Whispers that echo: Girls' experiences and voices in news media reports about STEM education reform

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Abstract

This paper attends to the ways in which girls' voices are deployed within news media to support current discourses regarding STEM education. Newspaper reports constitute an important field of cultural production in that they construct a particular reality that contributes to public understandings of girls' lived experiences in and with STEM. Using a recursive process of frame analysis and Critical Discourse Analysis, our examination of news reports revealed a description of girls' experiences that largely reflected official STEM policy discourses. Journalists employed girls' comments, voices, and experiences to reaffirm such narratives by cementing beliefs regarding the economic purposes of schooling in the United States. The analysis also revealed a complex reading of girls' direct experiences. On one hand, the reporters used girls' voices to support the overall official STEM policy narratives, particularly when reporting on exemplary STEM program and experiences and the need for STEM career development that maintains the economic ascendance of the United States. At the same time, some of the quotes employed revealed a far more nuanced response: girls could envision themselves with a future professional career in STEM, but also found the experiences to be personally in the present. The authors conclude with a discussion of the limitation of methodology and potential future areas of inquiry to further understand how students' might experience programs influenced by policies such as STEM and how such experiences are framed to form normative views of the impact such policies are making in educational issues at large.

Keywords: *STEM education, girls, news media, neoliberalism, critical discourse analysis, frame analysis*

This article attends to the ways in which girls' voices are deployed within news media reports to support current discourses regarding STEM education. STEM education (science, technology, engineering, and mathematics), a set of policies including curricular and teacher education reforms, seeks to address a number of concerns in regard to workforce preparation, technological innovation, market competition, and minority access to STEM fields (Drew, 2011; Friedman & Mandelbaum, 2012; Pierce, 2012):

> ...there is a large interest and achievement gap among some groups in STEM, and African Americans, Hispanics, Native Americans, and women are seriously underrepresented in many STEM fields. This limits their participation in many well-paid, high-growth professions and deprives the Nation of the full benefit of their talents and perspectives. (Prepare and Inspire, 2010, p. viii)

The growing interest in STEM education has resulted in federal policy initiatives and non-government grant programs that advocate for specific educational reforms and provide funding to develop educational experiences and curricula for students, particularly minorities and girls (Change the Equation, 2010; Educate to Innovate, 2009). The programs that have developed out of such reform efforts are delivered in a wide range of education settings, including traditional public education settings as well as after-school, weekend, and summer programs sponsored by both public and private organizations. Although researchers in a wide range of contexts have examined the potential benefits and challenges of these programs (e.g. *Journal of STEM education*), what information is made available to the public is largely determined by news media and/or personal exposure.

Public understanding of students' experiences in STEM education is shaped by the information to which people have access. Those who do not have regular interaction with school-aged children may have little direct knowledge about available STEM programming, let alone their purposes. Instead, people rely on anecdotal evidence, social media feeds, and newspaper reports to inform them about students' experiences. Newspaper reports constitute an important field of cultural production in that they construct a particular reality that contributes to public understandings of girls lived experiences in and with STEM (Bourdieu, 1993). They are also a valuable site for interrogation because they are one of the locations in which public discussions include girls' experiences and perceptions about STEM policies and programming.

As we discuss, our analysis of newspaper reports revealed a description of girls' experiences that largely reflected official STEM policy discourses. Journalists employed

girls' comments, voices, and experiences to reaffirm such narratives by cementing beliefs regarding the economic purposes of schooling in the United States. The analysis also revealed a complex reading of girls' direct experiences. Reporters used girls' voices to support overall official STEM policy narratives, particularly when reporting on exemplary STEM programs and experiences, and the need for STEM career development that maintains the economic ascendance of the United States. The analysis of data revealed that journalists' use of girls' quotes was both empowering and exploitative. As we illustrate, journalists' decisions to employ certain quotes provided young women with a public space in which they could reflect upon and consider their own abilities in regard to STEM. At the same time, such use of quotes may have manipulated both the content of and context within which the quotes were situated, so that the overall reported narrative about STEM education within the newspaper stories constrained young women's agency to speak for themselves.

We begin with a discussion of STEM education policies to contextualize and offer background in order for the reader to make sense of policy makers' recommendations regarding girls' experiences with STEM. Next, we explain the importance of studying news media, because of the ways in which they help to define and shape reality and public understanding of issues relevant to people's lives. We then turn to an explication of the methodology and data collection process followed by a discussion regarding the findings. We conclude with a discussion of methodological choices and point towards future areas of inquiry ripe for exploration into educational policy issues and how they affect the ones most at stake - students.

STEM, an exemplar of neoliberal reform

Although concerns regarding the US education system's ability to meet the needs of a changing society have long been debated, several key 21st century policies and documents have catapulted STEM education into the center of US political and policy debates (see for instance, Drew, 2013; Feinberg & Soltis, 2009; Kliebard, 2002). At the national level there are two interconnecting objectives for STEM education. The first advocates for identifying and retaining the STEM specialists needed to provide the country with innovative economic products, knowledge, and skill sets to ensure the nation continues its global dominance (Goldstein & Chesky, 2011; Goldstein, Macrine, & Chesky, 2014). The second employs discourses about equity, access, and equality. Within these discourses, each student deserves access to high quality STEM instruction and materials, opportunities to explore STEM careers, and exposure to STEM mentors

(Brown et al., 2011; Bybee, 2010). *Rising above the gathering of the storm* (2005), a widely cited report among those interested in STEM, admonishes that failure to implement education policies that harness the nation's human capital in science, technology, engineering, and mathematics will result in the United States falling "behind in the race," resulting in a lower standard of living than "most Americans have come to expect" (pp. 5 & 11).

More recent STEM reforms have turned their focus to developing pathways for success for minorities interested in STEM fields, including developing new programs serving K-12 students, developing mentoring experiences for girls and minorities, expanding public/private ventures focusing on real world applications of STEM, and connecting issues of equity and job parity for girls and other minorities to national and global competitiveness:

> Today's US economy depends more than ever on the talents of skilled, high-tech workers. To sustain America's preeminence we must take drastic steps to change the way we develop our workforce. An increasingly large proportion of the workforce consists of women, underrepresented minorities, and persons with disabilities—groups not well represented in science, engineering, and technology (SET) fields. Unless the SET labor market becomes more representative of the general US workforce, the nation may likely face severe shortages in SET workers, such as those already seen in many computer-related occupations. (Baine, 2009, p. 2)

What is important about this language and that of other STEM policy documents is the explicit connection between the underrepresentation of women and minorities in STEM fields and the economic benefits STEM parity would have on the wellbeing of those who enter STEM fields as well as the United States. These policy documents focus on the importance of increasing the pool of qualified workers, not because equity has any political or social value, but because it will provide employers with more qualified candidates. In this manner, STEM policies reflect the disturbing trend of appropriating the discourses of equality and equity to mask neoliberal interests. While they presumably address issues of parity and ending unequal representation and access to different STEM fields, they do so as a function of workforce development and individual economic self-interest, not as a function of the wellbeing of individuals, communities, and challenging institutional and systemic discrimination (Duggan, 2012).

Such statements and policy documents reflect a growing consensus across political parties that highlight how neoliberalism has permeated discussions about education. The

only or most important purpose of schooling in the United States is to get a good job, preferably in an economically competitive field that enables the nation to maintain its competitive edge and political standing as a world power. Those who support such initiatives assert they fulfill an important educational equity challenge: targeting those who are underrepresented in STEM fields so that they, too, can take part in the economic success of STEM related jobs (Darder, 2005; Duggan, 2012; Gutstein, 2008). Obama Administration policy initiatives such as *Educate to Innovate* (2009) and *Change the Equation* (2010) have targeted a particular subset of minority students—girls: "women make up 46% of the total workforce but only hold 24% of jobs in technical or STEM fields" (*Change the Equation*, 2010, p. 2). Reasons identified for women's under-representation in STEM include the following: a lack of women represented in STEM fields in media and pop culture, girls' self-reported disinterest in STEM, a lack of encouragement from parents and teachers, and the lack of awareness of STEM as a growing career option. These same policy initiatives present particular solutions to solving the problem of recruiting women to STEM and describe a number of experiences girls should have, including hands-on activities that highlight problem-solving and real world applications, meeting STEM role models and mentors, attending STEM summer camps, exposure to STEM career opportunities, and participating in academic events such as fairs, conventions, and museum trips.

As a result, STEM policies reflect a number of current conceptions about the relationships between young people, their "future potential," and their "place" in modern global societies. First, STEM rhetoric reflects the ideological position that the primary purpose of education "is not intrinsic but extrinsic, because the primary aim is to exchange one's education for something more substantial, namely, a job, which will provide the holder with a comfortable standard of living, financial security, social power, and cultural prestige" (Labaree, 1997, p. 55).Further, young people—particularly adolescents—are perceived to be moving towards something, in this case successful assimilation into lucrative STEM careers as fully actualized adults (Lesko, 2012). Adolescents are to be studied, surveilled, and directly *acted upon* through particular interventions in order to shape their development as productive members of society (Down, 2009; Lesko, 1996; Raby, 2004). They are homogenized, and who they are in terms of their raced, classed, gendered subjectivities is erased as part of the production of a particular 21[st]century subject hood in which one's ability to produce and consume is most valued (Giroux, 2014; Lesko, 2012).As a result, STEM programs reflect educational interventions based in social efficiency:

> … society counts on schools to provide the human capital it needs to enhance productivity in all phases of economic life, which means that schools must assure that everyone engages in serious learning-whether they are in college or kindergarten, suburb or inner city, top track or bottom track. In this sense then, social efficiency treats education as a public good, whose collective benefits can only be realized if instruction is effective and learning is universal. (Labaree, 1997, p. 50)

Thus, STEM programs can be understood in terms of their pedagogic function to shuttle students towards particular careers and identities that reflect market values and those espoused by political and economic elites.

Why study news media reporting about education?

Discussions regarding the role that the news media play in shaping public perceptions and informing the public about different issues has long been a question of those in communication studies, journalism, discourse studies, media studies, and other fields that attend to how messages are communicated between individuals, groups, and the public. Those who study media— systems of mass communication—have employed multiple theoretical lenses through which to interrogate and understand its influence, including understanding media technologies and convergence (Debord, 2000; Jenkins, 2006; McLuhan, 2001), exploring relations between media and power (Gramsci, 1971; Herman & Chomsky, 1988; Hodkinson, 2011), constructing the news and messaging, agenda setting, and framing (McCombs & Shaw, 1972; Entman, 1993), and others. Many scholars focus on liberal/pluralistic perspectives that view the connections between the media, the press and news journalism in particular as vital to a vibrant democracy (Habermas, 1991). From the debates over whose view the news media ought to represent, e.g., those of the elite versus those of the general public, to more recent discussions about media in a highly technological society, questions about the impact and reach of different media continue. If media communication is understood to create a convergence of cultures, it is also a defining and contested site for identity construction and meaning making with its own culture and practices that help to construct reality (Jenkins, 2006; Schudson, 1996).

Even with concerns regarding the state of news journalism in general and education journalism specifically, the news media continue to construct narratives about education, and therefore contribute to wider discussion about STEM education (Bales, 2010; Fenton, 2010; Maeroff, 1998; West, Whitehurst, & Dionne, 2009). In the age of the Internet, news articles and other information can be produced, re-produced, remediated, and

quickly disseminated (Castells, 2011). Digital technologies like the Internet help to make the global, local, and bring news, people, and stories from all over the world into one's locale instantly. As a result, news media sources not only function as part of the policy enactment process in that they help to clarify the processes and official arguments; news media help to enforce policies through reporting on those policies (Baroutsis, 2016).

There is a growing consensus that the news media contribute to the shaping of public conceptions of school reform and as such, this connection is ripe for systematic and rigorous examination (Blackmore & Thorpe, 2003; Gerstl-Pepin, 2007; Haas, 2007; Opfer, 2007). What critical education policy scholars can glean from inquiry into the news media can enable them to better understand "both the media processes and impact on public understanding of education policy" (Opfer, 2007, p.168). Like other school reform initiatives that have evolved out of the debate over how best educate children and youth, STEM education policies are presented as a means for the nation to remain economically and technologically competitive in an era of globalization and increased global competition, while simultaneously addressing income inequality, particularly for women and minorities (Drew, 2011; *Educate to Innovate*, 2009). And, like other neoliberal school reform discourses, STEM discourses and policies employ a language of urgency in regard to addressing the needs of children and youth in a global society (Drew, 2011; *Educate to Innovate*, 2009). News media outlets exacerbate the sense of crisis, declaring that the US will further lose its competitive edge in a global market economy if national public education is not improved (Altheide & Michalowski, 1999; Wallace, 2007).

Other research examines how the news media reports on particular aspects of public education—for instance, testing (Stack, 2007a), policy issues (Blackmore & Thorpe, 2003; Lingard & Rawolle, 2004), and curriculum (Thomas, 2004). Even so, it remains a relatively small field of inquiry. Studies in education have analyzed extensively the media's role in educational discourse production and reproduction (e.g. Davies, 2002; Stack & Kelly, 2006; Thomas, 2004). At present, studies examining news media reporting related to STEM have largely focused on how controversies in particular subject areas—like evolution, creationism, and the science curriculum) are framed in news reports (Allgaier, 2010; Allgaier & Holliman, 2006). Other scholars have focused on math and testing, like the work of Stack (2007a). Stack analyzed Canadian media surrounding the 2000 PISA (standardized national test), focusing on coverage of two national papers. She aggregated the results with press releases of the same time frame to see if the media coverage did indeed follow the government press releases, which

celebrated the apparently decreasing gap between rich and poor in Canada. Stack found that the "newspapers relied heavily on government sources to contextualize the PISA results" (p. 58). Thus, the rise in PISA scores and the narrowing of the gap between the scores was a direct result of school reform efforts alone, without any other factors coming into play. Even so, little attention has been paid in educational research to how the news media talks about young women's experiences in STEM education.

Finally, common-sense reform policies that offer solely market-based solutions to the perceived problem of "failing public schools" are constructed and presented to the public through press releases and news stories, and often directly reference young people as those who have the most to lose if education does not improve (Kumashiro, 2008;Stack, 2007b). Educational researchers have paid particular attention to how discourses about global competition and economic crisis have been used to justify school reform practices like the closure of public schools and reopening them as ostensibly public charter schools under private control, diminishing employee rights and eliminating pensions and benefits, and the narrowing of the school curriculum to cover only those subjects beneficial to competition in a capitalist society are reflected in news media reports to largely and uncritically support neoliberal education reforms (Peck, 2015). Thus, an investigation into how news media reports construct narratives about STEM education, girls, and larger concerns about the global economy is an important avenue of inquiry for critical policy scholars, particularly if they are to more adequately understand how neoliberal discourses seek to subvert and pervert public education for private interests.

Methodology and Data

As critical educators and members of the public, we have been interested in what information has been made publicly available regarding school reform policies and initiatives. Since 2007 we have collected artifacts like letters sent home from schools, news reports, press releases, speeches, policy briefs, blog posts, social media discussions, popular movies and television programming, and images depicting schooling in America. In particular, we have examined the policy discourses and the language employed by policy makers and advocates when communicating with different audiences. We have explicated how journalists have employed discourses of crisis and fear to leverage consensus for different reform efforts, including standardized tests, tenure reform, the closure of low-performing public schools and converting them to charter schools, and more recently, the Common Core Curriculum Standards and STEM education initiatives.

The data discussed here—newspaper articles from a selection of national outlets—derive from our exploration of STEM.

STEM is one of many initiatives introduced in the last fifteen years to address what has been framed as ongoing crisis in public education in the United States (Berliner & Biddle, 1995; Berliner & Glass, 2014; Giroux, 1984). In earlier work, we have documented how STEM reform discourses in news media reports reflect neoliberal interests and solutions as both common sense and the most effective means to solve intractable problems in education like equality, preparing graduates for the world of work, and meeting the needs of private interests in a globalized society (authors, 2011, authors 2014). The analysis presented below is part of this larger inquiry because one of the foci of many current policy documents, federally funded grants, and teacher education programs has been to address the need to encourage girls to explore STEM and persist to a career. Within the context of the policy documents, girls are clearly stakeholders—they have the most at stake regarding any given outcome—particularly as it relates to advocating for STEM as a means to achieve equality.

Research questions and protocol

Our inquiry was guided by the following overarching question: What can we learn from examining how girls' voices are utilized in newspaper reports about STEM education? In order to make this more manageable, we identified three sub questions:

1. What do girls say about STEM education as reported in newspaper articles?
2. What are girls' experiences with STEM education as reported in newspaper articles?
3. How do newspaper articles construct narratives about girls and their experiences in relation to STEM education?

Theoretically, we draw from communication studies, journalism, media studies, and media education and literacy to inform the conceptual and methodological frameworks. We engaged in a recursive, interdisciplinary analytic process that combined both qualitative and quantitative analysis through the concomitant deployment of Critical Discourse Analysis (Fairclough, 1995; Gee, 1999; Richardson, 2007) and frame analysis (Entman, 2004; 2007; Reese, 2007). As an analytic method researchers employing Critical Discourse Analysis (CDA) seek to examine and illuminate the "relationships between the text and its social conditions, ideologies and power-relations" (Wodak, 1996, p. 20). Working from the position that "language simultaneously reflects reality ('the way things are') and constructs (construes) it to be a certain way," CDA examines discourse

in context, and thus help to reveal the ways in which discourse can function to construct and normalize inequities (Gee, 1999, p. 82). Fowler (2007) notes that CDA enables researchers to map the relationships between how the news gets made (and issues of ownership, sources, norms of the profession, the context, etc.), the final produced text, and the consumer/reader (issues about interpretation, what one knows about a topic, the context, resonance with personal views, etc.). Finally, CDA, like frame analysis, views all forms of discourse as a social process (Fairclough, 1995). Of particular importance is CDA's attention to the power relations embedded within and across texts. As such identifying *sensitizing objects (SO)* enables researchers to uncover the power relations at work.

In contrast, frame analysis seeks to uncover and illustrate ideas and discourses that endure over time and persist in the face of evidence to the contrary. According to Reese (2001), "Frames are organizing principles that are socially shared and persistent over time, that work symbolically to meaningfully structure the social world" (p. 12). They convey the parameters of discussion for a given issue. Those who most effectively structure a given frame can also constrain related discourses by bounding the discussion to what is defined within the frame itself. In other words, when one frames, one "select[s] some aspects of a perceived reality and make[s] them more salient in a communicating text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation" (Entman, 1993; p. 52).Frame analysis helps the researcher to organize and make sense of data, at the level of an individual text *and* across a range of texts in a given data set. The following questions are pertinent:

> 1) What is the identified problem?
> 2) What solutions, if any, are proposed to address the identified problem?
> 3) Who or what is to blame for the existence, scope, intractability, etc., of the problem?
> 4) Who are the experts? Who is identified as having expert knowledge, resources, or particular insight into the problem and/or solution?
> 5) Who are the stakeholders—that is, who has the most to "gain or lose" in relation to identified problems or solutions? (Altheide, 1997; Altheide & Schneider, 2012).

Taken together, CDA and frame analysis enabled us to develop a research protocol to examine how the newspaper reports might play a role in how readers come to make sense of and understand STEM policy as it relates to girls in US (Moses, 2007). Because we identified items that employed the problem frame—the underrepresentation of girls and women in STEM education—as part of the initial identification of the data to be

included, analysis proceeded to uncover the remaining constitutive elements of the frame: proposed solutions, assigned blame, experts, and stakeholders (Entman, 1993; Monashe & Siegel, 1998). In this regard, we worked to highlight how framing provides "the interpretive background by which the story is judged," as well as the normative narrative that reinforces and is reinforced by the process of framing itself (Graber, 1989, p. 7).

Data

Data were identified using the Lexis Nexis database searching for the terms "STEM education" and "girls" in US newspapers from January 1, 2005 through August 23, 2015. The search yielded 990 items (newspaper articles) from across the nation. Duplicate items, articles published in international newspapers, STEM stories outside the United States, and stories that did not discuss STEM (e.g., stem cell research) and articles that did not focus on K-12 education were excluded yielding 199 articles. Of those 199 items, 77 stories directly referenced girls' experiences or voices as key components of the story.

To illustrate how we analyzed an item, consider the article, "Future science, math leaders" (May 10, 2012) published in the McClatchy-Tribune owned *Puyallup Herald* located in Washington state (See Chart 1). Reporter Andrew Fickes highlights the experiences of senior Jennifer Ashmore and other girls enrolled in a model school-to-work STEM program housed at a local high school in which future workers learn about relevant fields and jobs, and develop the requisite skills so that when hired (ostensibly by Boeing) they are already prepared with the basics of the field. Reporter Andrew Fickes describes the experiences of students like Jennifer Ashmore and others, as they learn about STEM careers, such as aeronautical engineering and civil engineering. STEM program housed in a traditional public school. Here, the reader learns about how the partnership will help girls get jobs, an important step to self-sufficiency and achieving economic parity. In addition to describing the program run by Boeing, Fickes also quotes a Boeing representative talking about the explicit need for well-prepared workers:

> The Boeing Co., for example, anticipates it will need to fill 700 or more engineering jobs in the next three to five years, based on attrition and growth in the industry. With this class, students can go right to work for Boeing…I call this a pre-apprenticeship program at Puyallup High School. (Fickes, 2012, para. 7).

Chart 1:*Frame Analysis of item 98/990*

Problem	How do we "boost education" and meet the "demand for [STEM] talent in the workforce?" (para. 6)
Solution	●STEM program that introduce girls to STEM careers ●In-kind private funding ●Develop partnership with local university
Blame	None attributed
Experts	District director, Mike Joyner Director of instructional leadership, John Parker Puyallup School Teacher, Alex Macdonald Student Jennifer Ashmore
Stakeholders	High School students, including Jennifer Ashmore, Jacqui Binam, and Amanda Body The technology sector and general workforce

Frame Analysis of the article revealed that the article largely reported on Boeing's STEM program as a solution to what the company (and its partner school district) identified as its largest pressing problem regarding STEM talent development: that education, that is, the learning experiences of students needed to change in order to provide them with requisite skills *before* they complete high school, shifting what was once on-the-job training to high schools. Fickes (2012) relied on teachers, administrators, and Boeing representatives to develop the story, and they were quoted in the article as experts about STEM education. Students, like Jennifer Ashmore, Jacqui Binam, and Amanda Body represented one group of stakeholders—students and girls in particular—as it is their future careers and economic potential at stake. These young women also stood in as nominal experts, an occurrence in which their views about the program were included because they took part in the program, and could provide insight into what an effective STEM program might look like.

Once preliminary frame analysis was completed, we then turned to Critical Discourse Analysis and employed the sensitizing objects identified in early stages of data collection, organization, and code development (see Chart 2). Critical engagement with documents like *Race to the Top*, *America Competes* and *Educate to Innovate* sensitized us to policy positions regarding the importance of STEM to meeting equality, workforce needs, and national pressures in a global economy. Thus, we were mindful of these discourses as we engaged with the data.

Chart 2: *Critical discourse analysis of item 98/990*

Sensitizing Objects (Fairclough, 1995)	Definition	Example of Girls' experiences in STEM programs as reported in newspaper article	Girls' voices (direct quotes from newspaper article)
Education for the Global Economy	The purpose of education is to prepare students for the world of work in a global economy. Successful reform efforts enable students to acquire these skills prior to college.	"The course even encourages students to take on different roles. Ashmore is the class supervisor of all the different jobs, so she gets management experience, too." (para. 4)	"This class teaches different career pathways, like electrical, aeronautical engineering and civil engineering" (para. 3).
Underrepresentation of girls in STEM	In order to achieve parity for girls and women in the STEM pipeline, good STEM programs must be made available to all students.	"The district also hopes students, regardless of gender, will show interest." (para. 24)	"I think engineering is a stereotypical male-dominated job," Ashmore said. "I think women can look at me and other ladies and know that we can be just as technologically smart. I think we can definitely do the job."
"Good" STEM programs	Successful STEM programs can be offered in school settings, but need private funding and university partnerships to successfully garner interest in STEM among girls.	"Meanwhile, the Puyallup School District continues its dedication to STEM education by developing a partnership with the Washington State University Puyallup Extension Center." (para. 26)	"It excites me to be in the sciences and help change the world," she said. "I want to get my name out there. I believe in total equality between men and women. I hope to level the playing field (para.BB).

Fickes' (2012) article constructs a reality in which STEM education learning experiences provide hopeful girls with affirming messages about potential STEM career opportunities. Analysis of the article reveals important tensions between how the adults who design and deliver the program (one set of identified experts) and the young women's interpretations of those experiences as expressed through their news quotes (stakeholder and nominal experts). On the one hand, the experts that delivered the program focused on the importance of developing skills that would be useful in a STEM career. In contrast, the three girls quoted were less interested in the skills associated with the program than they were in the empowering potential of taking part in the first place. For Jennifer Ashmore, her presence was an indication that engineering isn't just for boys and men. For Amanda Body, also quoted in the article, participating in the sciences enables her to quite literally "help change the world" (Fickes, 2012, para. 26).

We applied the above protocol to all 77 items in the dataset and organized our coding and findings using a basic spreadsheet. We chose not to use a qualitative software program like NVivo or Hyper Researcher because we wanted to be able to capture nuances in how the news reports were constructed that might not be picked up by autocoding. We then reconstituted the data in order to further refine the analysis. Doing so enabled us to consider how girls' voices were deployed (as expressed in direct quotes and through paraphrased narratives) and how they might shape understanding or interpretation of the text.

Findings

In this section we elaborate upon our findings to highlight how newspaper articles in the dataset constituted a coherent narrative about STEM and girls by focusing on reported experiences and girls' comments about those experiences. Analysis of data revealed that newspaper articles written by journalists largely reflected official policy discourses regarding good STEM programming and the experiences girls and young women should have if the nation is to maintain its global competitive edge in technological innovation and economic dominance. Reporters also used relied on the voices of the girls who participated in the programs to further support news story frames. While most of the quotes employed supported the overall organizing frame about STEM and girls, some of those chosen by journalists revealed that some girls saw more to their experiences than just STEM as a future career options.

Even when journalists were trying to sell STEM as a solution, girls' voices still managed to penetrate the dialogue and decouple their educational experiences and who they were from the commodifying discourses complicit in neoliberal school reform agendas. While this is a nuanced reading that counters our initial findings, it highlights how the news media may exploit girls and their voices. We feel it is essential to report on this nuance in order to sensitize those interested in the educational experiences of girls as they relate to STEM. Even so, regardless of how newspapers might be exploitative, there are places to find authentic representations of girls' voices.

Girls and their experiences with STEM

The 77 articles that comprised our dataset reported on a number of different experiences and activities that occurred in both traditional public school settings as well as after school programs offered in collaboration with community-based organizations like the Boys' and Girls' Clubs and the Girl Scouts. Different groups, often private or corporate philanthropic groups committed to increasing the pool of job applicants in STEM fields sponsored the experiences and activities upon which journalists reported. Among those groups include Boeing, The George Lucas Foundation, Exxon/Mobil, and others, many of whom practice venture philanthropy and actively donate to pro-market, pro-privatizing, and above all, pro-neoliberal think tanks and advocacy groups to support their vision of school reform (Saltman, 2010, 2016)).

Newspaper reports explicitly connected the experiences described in articles with career development (45%), best practices in STEM education (37%), and the importance of programs and opportunities being fun or enjoyable. Students involved in the enrichment programs had the opportunity to engage in hands-on learning activities, real-world application, problem-solving, and cooperative learning--all activities identified by the journalists and official STEM policy documents as crucial to preparing girls to be effective and innovative STEM workers. Finally, journalists employed girls' quotes to highlight the utility, enjoyment, and novelty of the programs in which they participated.

Of the newspaper items analyzed to uncover how girls' voices were employed and represented in the data set, 55.84% (n=43) highlighted what girls considered to be good STEM programming. Girls *described* such programs "being fun," "enjoyable," "cool," "new," and "exciting." Reporters employed girls' quotes like, "My class was fun yet educational, [...] I love to build and when I'm older I might like to be an engineer" ("NJIT

and STEM: Perfect Together", March 10, 2015), and "It really hurt, but it was fun at the same time," ("PPPL hosts Young Women's Conference," March 20, 2015).

Take, for instance, student Katie Valdez, 11, a fifth-grader who was quoted in an article reporting on a STEM day in which girls had the opportunity to explore different disciplines through hands-on activities like coding, building with Legos, and extracting DNA from strawberries. Reporter Rachel Raskin-Zrihen quoted Katie: "It's good because you get to learn some stuff other kids don't get to learn - about cells and how to power stuff. And it's fun stuff that some girls never get to do" (4/26/15, para. 16). For Katie, the fact that the STEM day was fun was important, but Raskin-Zrihen's use of Katie's quote also highlights other elements of the program that were important to Katie, namely the fact they she had the opportunity to learn something that other kids her age didnot. Thus, for students like Katie, enjoyment was part of the experience, but was not nearly as valuable as an opportunity to acquire additional STEM skills that might set her apart from her peers.

Girls, STEM, the global economy, and future aspirations

45.45% (n=35) of articles included discussion of experiences and quotes that highlighted the importance of STEM education for career development, and discussed explicit STEM-related careers. Stories included reporting on careers in the petroleum industry and how one nonprofit program, Girlstart, introduced girls to STEM careers (Villalpando, February 2, 2013). In the case, the report highlighted "fun hands-on" STEM activities for girls in which they learned how to find fossil fuels in the ocean and other important skills needed for the petroleum industry" (p. E101). Villalpando reported that girls engaged in an activity designed to simulate drilling for oil in different locations, in order to teach girls about the complex nature of oil extraction. In addition, girls were challenged to think about the economics of oil extraction, particularly in terms of overhead costs and efficiency. Tamara Hudgins, the executive director of the program, focused on the need to get girls into the right types of STEM:

> Girls are underserved in STEM. Half of the earners of undergraduate degrees are women, but only 25 percent of all STEM jobs are populated by women. "Of those STEM jobs populated by women, many are in lower-paying jobs like nursing", she says, "and only 1 in 7 engineers are women." (para. 15-16).

What is significant about the above passage is the relative value assigned to different STEM-related occupations based upon salary and value to the market. Hudgins

acknowledged that many women were nurses, but that because it was low-paying it wasn't the type of career that would break down STEM barriers or be particularly lucrative. Her focus, instead, was encouraging young women to consider STEM fields in which women were under-represented, because those fields were more lucrative.

Hudgins, and later colleague Julie Shannon, focused on both underrepresentation of women in fields like engineering and the fact that within learning situations in classrooms at the K-12 and university levels, girls ultimately defer to boys and men in regard to decision making and who completes what tasks, with the men assuming responsibility for those requiring "more engineering skills." Somehow they had the idea that the men wouldn't let women build. "These are college students," Hudgins says. "It made me concerned about their retention in college. We are giving girls the opportunity to be comfortable with the doing" (para. 18-20). Of particular note here, is the fact that Hudgins focused on issues of retention in STEM majors rather than larger issues that shape girls' beliefs about STEM education. Attention to larger social and political constraints that might affect girls' ultimate decisions to pursue, persist, and be successful in STEM fields are only important within the context of retention. In other words, girls' choices and decisions regarding participating in STEM fields were what needed to change, not institutional or cultural conceptions about STEM and who pursues a STEM career. Making the right choices was crucial for girls' STEM development.

Other articles focused on other specific careers, and made explicit connections to the importance of girls entering STEM into fields like bioengineering and cybersecurity. The May 2, 2015 in the *Contra Costa Times* (California) article on the program the CyberGirlz Silicon Valley Summit is a case in point. Journalist Patrick May reported on the program and its efforts to create a more gender parity in the field of cybersecurity, one of the many STEM related fields that focuses on computer science, technology, and global security. Students engaged in activities that helped students learn how to write code, find vulnerabilities in different websites, and write video games. May included quotes from girls that both highlighted their experiences with CyberGirlz and their experiences with learning to code and decode as a function of cybersecurity. Student Cynthia Solorio, who learned about encryption and "steganography, the science of hiding information" (para. 8) was quoted, "I learned that there are a lot of people out there who take a lot of time to put words into code and kind of hide stuff on the Internet from other people" (para. 8-9). 12-year old Cassie Pinkney noted that:

> If you can make a video game, you can then learn how to protect it from hackers, which is great training for me to one day do the same thing on a larger scale… [It's] a good

opportunity for my future and possibly pursuing a tech career. We live in a very tech-savvy era and not knowing about tech isolates you. (para. 14-17).

Both girls acknowledged the importance of understanding and being able to use information technology, as well as understand and write code, for personal, national, and global protection. In this manner, their quotes helped to reinforce investing in girls STEM education because the quotes spoke to current concerns while looking to future dividends and opportunities.

Tackling underrepresentation by empowering girls

It is important to note all the articles in our dataset include in their discussions about effective STEM programming and recruiting girls into STEM pipelines, and thus broadly addressed issues of underrepresentation and empowerment. However, only 27.27% of the articles in our dataset (n=21) addressed explicit ways that the programs addressed issues of underrepresentation. These articles focused on the importance of girls developing a positive impression of themselves in relation to STEM. Examples of the discourse used in these articles include ideas like girls can change the world, and girls can do X (e.g., STEM) as well as boys.

Take for instance the article titled "Future science, math leaders," we discussed above. Jennifer Ashmore, whose voice was extensively employed quoted throughout the article was quoted: "I think engineering is a stereotypical male-dominated job [...] I think women can look at me and other ladies and know that we can be just as technologically smart. I think we can definitely do the job" (para. 9-10). Jennifer is aware of the stereotypes she might encounter, but she believes she has already started to overcome them. Amanda Body, another young woman quoted in the article, echoed Jennifer's thoughts: "It excites me to be in the sciences and help change the world [...] I want to get my name out there. I believe in total equality between men and women. I hope to level the playing field" (para. 25). Amanda's interests not only include being known as someone who is good in STEM, but also sees the empowering potential for women with STEM backgrounds. Finally, both girls were able to envision themselves in future roles in which they changed their respective STEM fields in regard to gender parity, perhaps helping future girls through similar mentorship.

Other articles also talked extensively about girls needing role models in STEM who could serve as mentors. A January 13, 2011 article from *The Reading Eagle* addressed the low enrollment of female students in a high school engineering class. In response to this

concern journalist Erin Negley reported out on the school's decision to bring in women with careers in engineering to inspire girls to take the course. Eighth grader, Angel Nieves is quoted: "When I hear 'engineering,' I always think of guys and masculine, but they described all the different kinds of engineering that women can do and it showed that women can actually can do engineering" (para. 17).

Another article, "New day in NYC: Schoolkids on the fast track to better jobs" (December 10, 2013), reported out on the New York City Public Schools efforts to transform the city's public schools using STEM education. The reporter highlighted efforts to bring in female mentors to inspire girls to think about STEM careers. A female student named Josephine is quoted: "The best part was seeing women working in tech at a very high level [...] It shows us what's possible" (para. 8). For Josephine, like Angel, learning about women who were successful in engineering helped to challenge their perceptions of women in STEM, and perhaps further encouraged them to pursue STEM.

The programs and experiences upon which journalists reported were ostensibly designed to encourage girls (and minorities) to explore and persist in STEM. However, many of those who argue for access seem to lose sight of or ignore the structural and institutional barriers that have enabled underrepresentation to persist. Even so, there were instances in which news reports expanded the discussion beyond access. In the article, "Cassidy: Presentation High senior recruits female NASA scientists to promote STEM education" (October 12, 2012), journalist Mike Cassidy notably brings the reader's attention to the complexity of equality and STEM educational reforms. Cassidy reported on senior Deepika Bodapati, who organized bringing in four NASA scientists to speak on a panel at her high school. Bodapati, reports Cassidy, wants "to conquer the reluctance of students, especially girls and low-income kids, to pursue classes and careers in science, technology, engineering and math" (para. 2). Cassidy reports on efforts to identify role models in STEM, and points to Bodapati's desire to act as a force for positive change for students, particularly in regard increasing the visibility of women and people of color in STEM: "Don't get Bodapati wrong. She knows there are people of color, people who struggled as kids, women and all kinds of other people excelling in the fields of the future. But the numbers just aren't there yet" (para. 4). According to Cassidy, Bodapati wants to expand the panels beyond her private, Catholic all-girls schools:

> Her plan is to organize similar panel discussions at schools where students don't have the same advantages that she and some of her classmates have. She's aiming for students who are saddled with disadvantages of geography, living in neighborhoods where just walking to school can mean navigating a world of gangs, drugs and violence....

In these underrepresented areas, there are so many other things to be concerned...there are so many other influences that I don't have to deal with.(para. 16-18)

This is one of the few articles that explicitly acknowledged the impact of outside factors on students' access to and success in STEM. Cassidy, in employing Bodapati's voice through quotes, extended the conversation beyond the discourses of STEM policy to highlight the ways in which students can and should be part of STEM conversation, and that while effective STEM programming must provide students opportunities to engage with STEM materials and activities, mentors, and role models, is necessary but not sufficient if girls and students of color are to truly feel part of and thrive in STEM communities and careers.

Discussion and Conclusions

Analysis indicates that the articles in this data set about STEM education and girls fit the "good news" story structure often found in news articles. Such stories are one-time pieces of journalism disconnected from their wider context, for instance, the impact of cuts to federal, state, and local funding on public school districts (see Tuchman, 1978). Such articles hit the "high notes" of "good STEM learning" experiences, "hands-on," engaging, inspiring, exploratory, real-life application, and connects these experiences to career choices. They report on role models, mentors, and the importance of girls meeting and interacting with prominent women in STEM who had the persistence to be successful regardless of the challenges they faced. Finally, journalists report on how girls themselves view the importance of women in STEM and their potential futures. This summary, however, does not constitute the complete narrative of the corpus of articles. Instead, those data must be set back in their wider context, to reconstitute a more complete picture. Here, we resituate our data and analysis within the news media production process, neoliberal discourses and practices, and discourses about youth to consider extensions and limitations of our research.

This study, in uncovering what a selection of news sources reported to be solution to the problem of STEM and girls, reflects how "[n]ews incorporates political values, which arise from a range of influences, from routines of information gathering to recruitment patterns of journalists and shared ideological assumptions of the wider society" (Hallin & Mancini, 2004, p. 26).The stories shared the experiences of girls of different background who took part in various programs, and journalists strategically used quotes to support the overall narrative in the story, especially when discussing how to get girls interested in

STEM careers. In this case, the "constructed reality" reflects a normative narrative about the education and neoliberalism—that the purpose of schools is to meet the needs of a global, free market society, and underrepresented and underserved groups must have better educational experiences so they, too, might become a contributor to society, as opposed to being "at risk" if one makes the wrong choices about school and career (Giroux, 2004; Kelly, 2003).

What readers encounter is the use of girls, their experiences, and their voices in news stories to bolster the common sense framing of how to recruit girls into STEM careers. Girls are the satisfied customers of the neoliberal STEM revolution. This revolution seeks to recruit individual girls to enter into the pipeline so that they can take advantage of having the opportunity to apply for highly lucrative careers in STEM. Within this discourse, targeting girls is not designed to address serious inequity issues that discourage and prevent girls from entering STEM. The goal is to provide the resources— programming, curriculum, role models and mentors—to what has been largely an untapped potential workforce for STEM. As reported in the news articles, girls largely confirmed they enjoyed the experiences, and several noted feeling hopeful and empowered. At the same time, their empowerment was constrained to having access to, entering, and assimilating into fields traditionally relegated to white men. They were not empowered to question why women were historically excluded, nor did any of the programs on which journalists reported engage girls in considering what equitable STEM learning and work environments might look like.

An important aspect of understanding the news production process, whether about girls and STEM or any topic, is the reality that reporters chose which girls' stories and voices to employ as part of article narratives:

> Journalists play a dual role in this arena. By including quotations and paraphrases from various spokespersons, journalists decide which collective actors should be taken seriously as important players. They are not merely gatekeepers in this process but are themselves players who comment on the positions of other players, shaping and framing the discussion in their interpretations and analyses. (Snow, 2008, p. 243)

As journalists gathered information and identified sources for a given story, they made conscious decisions—constrained by time constraints, the news production process, and girls who had permission and were willing to speak with them—that then were used to construct the story. In the case of girls' voices that were included in different articles, it is crucial for researchers to be aware that journalists don't necessarily have access to all of

the students enrolled in a particular program. Parents may not have signed media releases for their children and program providers may have also chosen who was going to represent all students. Consequently, readers encounter both a carefully constructed and constrained story that might fail to explore the full extent of girls' experiences and interests. Readers only engage with the final text, and are often unaware of earlier drafts and what information was excluded from the article, whether because of word limits or due to journalistic judgment.

Analysis also revealed how effective and embedded neoliberal discourses are in shaping how members of the public talk about education reform. They are equally effective at co-opting equity and social-justice based narratives to assert the neoliberal imaginary, so much so that many of the girls quoted in the data may have inadvertently supported school reform policies that fail to see their humanity in-the-present. Young people are only future workers and contributors to the global economy. Even so, from studying how girls' experiences and voices are framed in newspaper reports about STEM education, we glean insight into what the public might understand about current education reform policies that target equity issues such as the disparity of women and minorities in the "STEM pipeline."

In addition, we see how a subtler reading of how girls' experience and talk about such programs can enable people concerned about the general educational experiences of girls, as well as the more specific issues related to STEM, to more fully understand the structural and institutional impacts on girls and how they see themselves. Within this latter understanding, we find that STEM programs offer girls nationwide with a wide array of experiences, information, and opinions about their own future lives, with little attention paid to their current realities. Paying attention to their voices sensitizes the fields of education policy and educational research to a more nuanced understanding of the key stakeholders in policies—students that said policies are prescribed for. Learning how students—key stakeholders in policies—make sense of their experiences, even in a newspaper story, sheds light on key aspects of the covert or unattended outcomes of educational, such as personal fulfillment, community and global awareness, and belief that one can change the world.

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