so than STEM, be looked upon as something that helps define gender (Dworkin and Messner, 1999). Despite obvious differences between the two fields, both STEM and PE/PA/Sport have long had the persistent shared challenges of recruiting and retaining girls and women.

The dilemma of fewer girls and women being attracted to PE/PA/Sport programs and to STEM careers is a genuine problem in the United States, but it is not a wholly widespread problem. In both the fields of PE/PA/Sport and STEM there are areas in which the proportion of girls and women is either on par with or exceeding that of boys and men. Women actually earn approximately fifty percent more bachelor degrees than men in the fields of biological sciences; this comparison is even more distinct in psychology where women earn nearly three times the amount of bachelor degrees than do men (National Science Foundation, 2011). Yet, in what are sometimes termed the “hard sciences,” women are notably underrepresented. Men far outpace women in the United States in both earning degrees and possessing jobs in the fields of computing and information sciences, mathematical sciences, physical sciences, and engineering. A few examples of the distribution of gender in the biological sciences and selected hard sciences are provided in Table 1. Overall, despite gains in recent decades, men occupy science and engineering careers at a three-to-one ratio compared to women (Hill et al., 2010).

Table 1. U.S. Bachelor's degrees and workforce of selected STEM fields

	Gender	Bachelor's degree recipients, 2007	Percent of workforce, 2008 (%)
Biological sciences	Female	48,001	52.9
	Male	31,347	47.1
Chemical engineering	Female	1,743	13.1
	Male	14,894	86.9
Civil engineering	Female	2,499	10.4
	Male	8,819	89.6
Electrical engineering	Female	2,109	7.7
	Male	16,438	92.3
Mechanical engineering	Female	2,017	6.7
	Male	14,894	93.3

Specific to PE/PA/Sport, progress has been made in some programs that have led to tremendous participation of women, particularly among high school athletes. For example, in 1972, only one of 27 high school girls in the United States played varsity (i.e., high level) sports. In 1998, the figure had risen to one in three. Still, boys outnumber girls by a two to one ratio on high school varsity sports teams (Lopiano, 2000). Of course there are some sports that are, and have always been, dominated by female participants such as dance, equestrian, gymnastics and ice skating (Fasting et al., 2004) and more women than men take on the job of elementary physical education teacher.

Yet, despite being able to point to some areas where the participation of girls and women is comparable to, and even exceeds the participation of boys and men, overall PE/PA/Sport and STEM are fields dominated by boys and men. The collective challenge across PE/PA/Sport and STEM is then to determine what barriers exist that dissuade female participation and what supports can positively influence retention.

THE COMMON DIVIDES

A great deal of literature exists that has underscored disproportionate gender participation in PE/PA/Sport and in STEM. Some of this prior research has even pointed to areas where these gaps have either been closed or possibly never existed. Yet, while it is apparent that gender inequity is of concern in both PE/PA/Sport and STEM, determining where logical crossroads lie can be somewhat confounding. As we considered the intersections, the two authors were able to bring to the table their particular expertise, as one is an expert in physical education pedagogy and the other is an expert in STEM education. After a considerable amount of discussion and examination of existing research, the authors resolved that a valuable way to present this paper would be to adapt a framework outlined by Stoilescu and McDougall (2011) when they explored the differences between male and female participation in technology programs. This adapted framework is structured on three types of divides wherein both PE/PA/Sport and STEM have gaps, if not chasms, between men and women. These divides are categorized in the areas of a) exposure and image, b) instruction/coaching, and c) socio-cultural.

Exposure and Image Divide

It's generally considered that schools provide seemingly equitable opportunities for young girls and boys to participate in PE/PA/Sport and STEM opportunities. Through the elementary grades children are ostensibly exposed to the same amount of physical education, science classes, and math classes during the school day. Similarly, boys and girls are often provided with corresponding opportunities to access technology and enroll in PE/PA/Sport programming. However, there exist dynamics that are both explicit and implicit contributing to boys having greater exposure and access to STEM and to PE/PA/Sport programming. For example, during visits to science museums, parents are three times more likely to explain the science concepts represented at exhibits to their sons than to their daughters (Crowley et al., 2001). In some cases these dynamics emanate from societal traditions that may be rooted in dominant images of male scientists and male

athletes. In this vein, consider that even though progress has been made to present men and women equitably in science textbooks, researchers have discovered that gender stereotypes, biased toward the representation of a male dominated field of science, still persist (Elgar, 2004; Kahveci, 2010). Bain (1985) would call this the hidden curriculum, that is, hidden messages that are not explicitly or implicitly taught or acknowledged by the teacher or students. These are embedded factors that may often be interpreted by girls as messages indicating that STEM is a domain primarily for men. In turn this can lead to a negative effect on girls' self-efficacy as they quietly deselect themselves from thoughts of pursuing a career in STEM. This is particularly discouraging given that girls' aptitude for STEM is equivalent to that of boys, even though boys are more confident in their abilities (Else-Quest et al., 2010; Hyde et al., 2008). Clearly the messages of STEM stereotypes do not go unheeded, as both boys and girls tend to sketch pictures of white men when asked to draw pictures of scientists (Finson, 2002) and they list television and as their primary source of this information, as opposed to other sources such as teacher role models, people they know, books, or their imagination (Steinke et al., 2007).

Similar findings of a perceived male dominated province have been reported related to PE/PA/Sport. For example, McCallister, Blinde, and Phillips (2003), found that 41 percent of female fourth and fifth grade students indicated that athletes were only male. Zittleman (2008) also reported that middle school students indicated that an advantage of being male is being able to play sports. This skewed image of male versus female athletes is quite prevalent in sports broadcasts. Even though 42 percent of all athletes at the Beijing Olympics in 2008 were women, media support for women's sports is still grossly lacking. Men's sports receive as much as 90 percent of all sports newspaper reporting and hours of television sports coverage (Lopiano, 2000). An analysis of international newspaper coverage of sports in general and the Olympics in particular revealed that female athletes in Western countries typically receive less than ten percent of the coverage devoted to general sports and fare only slightly better in the calculation of Olympic sports coverage (Markula, Bruce, & Hovden, 2010). Yet, even this increased coverage during the Olympics is often devoted to sports that are viewed as feminine, i.e., those not requiring physical contact or obvious strength. Gymnastics, which does receive a disproportionate amount of media coverage of women, is then an example of a so-called appropriate activity that promotes feminine qualities of fitness, sleekness, and flexibility. The emphasis on female appearance and body shape within the context of sports is not to be trivialized, as sport has been assessed to be one of the key institutional sites for social construction of gender concepts (Dworkin & Messner, 1999).

The exposure and image divide is analogous across both STEM and PE/PA/Sport. Whether the carrier of the message is the media, parents, or school, children receive signals that men and women are represented differently. Of course, there is surely some legitimacy in this message as there simply are more men than women in the hard sciences and in most PE/PA/Sport programming. Nevertheless, what must be averted is the message that these fields are not as accessible to girls.

Also needing to be confronted are the off-putting images of STEM professionals and athletes. Specifically, if children view scientists and engineers as “geeks” and athletes as “jocks,” then girls, particularly adolescent girls, will distance themselves more quickly from these fields than boys. Girls are less prone to align with the “geek mythology” that asserts an image of a loner scientist on a dogged pursuit of unraveling a science irregularity or writing code for a computer program simply for the satisfaction of completing the task. Likewise many girls feel that participation in competitive sports will lead to them being viewed by peers as female jocks – a stereotype that suggests an unsociable disposition and may at worst call into question a girl’s heterosexuality. Both images of the geek and the jock as being outside the standard have greater implications for girls than for boys because the threat of being barred or ignored by peers is more significant for girls, as girls are more apt to take subtle actions to protect themselves from exclusion (Benenson et al., 2008). Girls, particularly at the middle school grades, are more likely to participate in social contexts considered gender appropriate and avoid nonstandard situations where it is unusual to be female or where being male is the norm (Barker et al., 2006). Given girls’ perception that the pursuit of many STEM fields and PE/PA/Sport activities are viewed as being in the male domain, girls often self-select out of such pursuits. They will instead opt for other areas where the female image is equivalent or even dominant, such as social sciences and art. This reinforces the hegemonic masculinity that can prevent girls and women from pursuing PE/PA/Sports and STEM fields.

Finally, the exposure and image divide is often widened by its own vicious cycle. That is to say, we know that enrollment into after-school sports and career and technical education classes (e.g., robotics) is greater for boys than girls (Dahlmann et al., 2008; Seefeldt & Ewing, 1997) and this can develop into a causal nexus wherein girls quickly end up lagging further in their exposure to robust sports and to engaging applied science. Moreover, even during recreational time boys spend more hours utilizing computers to play video games that require thinking skills in order to advance to the next level of a complex game (Cummings & Vandewater, 2007) and girls spend less time engaged in physical activity after school and during recess (Beighle et al., 2006; Thirlaway & Benton, 1993). These types of choices, about how discretionary time is spent, are also contributors to an exposure gap that can become severely apparent when college freshmen enroll in a computing class or elementary school-aged children select their teams on a schoolyard.

Instruction/Coaching Divide

Regarding the instruction/coaching divide, we focus here on the shared dilemma across STEM and PE/PA/Sport in which traditional instructional and coaching practices are better suited to recruit and retain boys than girls. Perhaps more accurately, though, it might be said that traditional STEM teaching and sports coaching practices simply turn boys off at lower rate than girls. Although there are many cases where teaching and coaching strategies have been developed to be equitable and inviting to both genders, a pedagogy of preference has dominated both disciplines. We highlight in this section how, particularly for women, competitive environments can be distasteful and how collaboration and relevance can be alluring.

The spirit of many American classrooms, and certainly the spirit of PE/PA/Sport, is that of competition. Yet these competitive environments can act as filters, particularly for girls, who tend to prefer non-competitive, collaborative situations (Niederle & Vesterlund, 2007). This is not to say that girls and women altogether shy away from competition; research indicates that female competitiveness can vary based on factors such as the sex of the opponent and the context of the competition. Related, Hibbard and Buhrmester (2010) found connections between competing to win with higher male scores and competing to excel with no gender differences. Similarly, although Gneezy and Rustichini (2004) found that boys and not girls, aged 9-10, increased their speed when running against one another as compared to running alone, other researchers found that girls and boys, aged 7-8, were equivalent in their competitiveness when skipping rope, dancing, and running (Dreber et al., 2011). Yet evidence generally points to girls being more inclined to be cooperative, versus competitive, than boys (Eckel, et al., 2008; Fabes, et al., 2003). This then suggests that STEM classes and PE/PA/Sport programs should emphasize collaborative effort and teamwork. While it can certainly be argued that a science or math lesson is designed to be no more or less competitive than a lesson created for social studies or reading, this only leads to the supposition that girls are likely being turned off at a higher rate in those classes too if group work is only perfunctory and students' grades are held up as high reward.

While girls are reputed to be overall better behaved than boys, this is often due to girls simply being commonly quieter and more compliant than boys. The generally more assertive nature of boys, which can lead them to cause greater disciplinary problems at school, can also serve boys well in being more resistant to low academic grades. So while they may appear to be more quiet and amenable, girls are also more likely to decrease persistence and interest after they have experienced failure (Forsyth, 1986). This can be especially acute in STEM classes where women have been shown to be more likely to attribute low grades to lack of ability and high grades to external factors such as luck (D'Amico et al., 1995). Girls' higher avoidance of competitive situations then becomes dangerously coupled when they feel they have less experience with science and technology. In the context of PE/PA/Sport, girls tend to score significantly higher on motivational surveys on items related to teammates encouraging and valuing one another, and working to try their hardest; boys score significantly on items related to trying to outplay their teammates and putting down teammates with negative comments (Smith et al., 2010). This suggests that girls may benefit more from a supportive PE/PA/Sport coaching environment. In brief, there is compelling evidence that girls are usually more cooperative and relational and less competitive than boys (e.g., Alexopoulou & Driver, 1997; Brotman & Moore, 2008). Because girls are more likely to place greater emphasis on the concerns of connection, relevance, and relationship, the archetypal science and math lessons that are taught in a straightforward and de-contextualized manner tend to numb women from considering a career in many STEM fields (Goode et al., 2006). This likely contributes to why, during secondary school years, girls lose interest more than boys in physics while maintaining a relatively stable interest in biology (Williams et al., 2003). Physics is perceived as a static math-based subject while biology is viewed as contributing to environmental and medical solutions. Similarly, the increasing focus on competition found in

PE/PA/Sport programs by adolescence can be exceptionally disconcerting for girls, particularly if the value and consequence of participation has not been made apparent. Fine tuning instructional and coaching strategies to support these key concepts of promoting relevance, demonstrating connections, and building relationships may go a long way toward retaining girls in STEM and PE/PA/Sport programs.

Socio-cultural Divide

When considering the broader social issues that can hinder female participation, the intersections most apparent between STEM and PE/PA/Sport are the influence of external supports, perceptions of competence, and the perceived masculine structure of both domains. As a whole, these are understood as a socio-cultural divide. External supports encompass parents, peers, coaches, teachers, and counselors. All of these individuals have a great capacity to influence the decisions of women to participate in both STEM and PE/PA/Sport programs. For example, it has been discovered that the opinions of parents and peers hold greater weight for female high school students than they do for male students when decisions are being made about future careers (Golotti & Mark, 1994). The implication here is that since physical science and technology careers are still largely viewed as male domains, the lack of encouragement from peers and family to pursue such careers is more acute for women. Similarly, women who do enter technical fields tend to rate the value of having had an encouraging teacher and a knowledgeable counselor significantly higher than men in these same fields (Hall et al., 2009). Correspondingly, we know that parents are more likely to encourage sons than daughters to participate in moderate-to-vigorous intensity team and individual sports; moreover this bias even extends to household chores, as parents are more inclined to have sons engaging in vigorous activities such as raking leaves, moving furniture, and weeding (Anderson et al., 2009).

Another common socio-cultural gap across STEM and PE/PA/Sport programs is that men generally have stronger perceptions of their competence in these two fields. Even at an early age, boys tend to associate self-perceptions, more readily than girls, with the images of athlete and scientist. In a study of over 500 high school students, Shapka and Keating (2005) revealed that although girls do have higher perceptions of themselves in the domains of friendships and social acceptance, boys have significantly higher perceptions of their athletic abilities. A similar study in STEM showed that even when girls are earning higher grades than boys in mathematics classes, boys persist in having greater confidence in their mathematical abilities (Azar, 2010). Despite evidence that girls achieve equivalently to boys on standardized mathematics and science tests, and that gender gaps have vanished in recent years, boys still report more positive attitudes toward STEM. In both PE/PA/Sport and STEM, these types of self evaluations then influence the types of activities individuals will choose to engage in and the likelihood of future perseverance.

The third socio-cultural shared intersection points to the predominant masculine perspective attributed to the hard sciences of STEM and to many PE/PA/Sport activities. There still exists a common societal view that by and large many aspects

of PE/PA/Sport and STEM are “men’s work.” In STEM, there is the familiar belief that scientific knowledge is objective, unbiased, and even quite calculated; this is particularly true among the hard sciences. Similarly, the most popular sports programs in the United States (i.e., basketball, baseball, American football) are often socially communicated in terms of hard statistics. The maleness of the hard sciences and of several PE/PA/Sport activities can be found in numerous patterns and instances. Within STEM, these perceived attributes emerged possibly because science has historically been conducted by men or perhaps due to the manner in which the process of science is often taught as a series of methodical steps comprising the scientific method. Notwithstanding, qualities more commonly regarded as feminine, such as subjectivity, sentiment, and creativity, are not well associated with the hard sciences which are characterized as relying on accuracy, objectivity, and the use of quantifiable empirical data. Whether the conversation is among boys discussing baseball cards and the batting averages of their favorite players or among men talking about prominent college athletes, the discourse can be viewed as a form of male bonding that is often exclusive of women. As with STEM, although the PE/PA/Sport dialogue might be quite passionate, it is often data-driven and dominated by deliberation and consideration of multiple factors such as playing field conditions and obscure rules.

The underlying masculine structures of STEM and PE/PA/Sport then often manifest in stereotypical cues that can be alienating for women, as well as many men. These cues may be quite subtle, but nevertheless send a signal of what a community values and can alienate outsiders. For example, an elderly couple may not feel comfortable in a college town where all restaurants play loud contemporary music. Among professionals in the hard sciences these cues are sometimes evident in discussions on topics such as science fiction and violent video games (Cheryan et al., 2009). These cues then dovetail into the more apparent indicators of the field such as writing software programs to manipulate robots and solving isolated mathematical problems simply for the sake of resolving a textbook problem. These cues and the discourse of the domain may act like gatekeepers that prevent individuals, who do not immediately feel they belong to this community, from even considering membership. A present-day example of this in PE/PA/Sport can be drawn from the growth of fantasy sport leagues as a male dominated province. Fantasy sports simulate leagues from multiple sports (e.g., basketball, hockey) and allow participants to act as owners to assemble a team of athletes to compete virtually against other teams in their league. Statistical performances of the athletes in the real world are converted to a point system in the fantasy sports realm. Male fantasy sports players outnumber women by a nearly nine to one ratio (Berr, 2009). Yet, as Davis and Duncan (2006) point out, although no actual physical involvement is necessary, the “very nature of participation in fantasy sports suggests that it is a haven for affirming masculinity in the sport domain” (p. 247). Through qualitative study these researchers discovered that membership of the fantasy sports culture emphasized the attribute of commanding authority (as athletes are virtually drafted and traded), necessitated desire for ongoing competition, and strongly involved being able to manipulate sports knowledge. All of these characteristics thereby reinforce a hegemonic masculinity that can keep

women at bay not just from fantasy sports, but from developing a broader interest in PE/PA/Sport.

CROSS APPLICATION OF LESSONS LEARNED

We have thus far attempted to chart the common challenges related to attracting and retaining girls and women in STEM and PE/PA/Sport. We now turn to specific successes from each domain that we believe may be utilized as blueprints to expand the engagement of women. We have chosen to examine each example as a model for promoting gender equity and to apply that model to the other domain. Namely, the case of parity being reached in biology is applied to PE/PA/Sport, and the example of United States Title IX legislation hastening female participation in PE/PA/Sport is applied to STEM.

The Lesson of Biology Parity Applied to PE/PA/Sport

The discipline of biology stands out in STEM because it is an area where female participation outpaces that of men. In fact, in the United States, 60 percent of bachelor's degrees in the biological sciences were earned by women in 2007 (Table 1) (Hill et al., 2010). This high rate of participation cannot be attributed to concerted efforts to raise the enrollment of women in the biological sciences; rather, it seems due to how the field of biology is perceived. Specifically, biology, much more than the so-called hard sciences, is an area of study seen as being relevant and useful in addressing humanitarian concerns. Additionally, there is generally a gender equitable exposure among children to everyday biology topics, such as family medicine, as opposed to some other science topics, such as electronics and mechanics. Biology is also often viewed as being wrapped within a feminine context (Kerger et al., 2011). The characterization of feminine context, as opposed to masculine context, implies that the discipline is seen as contributing to addressing benevolent issues. A feminine context can also simply mean that the discipline includes issues that girls tend to be more interested in than boys. For example, Kerger et al. (2011) point to how physics can take on a feminine context if it is learned as a means to understand how an artificial heart pump works, as opposed to calculating the depth from which derricks can extract oil. This implies a moderate shift in contextualization that may not lead to altering career choices for most girls, but may at least maintain their interest in a STEM subject.

The lesson not just for PE/PA/Sport, but for other branches of STEM, is that relevance and context matter. Although experts from other disciplines of STEM may state that their field is just as germane as biology, the hard sciences have not gone far enough to make that relevance apparent. An example of relevance being a lure to the hard sciences is that researchers have demonstrated the value of computing science through assistive technology as one way to attract more women to the field (Wardle et al., 2005). Applying this lesson to PE/PA/Sport means ensuring that participation is seen as having value beyond just the time when a girl is playing a sport or is engaged in a physical activity. Emphasizing relevance and context may entail underscoring the lifelong health benefits reaped from participation or highlighting the camaraderie that grows among teammates beyond the field. Further, demonstrating how PE/PA/Sport can bring family members together,

whether as participants or as fans, can also promote appeal. If the image of PE/PA/Sport can then be shifted from a standalone activity to a nucleus of social, health, and community benefit, the ability of PE/PA/Sport to attract girls and women to participate may be greatly improved.

The Lesson of Title IX Applied to STEM

In 1972 Title IX was enacted into law in the United States. Title IX states that nobody is to be excluded from participation, or be denied benefits of any education program, on the basis of sex within an institution receiving United States federal funding. Although Title IX language does not direct attention to sports, or any specific program, it has largely been interpreted by the American public as a law that was established to promote equity in athletics. To that end, Title IX has been extremely successful. Opportunities for girls to participate in athletic programs grew tremendously during the 1970s. Since the enactment of Title IX the proportion of female athletes in high schools has grown from eight percent to 41 percent (American Association of University Women, 2010). The accomplishment of Title IX in PE/PA/Sport can be attributed to the well-organized method used in applying the law. Every school system must have a Title IX coordinator who monitors compliance, makes students and staff aware of policy, and to whom sexual harassment complaints may be submitted.

Because it is easy to observe the access and opportunity in athletics (e.g., facilities, scholarships, teams), where genders are naturally segregated, it has been a straightforward matter to assess distribution. The observation of balance of opportunity may not be quite as simple a matter in STEM, but what the field of STEM can learn from the application of Title IX to PE/PA/Sport is the organizational approach it has taken. Typically in STEM, attempts to increase the participation of girls and women have been crafted to address a guiding deficiency model (Sevo, 2009). This implies that women are missing something, such as interest or awareness, and that an explicit intervention can remedy the deficit. The utilization of Title IX in PE/PA/Sport does not assume a deficiency model, but simply works to correct any patterns that inhibit or exclude female participation. The application of Title IX to STEM should similarly address the organizational aspects that can restrain female participation. In an analysis of Title IX and how it can best serve to support equity in STEM, Pieronek (2005) pointed to a need for assessments to be conducted, especially in universities, to determine if there exists an environment that provides equal opportunity to men and women. We have come a long way as far as placing opportunities on the table that are available regardless of gender, but discrimination can often be covert and unintentional. Bias can be hidden within the everyday practices ingrained in recruitment, course sequences, and teaching styles. Likewise, predisposition, if not outright unfairness, can be embedded into the attitudes of faculty members and the environment perceived by potential students. This suggests that institutional climate surveys and regular reviews of practices are needed to assess the degree to which an equitable atmosphere has been developed. Further, Pieronek suggests that institutions may at times develop services for women that are different than those for men, in order to develop equity. By addressing the organizational elements methodically, Title IX can help in making many areas of STEM more hospitable. This in fact is the goal of a pending

bill submitted to the United States Congress, H.R. 889: Fulfilling the Potential of Women in Academic Science and Engineering Act of 2011. This bill can be viewed as a deliberate expansion of Title IX to STEM. Leveraging research that indicates the number of women interested in STEM careers is reduced at every education transition, from high school through higher education, the bill calls for relevant agencies to carry out workshops that address the effects of gender bias and for regular reporting of faculty demographic data. Additionally, the bill calls for the United States Director of the Office of Science and Technology Policy to develop policy that will extend research grant support and technical support for federally funded researchers who are caregivers. This is a great example of how STEM can follow the lead of PE/PA/Sport and attend to specific organizational elements in order to address the overarching goal of a level playing field for girls and women.

CONCLUSION

The approach taken here has been to scrutinize analogous deficiencies in female participation in STEM and PE/PA/Sport through an organization into three divides. However, we end with noting that the dominance of men in many PE/PA/Sport and STEM disciplines is more complex and is likely to be attributed to the invisible practices of hegemonic masculinity that are difficult to discern. While we can point to some specific causes of reduced female participation in both STEM and PE/PA/Sport, such as girls' greater desire for relevance and teaching and coaching styles that do not promote relationships and cooperation, there are likely other more elusive pervasive cultural norms that exclude girls and women. An established male hegemony in some sports and STEM disciplines is itself a difficult hurdle to overcome. Subtle differences, such as a dearth of local female role models, can quietly send a message of exclusion. The hard sciences and many PE/PA/Sport programs have established a hushed hegemonic masculinity that is difficult to infiltrate even when women are aware of its existence.

This paper has taken on the American perspective of its two authors. Like many nations, the United States takes pride in its heroes. Our initial images of champion athletes and outstanding scientists are, disappointingly, typically male. From an international context, Americans view themselves as spirited and have historically vied to be highly competitive in the arenas of athletics and STEM. Yet, this context of international competition itself may also be deterring female participation and be at the root of several of the shared challenges we have pointed out. American stories of athletes opposing competitors from other nations and scientists struggling to maintain advanced technology are habitually illustrations of men. Narratives of American female athletes and female scientists are more personal and emphasize individual challenges and their need for perseverance. The point here is that our American emphasis on tenacious, and at times even bloodthirsty, competition in both the hard sciences and many sports will dissuade numerous women from the wider fields and they may instead gravitate to STEM fields that appear more personal (e.g., psychology) and sports that seem gender appropriate (e.g., gymnastics).

Our examination of the asymmetrical representation of the genders in STEM and PE/PA/Sport began as an assessment of a common issue, but determining collective

and successful solutions is more difficult. Clearly there are some comparable bases of decision making, or lack thereof, when girls and women elect to enroll or persevere in many STEM and PE/PA/Sport situations. We discovered common intersections occurring as three joint divides: (a) exposure and image, (b) instruction/coaching, and (c) socio-cultural. However, pointing to these analogous junctions is intended to be more than an intellectual exercise. By viewing each discipline and the issue of recruiting girls and women through the lens of the other discipline and seeing the issue as a shared dilemma, we become more able to address the predicament. On one hand, our analysis can be taken only as an essay pointing out a widespread problem. However, we argue that by widening our understanding of the mutual reasons that girls and women choose not to participate in STEM and PE/PA/Sport we then improve our likelihood of addressing the issue and are more keenly aware of it. Each discipline therefore provides the other with a new reference frame. The hope is then to continue to learn, from a now wider field of study, how best to promote female involvement in what have been male dominated settings.

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