INFLUENCES ON OCCUPATIONAL IDENTITY IN ADOLESCENCE:
A REVIEW OF RESEARCH AND PROGRAMS

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Suggested citation:
Callahan, Jessica, Ito, Mizuko, Campbell Rea, Stephen and Amanda Wortman. 2019. *Influences on Occupational
Identity in Adolescence: A Review of Research and Programs.* Irvine, CA: Connected Learning Alliance.

EXECUTIVE SUMMARY

INFLUENCES ON OCCUPATIONAL IDENTITY IN ADOLESCENCE: A REVIEW OF RESEARCH AND PROGRAMS

This report synthesizes research and programs centered on youth occupational identity—their vision of their future selves in the workforce, what they like to do, what they believe they are skilled at, and where they feel they belong. The report outlines a three-part framework for understanding influences and barriers that are tied to occupational identity outcomes of self-concept, self-efficacy, and a sense of belonging.

1. **Exposure** to role models, media, and instructional content influences how youth value and identify with different activities and occupations. Stereotypes create associations between occupations and identity categories such as race, class, and gender, creating barriers for many youth.

2. **Engagement** in activities parallel to professional practices in educator-guided projects and hands-on experiences. Implicit bias poses a barrier to marginalized youth when they get social cues that engagement in high-value fields is not for kids like them.

3. **Participation** in authentic communities of practice through work experiences, internships, and civic action. Homophily, or the tendency to associate with others who share culture and identity, can inhibit participation in groups where they feel they do not belong.

The report suggests areas for further research that could offer actionable findings for programs seeking to influence youth occupational identity:

- Study of the influence of popular media representation on occupational identity, particularly targeted studies on the influence of alternative representation on the self-concept of marginalized youth.

- Research on how parents and families mediate and influence occupational identity, particularly between culturally specific subgroups.

- Investigation of *specific* program features in terms of occupational identity, particularly features and design approaches that lead to equity outcomes.

- Studies of the impact of social capital and relationships on feelings of belonging in occupational fields, particularly for marginalized youth.

- Across the board, more research on equity-oriented levers and influences specific to marginalized youth.

The report surveys educational programs that seek to influence occupational identity and vocational outcomes, with an emphasis on programs that address barriers for marginalized youth. While very few programs explicitly target occupational identity, the following approaches show promise:

- High-engagement programs that target marginalized youth and offer mentorship, training, and job-placement support are effective though resource intensive.

- Career exposure and apprenticeship programs in museums and other professional organizations are promising for building distributed capacity for influencing and expanding opportunities for occupational identity development.

- Many educational programs in and out of school target occupational identity development, but very few programs link formal and informal learning, which is a missed opportunity.

- Few educational programs are intentional and systematic in applying equity-oriented approaches to developing occupational identity. Deploying these approaches to large-scale programs that may not currently be equity focused could be a productive path to achieving equity goals.

- Very few interventions target influence through the family, although research indicates that parents exert a powerful influence in defining career aspirations and guiding their children's educational and career choices.

- Another underused form of engagement is asset-based approaches that stress youth agency, volunteerism, and civic action. Amplifying existing efforts in this area and more innovation on youth-driven efforts could yield more scalable and high-impact interventions.

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Pathways to viable and high-value occupations are broken for many youth. Labor market expert Tony Carnevale argues that ever since *A Nation at Risk* was published (National Commission on Excellence in Education 1983), the high school curriculum has emphasized an academic "new basics" focus that has crowded out career preparation. In his advisory role for this report, he argued that "it is no longer a question of whether youth are adequately prepared for the job market by the K–12 system—they aren't." Add to this the globalized marketplace for talent, and changing workforce needs due to automation, and creating viable occupational pathways becomes ever more challenging.

In order to address this gap, many programs have focused on support for skill development and workforce training, including STEM programming, vocational training, job placement, and reskilling. Educators and policymakers have been making headway in modernizing school curricula through efforts such as CS4All and expanded STEM offerings. Despite this, pathways are still insufficient for STEM specialties. Even with the push for STEM preparation, student interest is stagnant (ACT 2016), particularly among underrepresented minority students.[1] Questions of diversity and inclusion continue to plague professional communities even in progressive enclaves such as Silicon Valley. In response, researchers and educators have focused growing attention on issues of culture and identity, and on related barriers such as stereotype threat and implicit bias. This report reviews and synthesizes this growing area of research and intervention, focusing specifically on occupational identity development in adolescence.

Most efforts are aimed at expanding occupational pipelines and focus on relatively direct interventions such as skill development through education, job placement, and industry incentives. Occupational identity development is an underexplored piece of the puzzle in improving pathways to occupations for youth, and particularly important when they are from underrepresented groups. We focus specifically on adolescence as a key period when identity is still in development, but youth are honing in on specific career pathways. While a robust body of research in the social and behavioral sciences has investigated identity development and varied forms of discrimination, research on the impact of specific interventions on occupational identity is still relatively sparse. Even with programs that do have impacts on occupational identity, most research centers on traditional academic outcomes. In this report, we first summarize key concepts from social and behavioral research about occupational identity, presenting a framework for how to understand varied influences in relation to different forms of intervention. The second half of the report reviews what evidence does exist for the effectiveness of interventions, surveying studies of specific programs that influence occupational identity.

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[1] Among White students, when their exposure to math and science increased by 1 point above the mean of this factor score, the increase in the probability that the students would intend to major in STEM was .515. This increase in the probability of STEM intent would be .287 for Asian students and only .124 for underrepresented minority students (Wang 2013).

OCCUPATIONAL IDENTITY

We understand youth occupational identity to be a vision of future selves in the workforce—what they like to do, what they believe they are skilled at, and where they feel they belong. These aspects of occupational identity can be understood through the following concepts from the social and behavioral sciences.

1. Self-concept, or individuals' representations and evaluations of themselves, influences how they understand their own abilities and capacities and the choices that they make to pursue one activity as opposed to another. In other words, "self-concept does not merely reflect ongoing behavior, it actually guides behavior" (Brummelman and Thomaes 2017:1764). Self-concept is influenced by mental models, the internalized representations of the world that guide an individual's interpretation and action (Craik 1943; Johnson-Laird 1980), and are key factors that can serve to encourage and/or dissuade students from identifying with a particular domain and, by extension, their career trajectories (Myers et al. 2011). These mental models are in turn influenced by exposure to representations that influence the subjective value that individuals place on particular activities, interests, and fields (Eccles 2005).

2. Self-efficacy is an individual's subjective sense of his or her capacity to successfully execute a given task (Bandura 1977). Self-efficacy develops when young people both value a task and are able to exercise skills and experience success in that area (Kang et al. 2019; Lent, Hackett, and Brown 1999; Muenks et al. 2017; Wigfield and Eccles 2000). It is also driven by a growth mindset, or the belief that intellectual abilities can be developed through time rather than being fixed (Dweck 2006; Yeager and Dweck 2012). In other words, self-efficacy is an interaction between self-concept and actual experiences of success, and it can be developed through engagement in activities that involve hands-on and project-based learning.

3. Belonging is an individual's experiences and feelings of belonging and "fitting in" to a community (both real and imagined) with shared interests and practices (Jones, Tendhar, and Parretti 2016). This sense of belonging is influenced by self-concept and self-efficacy, as well as by participation in communities of practice (Lave and Wenger 1991). Belonging is not just a matter of being able to demonstrate what one has learned through successful performance. People must also be *recognized* by other practitioners in the community as legitimate participants in order to form occupational identities and develop career aspirations (Aschbacher, Li, and Roth 2010). In other words, it is both tied to and helps develop social capital—social connections that bind professional communities.
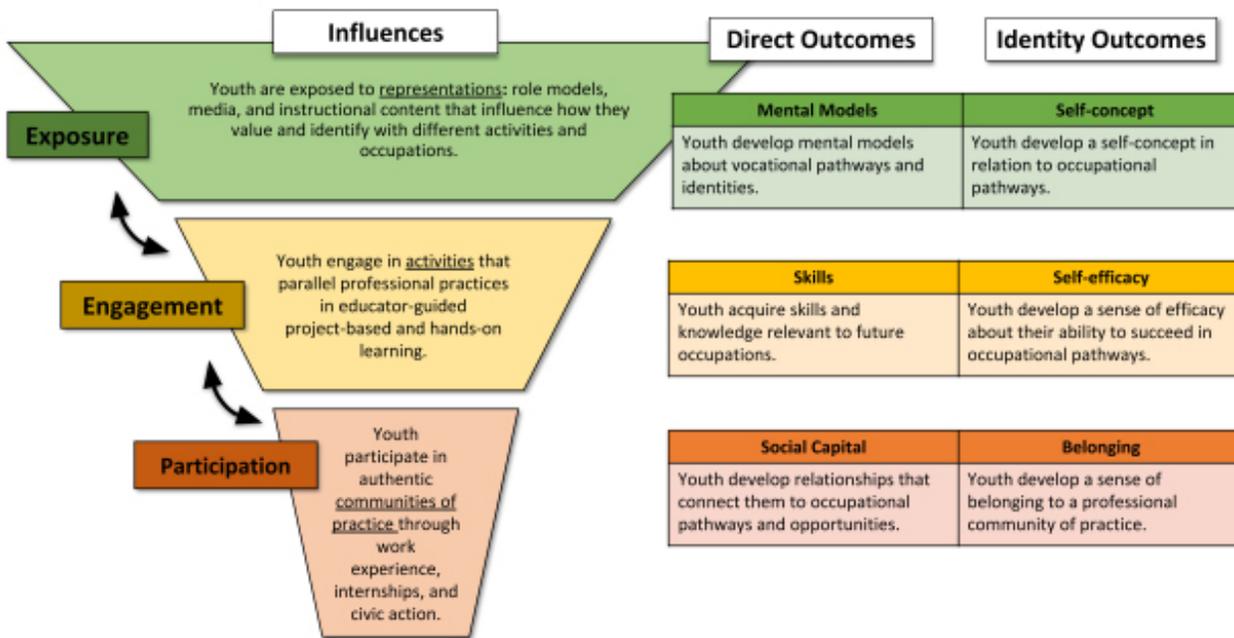
Figure 1: Funnel of Influences and Occupational Identity Outcomes.

The relationship between these three categories of influence on occupational identity is represented in Figure 1. Exposure is at the top of a funnel of influences, and it is the most diffuse and distributed across every setting of a young person's life, including home, school, community, and the media. Engagement in practice includes exposure and involves more participatory, often educational, settings where young people are engaged in projects and acquiring skills. Finally, participation includes exposure and engagement, and it means being part of and contributing to real-world professional life. While the diagram separates these three influences and related outcomes for conceptual clarity, they are interrelated. Influences near the bottom of the funnel powerfully drive outcomes at the top of the funnel. The funnel also partially maps to developmental stages, in which young people tend to progress through the funnel as they grow older. Interventions targeted toward younger children are often centered on exposure, and as they grow older they are able to develop skills through activities, and eventually they can participate in professional communities.

It is worth underscoring that parental and family influence persists across the developmental cycle and the funnel of influence. Not only do parents function as role models themselves, but their expectations and aspirations for their children exert a strong influence on self-concept and self-efficacy (Behnke, Piercy, and Diversi 2004:7; Diaz Soto 1989; Jodl et al. 2001; Qian and Blair 1999; Sandefur 1998; Shen et al. 2014; Whiston and Keller 2004). One study found that girls' experiences with science at home was a significant and positive predictor of their identification with STEM careers, across different races and ethnicities (Kang et al. 2019). Further, parents have a strong influence on what kinds of courses and extracurricular activities their children participate in, which in turn influences their skills and self-efficacy (Harackiewicz et al. 2012; Qian and Blair 1999).

ADOLESCENCE AS A CRITICAL WINDOW

Adolescence is a critical period for connecting developing occupational identities to academic and career pathways. Younger children have more malleable identities (Lemke 2000) and tend to be overconfident about their abilities (Wigfield and Eccles 2000). The openness to varied identities and activities in early childhood decreases as youth get older and more realistic, and exploration of varied occupational identities tends to plateau after eighth grade (Perry and Raeburn 2017; Archer et al. 2010). This suggests that younger children are more open to suggestion and exploration, but their occupational identities are not yet grounded in pragmatic realities. Early childhood media characters such as Dora the Explorer and Doc McStuffins may influence occupational identity (Carter 2008; Keys 2016), but effects on future occupational identity are difficult to capture empirically. Exposure to role models in the family and community are also undoubtedly important ongoing influences throughout early childhood and adolescence, but they are more challenging to target programmatically.

In contrast to early childhood, in adolescence youth explore and consider multiple options before committing to an occupational path, at which point uncertainty and anxiety about identity decreases (Becht et al. 2017). Adolescence is also marked by a period of brain development in which executive function is activated, strengthening the ability to make decisions, solve problems, and plan. By high school, students have stronger, more mature academic and occupational identities, and they have narrowed their interests (Aschbacher et al. 2010; Price et al. 2018). In other words, adolescents are past the blue-sky phase of imagining occupational identities, and they are engaged in the work of grounding still-developing identities to concrete opportunities and pathways.

This period is a critical window for decision making for occupational pathways, and for introducing youth to career-relevant experiences and opportunities. The majority of students who pursue STEM degrees make that choice before they enter college (Maltese and Tai 2010). Researchers have identified the period of middle school as a particularly important time for choosing to pursue STEM versus non-STEM careers (Barton et al. 2013; Kang et al. 2019). A 2010 study found that among the students who graduated with baccalaureate degrees from four-year colleges, those who expected as eighth graders to have science-related careers at age 30 were 1.9 times more likely to earn a life science baccalaureate degree than those who did not expect to have a science-related career. Students with expectations for a science-related career were 3.4 times more likely to earn physical science and engineering degrees than students without similar expectations (Maltese and Tai 2010; Tai et al. 2006). These findings suggest that adolescence is a sweet spot where children are still open to identity experimentation, but in ways that are tied to realistic planning and skill development.

Beyond adolescence, programs and research tend to focus less on identity and more on direct relational, informational, and economic supports. This might take the form of vocational training, career advising, mentoring and peer support, and work-based learning such as internships and on-the-job training. This report is focused on occupational identity as a barrier and a lever for expanding career opportunity, and thus narrows in on adolescence and programs and factors that influence identity development.

BARRIERS TO OCCUPATIONAL IDENTITY DEVELOPMENT

In addition to psychological and developmental factors, the future that young people imagine for themselves is impacted by broader contexts that are stratified by factors such as gender, race, region, and socioeconomic status. Several studies point to structural barriers that make it difficult for marginalized youth to imagine themselves in high-prestige occupations (Barton and Tan 2010; Caraballo 2017; Nasir and Vakil 2017). These barriers influence every stage of the funnel of influences on occupational identity, and they are depicted in Figure 2.
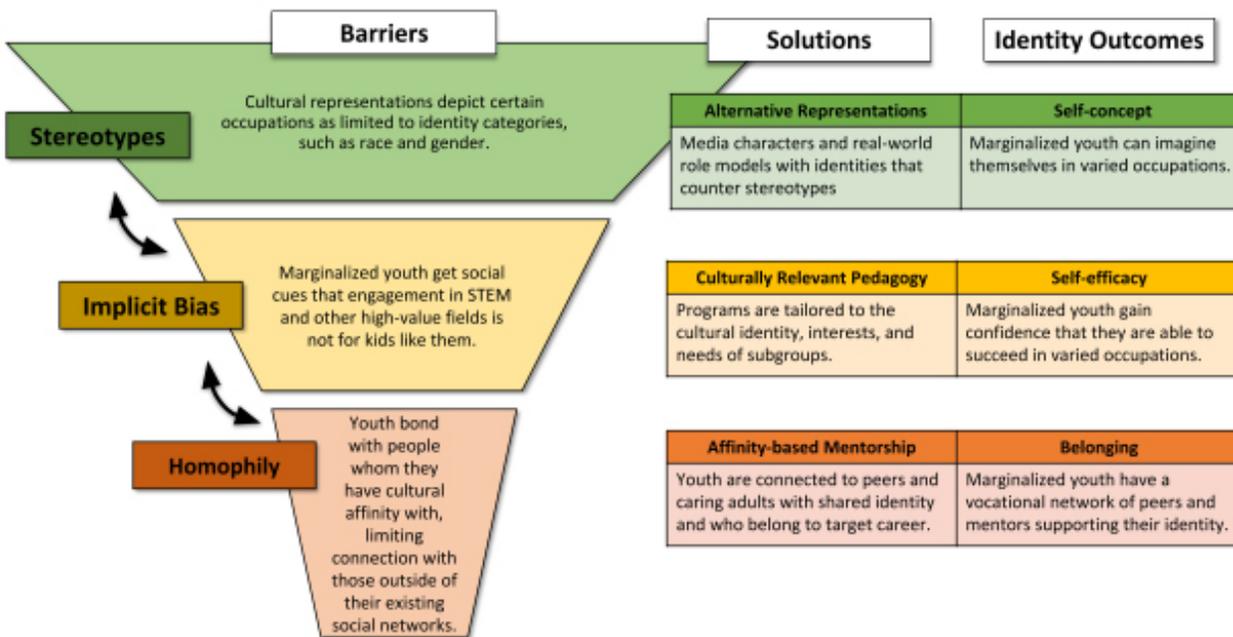
Figure 2: Barriers and Solutions for Marginalized Youth.

1. At the top of the funnel of exposure, stereotypes create associations between occupations and identity categories such as race, class, and gender. Stereotypes suggesting science and other high-prestige occupations are the province of people who are privileged in society—upper-middle class, White, and male—are pervasive even in school settings (Allen and Eisenhart 2017; Bang et al. 2013; Barton et al. 2013; Carlone and Johnson 2006; Carlone, Scott, and Lowder 2014). Exposure to alternative representation in the media, instructional materials, or through atypical role models exhibiting vocationally relevant dispositions and skills is a way of combating stereotypes (Carter 2008; Keys 2016; O'Keeffe 2013).

2. Even when bias is not explicitly named or represented, studies have found that teachers and employers act on implicit biases that can discourage women and students of color from becoming interested in science courses and careers (Barton, Tan, and Rivet 2008; Emdin 2011; Godfrey, Santos, and Burson 2017; Long and Mejia 2016). Young people who encounter these implicit biases can experience stereotype threat, which hampers their ability to fully participate and excel in educational and work settings (Allen and Eisenhart 2017; Archer et al. 2010; Carlone, Johnson, and Scott 2015). In addition to training teachers and employers about implicit bias, educators have developed culturally relevant pedagogy tailored to the interests, competencies, and identities of marginalized students

(Gonzalez, Moll, and Amanti 2005; Gutiérrez and Rogoff 2003; Lee 2007; Moll et al. 1992; Morrell 2007; Soep and Chávez 2005; Vasquez 2002).

3. Social stratification also manifests through homophily, the tendency for people to prefer to associate with others with similar interests and identities. Shared interests and affinity are powerful drivers of learning, engagement, and belonging, but they are also exclusionary to those with dissimilar backgrounds and identities (Ito et al. 2018). These exclusionary processes can be disrupted through affinity-based mentorship in programs where marginalized youth form relationships with peers and mentors who both share their background and are part of a high-value field or career path (Ben-Eliyahu, Rhodes, and Scales 2014; Raposa, Rhodes, and Olsho 2019).

These barriers to developing occupational identities intersect with and reinforce economic and social barriers, such as gaps in access to educational opportunities and social networks associated with certain fields and occupations. Parental and family influence is particularly salient as it is persistent, pervasive, and difficult to target programmatically. For example, one study found that students whose parents had lower educational and economic status were less likely to value STEM fields and subsequently less likely to enroll in STEM courses (Svoboda et al. 2016). Further, Archer et al. (2010) point to how children with higher socioeconomic status (SES) gain an advantage when they conduct science experiments at home with parents' supervision, drawing upon sociologist Annette Lareau's (2003) research that middle-class families push out-of-school learning activities more than working-class families. Research with marginalized youth suggests that parental supports can significantly influence vocational expectations (Diemer 2007), but many parents are not aware of their children's educational and occupational aspirations (Behnke et al. 2004). Further, parent expectations intersect with cultural stereotypes in powerful ways. Studies of Asian American families indicate that parents play a pivotal role in influencing their children's preference for STEM majors, often trumping the child's personal interest (Roysircar, Carey, and Koroma 2010; Shen et al. 2014).

Addressing equity in occupational identity requires attention to every segment of the funnel. Even if young people shake off stereotype threats and overcome biases, they can find themselves in fields and occupations with few peers and mentors whom they feel affinity with. Programs of any type can productively deploy equity-oriented strategies at every point in the funnel—alternative representation, culturally relevant pedagogy, and affinity-based mentorship. In the next section of the report, we describe in more detail how specific interventions and programs can support occupational identity, including these strategies targeted toward equity outcomes.

APPROACHES TO INFLUENCING OCCUPATIONAL IDENTITY

Synthesizing the evidence about how interventions can influence occupational identity is challenging because few programs explicitly measure these types of outcomes, focusing instead on academic outcomes. Some do, however, measure proxies for occupational identity such as interest in particular fields and choices of majors and careers. Further, social and behavioral research has made a good case for links between skill development, interest, and occupational identity. Thus we can draw some conclusions about whether programs are contributing to occupational identity outcomes even in the absence of direct measures. In this section we survey the evidence and programs that have an influence on occupational identity at each step of the funnel of exposure, engagement, and participation and suggest areas for future research and investment. We offer some illustrative examples of efforts in each area, but this is not a comprehensive review of programs.

Exposure to Representations

Research is clear that mental models and self-concept are influenced by representations in the media and in varied real-life settings. The messenger matters for identity; family members, peers, and media personalities are more influential for identity than information in the abstract. Thus we consider only interventions that go beyond simply disseminating information about occupations to consider forms of exposure that are more personalized, situated in a cultural context, and personified by specific individuals.

Evidence for Outcomes to Exposure-oriented Efforts

Studies of the development of scientific interest point to the strong influence of individuals such as teachers and family members (Maltese and Tai 2010; Osborne, Simon, and Collins 2003). In 2012, researchers mailed brochures to parents of high school students that emphasized the utility value of various STEM disciplines (or not, in control conditions). Students whose parents received the intervention enrolled in more math and science courses in high school (the equivalent of a semester) compared with the control group (Harackiewicz et al. 2012). In other words, representations of occupations embodied and delivered by caring adults is likely an influential form of exposure. Not surprisingly, this means that well-established efforts to expose youth to STEM fields in school, and supporting a diverse pool of educators, continue to be an important set of strategies. Looking beyond these effective educational approaches, it is also worth considering other influences such as popular media. In one study, researchers interviewed women and minority scientists about their popular media consumption. Many mentioned the influence of media characters such as Lieutenant Uhura in *Star Trek*, suggesting that even one powerful form of alternative representation can offset stereotypes (O'Keeffe 2013).

Exposure-oriented Programs

Exposure to representations of occupational identity is pervasive, but relatively few programs are explicitly designed and targeted for exposure to representations of occupational identity at the top of the funnel of influence. One widespread type of occupational exposure program that spans elementary to

secondary ages are summer camps and after-school programs sponsored by museums and professional organizations such as the Chicago Architecture Foundation, Brooklyn Navy Yard, Forest Park Forever, or the Rush University Medical Center. In these settings, young people get exposure to practicing professionals and experts in these varied fields. We were not able to find published research that investigated occupational identity outcomes of these types of programs.

One extensive and targeted effort in this category is *Roadtrip Nation,* which originated as a best-selling book about three young college graduates who went on a road trip in a green RV to find their paths in life after being disappointed by their career-counseling center. Building on their book's success, they launched a successful PBS series on the same theme, have amassed a database of more than 1,000 videotaped interviews with varied professionals about their careers, and developed a curriculum for young people to help connect their interests to careers. Most recently, they have focused on issues of diversity and inclusion, sponsoring road trips centered on alternative representations such as women in STEM and opportunity youth.[2] Unlike most efforts centered on influence through popular media, *Roadtrip Nation* has an explicitly educational arm that brings its content to schools and youth-development programs. Research on its curriculum has demonstrated that it helps young people both identify and sharpen commitment to career goals (Collins, Davis-Molin, and Conley 2013). Even in the case of a large-scale program such as *Roadtrip Nation*, however, no formal studies of the overall impact of the TV series have been conducted, much less the impact of its equity-oriented programming.

The PBS *SciGirls* series is another example of a program that leverages media content to influence occupational identity. Like *Roadtrip Nation*, *SciGirls* also offers curricular supports for educators in order to deepen exposure and impact, but from its inception was specifically focused on an equity mission of getting more girls into science. Audience research on *SciGirls* demonstrates that near-term exposure to the program improves feelings of confidence and self-concept in relation to science (Flagg 2010). Research on *SciGirls* is continuing, so we should expect to see more robust and extensive studies of impact. Another emerging effort in children's media is the Cartoon Network STEAM initiative, which seeks to leverage popular commercial media content to influence young people's enthusiasm about coding and other STEAM fields. It has created episodes of *Powerpuff Girls* centered on coding and has partnered with the Scratch coding platform to enable kids to code and animate their characters. Cartoon Network is continuing to investigate ways to have influence in this arena.

Recommendations

While social and behavioral research indicates the influence of representations on young people's self-concept and occupational identity, very few studies track the impact of specific interventions. Interdisciplinary research that weds communications research and learning research could productively explore whether exposure to popular media can have significant and lasting impacts on occupational identity. Some studies suggest that alternative representations in popular media can have significant, though difficult to measure, effects. Research specifically on how to deploy alternative representations in counteracting stereotypes would be particularly valuable. In addition, we found few programs that targeted the influence family and other caring adults in the community offer in alternative representations. This is another area where creative thinking and research on how to design scalable interventions could be productive.

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2   *Opportunity youth* can be defined as young people between the ages of 16 and 24 who are neither employed nor enrolled in school. For more information, see the 2012 White House Council for Community Solutions Report on Community Solutions for Opportunity Youth: https://assets.aspeninstitute.org/content/uploads/files/content/docs/resources/White_House_Council_For_Community_Solutions_Final_Report.pdf.

Engagement in Activities

The majority of educational efforts aimed at influencing occupational identity center on engagement in activities that develop skills and replicate activities of occupational fields. Spanning both formal and informal settings, these can include project-based classroom activities, experiential learning, makerspaces, student clubs, and competitions. While most educational programs arguably develop knowledge and skills that may be career relevant, we limit our focus to those with an explicit nod to occupational categories, and that are most likely to have direct influence on occupational identity.

Evidence for Outcomes of Engagement-oriented Efforts

Even with an occupational focus, most programs emphasize knowledge and skills rather than looking at occupational identity as the central outcome. This emphasis likely follows from the focus on academic pathways to college that we described in the introduction to this report. Few programs explicitly document outcomes in terms of occupational identity development. At best, programs might document feelings of identity or self-efficacy, along with some changes in perception of certain occupations. Particularly well-resourced programs track alumni through time and are able to document connections to relevant college majors and careers. Even without direct measures of identity, however, we can rely on the well-researched link between experiences of success and self-efficacy. It is safe to expect that programs that develop skills in the context of occupationally defined activities will likely expand the possibility that a young person will identify with that occupation. In other words, the influence that these educator-led projects have on identity shifts is generally assumed and not fully documented as an outcome in most efforts. Because of this influence, training educators in unconscious bias is also a critical component in equity-oriented efforts such as those championed by National Center for Women and Information Technology.

Engagement-oriented Programs

Because of the large number of educational programs that have some form of occupational emphasis, the programs we name are just a small slice of the vast landscape of efforts, selected to illustrate a range of approaches and outcomes.

In-school STEM Programs: With the growing emphasis on STEM preparation, and strong government and philanthropic investments in this area, programs that offer hands-on STEM learning have taken root in many schools across the country. For example, FUSE Studio is a project-based STEM curriculum centered on student interests, now in 136 elementary, middle, and high schools. Researchers note that FUSE influences students' thoughts about future STEM education and career pathways, both by supporting students' existing ideas and introducing them to new potential pathways (Stevens et. al 2016). Project Lead the Way (PLTW) offers PK–12 project-based science and engineering curriculum and teacher training. Participants are three times more likely to choose a STEM major than nonparticipants (Pike and Robbins 2014). STEM 101 is another national effort to offer school-based learning experiences. In contrast to the national average of 23 percent, 54 percent of STEM 101 high school students are interested in pursuing a STEM career (https://stemworks.wested.org/stem-101). Evidence from these programs suggests that project-based STEM experience can have a positive influence on STEM-related occupational identity development. Evidence of this kind of approach and outcomes outside of STEM programming is much harder to find.

Out-of-school Time Programs: The research on occupational outcomes to out-of-school time programs is also more robust for STEM than other fields. Even for long-standing programs such as Girl Scouts and 4H that encompass a wide range of fields, research tends to gravitate toward high-prestige

STEM occupations. The push for STEM activities in Girl Scouts and 4H is motivated by goals of equity and inclusion. Girl Scouts STEM programs emphasize hands-on projects and skill development, as well as providing alternative representations. "Girls learn about STEM careers and professions. Girl Scout STEM programs place a strong emphasis on introducing girls to STEM careers, demonstrating what STEM professionals, such as engineers and scientists, do in their work and how they do it" (Girl Scouts 2016:7). As a consequence, "more Girl Scouts than non-Girl Scouts desire careers in STEM (Science, Technology, Engineering, and Math), law or business" (Girl Scouts 2016:5). Similarly, efforts in 4H to expose youth who are not otherwise exposed to STEM careers have been tied to expressed interest and aspirations toward science careers (Mielke and Butler 2013).

The Tiger Woods Learning Center (TWLC), founded in 2006, is an after-school, weekend, and summer learning center for grades 4–12, with an emphasis on career-relevant STEM programs and outreach to lower-income youth. Researchers found that "86 percent of parents reported that TWLC had made their children more aware of future career options" (Vance and Vandell 2010:14). Further, "survey results reveal that students clearly felt that they learned how to work in groups, were exposed to career options [71 percent said this] and became aware of the assets that they possess" (Vance and Vandell 2010:19). Girls Who Code and Black Girls Code are more recent efforts that focus on adolescent girls, with a stronger emphasis on addressing equity barriers through alternative representation, culturally relevant pedagogy, and affinity-based mentorship. Both programs have reached thousands of girls but have not yet published sustained research on occupational identity–related outcomes.

Another important category of STEM-related project-based learning in the out-of-school space are competitions such as FIRST Robotics and CyberPatriot. FIRST is a well-known series of robotics competitions that span late elementary and high school. Over 75 percent of FIRST alumni are in a STEM field as a student or professional and FIRST alumni are 2.6 times more likely to enroll in an engineering course their freshman year (Melchior et al. 2005). CyberPatriot is a high school–based cybersecurity program and competition funded by the Department of Defense. Research on CyberPatriot concludes that "92.2% of the survey respondents indicated that their participation in CyberPatriot somewhat (50.1%) or significantly (42.1%) impacted their career and educational goals" (CyberPatriot 2017:10). Further, 87.5 percent of CyberPatriot alumni who are currently enrolled in a university are pursuing degrees in STEM fields (CyberPatriot 2017). Qualitative research on the program also shows growth of interest in technology-related careers (Brough 2016). With the exception of the Girl Scouts, these out-of-school STEM programs do not explicitly call out equity-oriented strategies for developing occupational identity, but many of them target low-income and minority youth and aim for positive equity outcomes.

The out-of-school space includes some well-established and researched programs in the humanities and the arts. A study of Inner-City Arts, which serves low-income youth in Los Angeles, found significant growth in general self-efficacy beliefs "based on questions probing perceived control over one's future and confidence about surmounting obstacles to achieving goals" (Catterall and Peppler 2007:556). 826, a national program centered on after-school programs for writing, has also found that participation helped students self-identify as writers and journalists and reported improved sense of self-efficacy (826 Program Report). More recently, digital arts programs such as the YOUMedia network of learning labs in libraries and museums have combined technical and arts-related fields, supporting interests such as digital design, spoken word, and music production. Research on YOUMedia Chicago documented how a focus on culturally relevant approaches and affinity-based mentorship attracted many teens of color who would not have otherwise been part of the library community. Many youth attributed their participation to their chosen professions in the arts, including luminaries such as Chance the Rapper (Larson et al. 2013; Stephens 2015).

<u>Multi-sited Programs:</u> Engagement-oriented programs that connect school, informal, and workplace engagement appear to be particularly effective in achieving vocational outcomes. Big Picture Learning (BPL) is a school-design effort with robust research-practice partnerships that has taken such an approach. The BPL approach has been described as "exceptionally successful in preparing students for work" (Arnold et al. 2015:39) with students going on to pursue both college pathways and more direct-to-vocation paths such as training for EMTs and certified nursing assistants. "Advisors reported that at least 46% of the alumni were studying or working in fields related to the internships they had at BPL schools (Arnold et al. 2015:26). Another notable multi-sited effort with a strong emphasis on equity is the Digital Youth Network (DYN) program that connects in- and out-of-school learning opportunities in the digital arts. A longitudinal set of case studies of DYN middle school students demonstrated that the combination of in-school and out-of-school supports, culturally relevant pedagogy, and affinity-based mentorship resulted in levels of digital literacy and commitment to technology-related careers among urban black youth that were comparable to more technologically privileged Silicon Valley youth (Barron et al. 2014).

More recently, the DYN team has been focused on girls of color with its Digital Youth Divas project. DYN Divas takes a culturally relevant approach by focusing on affinity-based mentorship and digital making activities such as e-textiles that are attractive to girls. It goes one step further by creating comic books and other narrative stories about girls of color engaged in digital creation, thus providing alternative representations. It is one of the few programs that addresses barriers to equity at every stage of the engagement funnel. Qualitative research has captured increases in STEM-related interests (Erete, Martin, and Pinkard 2016). Another newer multi-sited effort is the North American Scholastic Esports Federation (https://www.esportsfed.org/), which ties burgeoning interests in competitive gaming with after-school clubs and a high school language-arts curriculum that focuses on esports entrepreneurship. While it is still too early to document results of this effort, these kinds of multi-sited efforts deserve more scrutiny because of their promise to amplify outcomes by reinforcing the strengths of in- and out-of-school approaches.

<u>Parent Involvement Programs:</u> A small but compelling group of interventions have targeted parent-child dynamics in seeking to influence the choice of educational offerings and career aspirations. The 2012 experimental study described earlier, in which parents received brochures about STEM disciplines, indicates that such interventions can influence what courses students decide to enroll in (Harackiewicz et al. 2012). Another experimental program, tested with 20 families, provided parents with resources for their 10th- and 11th-grade children's career development. Research indicated that when offered a structured program, parents can become more effective career mentors (Palmer and Cochran 1988; Whiston and Keller 2004). The Family Creative Learning program takes a more hands-on approach by involving parents and their children in creative computing activities at community centers. This program was designed specifically with culturally relevant and equity-oriented principles and is targeted at families from groups underrepresented in computing. Qualitative research on this program indicates identity shifts in both parent and child self-concept, and feelings of efficacy in creative computing (Roque 2016; Roque and Liuzzi 2016).

Recommendations

Although many forms of project-based and experiential learning emphasize career outcomes, little research has looked closely at influences on specific dimensions of occupational identity. Given that the bulk of educational investments fall in this area, targeted research on which program features and approaches can best move the needle on occupational identity, particularly for marginalized youth, would be valuable to the field. Without this kind of focused research, it is difficult to know which program features are influencing identity outcomes.

The effect on occupational identity appears to be higher in out-of-school programs, likely because of their social and interest-driven nature (Kang et al. 2019). More educational programs that seek to influence occupational identity could emphasize connections between formal and informal settings, as well as build links to professional communities. While in-school programs are strong in skill development, out-of-school settings create stronger interpersonal bonds and emphasize ownership, identity, and initiative. Ideally both go hand-in-hand in influencing occupational identity.

In comparison to in- and out-of-school programs targeted at youth, very few programs target family contexts. Research indicates that parents have a strong influence on selecting educational programs and influencing occupational aspirations. The lack of programmatic interventions and related research in this area appears to be a significant gap.

While many of the programs we identified served low-income and marginalized youth, very few described explicitly equity-oriented strategies for addressing barriers to occupational identity. This suggests that outcomes for marginalized youth could be improved with more pervasive efforts to introduce alternative representations, develop culturally relevant approaches, and foster affinity groups for marginalized youth.

Participation in Communities of Professional Practice

Project-based activities can be highly engaging and impactful, but they are still educator led and sequestered from real-world professional communities. By contrast, participation-oriented programs involve direct participation in professional communities of practice and thus have an even stronger influence on occupational identity. These programs tend to be for older teens and young adults, before the transition to college or workforce. They can influence at the level of exposure and skill development, but they also support the development of social capital that can tie directly to careers. One step beyond these types of programs are internships, job-placement, and career-counseling programs that are beyond the scope of this review. Here we include programs that may have an apprenticeship or employment dimension, but that are primarily educational and youth-development programs.

Evidence for Outcomes of Participation-oriented Efforts

A long-standing body of research has documented how "legitimate peripheral participation" in communities of professional practice is tied to feelings of belonging and the development of occupational identity (Lave and Wenger 1991; Orr 1996). Research on youth affinity networks has also demonstrated how online, interest-driven communities can foster these feelings of purpose and belonging (Ito et al. 2018). Educational efforts in this arena tend to be smaller, more boutique programs where the populations are relatively small but outcomes are significant.

Participation Programs

The majority of participation-oriented experiences happen in the context of internships and other experiences of work, but some programs are specifically targeted at influencing occupational identity during the period of adolescence.

Apprenticeship: One category of program that has demonstrated strong outcomes is teen programs in museums and science centers. In these programs, teens may be engaged in project-based learning, but they are also working side by side with staff to contribute to the day-to-day operations of the organization. One study of "intensive" teen arts programs in museums found that 60 percent of alumni report that their participation in the program contributed a "great" or "strong" amount in their career

choices and more than half work in the arts (Linzer and Munley 2015). The Exploratorium in San Francisco has a long-standing "Explainers" program in which teens act as docents on the museum floor. Research has documented how explainers are more likely to take more science courses, and have improved confidence, sense of effectiveness, and attitudes toward their capabilities and desire to work with others and on their own (Diamond et al. 1987). Research on a similar teen-employment program at the American Museum of Natural History showed comparable outcomes (Gupta and Negron 2017).

One of the most well-researched programs that emphasizes both apprenticeship and equity is YR Media (Formerly Youth Radio), a youth media organization that trains and employs teens in journalism and multimedia production. It describes its goal as seeking to "apprentice historically underrepresented youth into more full and equitable participation in civic and professional spheres" (Gurn, Bass, and Hazer 2017:8). The organization embodies all three equity-oriented approaches of alternative representation (that youth themselves contribute to), culturally relevant pedagogy, and affinity-based mentorship. In-depth qualitative research on this program shows strong outcomes in terms of occupational interest and self-efficacy (Gurn et al. 2017).

Industry Projects: Another type of program that scaffolds participation in professional communities of practice are college programs that have a real-world project-based component. Many STEM-oriented college programs offer opportunities to do projects defined by clients in industry and the community. One example is the Harvey Mudd Clinic, which gives students opportunities to work on engineering projects for industry partners. Alumni of this program "report that the Clinic experience has been the single most useful part of their education with respect to preparation for professional practice" (Bright and Phillips 1999:191). Additionally, industry sponsors gave clinic participants that they had subsequently recruited high marks in "creativity and willingness to attack open-ended problems" in a 1996 survey (Bright and Phillips 1999:191).

Job Placement and Career Counseling: The most well-established types of interventions in this area are career counseling, internship, and other job-placement services. These types of programs are historically how most forms of school-to-career transitions have been supported. They exist in every college and many high schools and are beyond the scope of this study to review in full. Beyond these types of programs, a growing number of efforts in this area target marginalized and lower-income youth through more tailored approaches keyed to their specific needs and embedded in their communities. For example, the CareerLaunch program is offered by the Boys and Girls Clubs of America that anchor diverse communities (Boys and Girls Clubs of America report, N.d.). Generation, Braven, CareerWise, and Opportunity@Work are programs that provide career-relevant training and counseling combined with job-placement support for youth from economically marginalized groups (Braven 2018; Generation 2018; MDRC 2018). These high-engagement programs show evidence of effectiveness. Another emerging area of emphasis are programs that take a regional, ecosystemic focus, such as Pathways to Tech Careers, Tech/Hire Oakland, and Skillful (Lundgren 2018). These approaches are promising, but as of yet not well researched.

Affinity-based Mentorship: Programs that have a strong focus on equity often emphasize the importance of affinity-based social supports. The Couragion program combines an affinity-based mentorship approach with hands-on experiences, and research on the program indicates increased interest in STEM among students of color (Couragion 2018). Programs that build affinity-based networks for youth marginalized in a specific field, such as the NCWIT Aspirations in Computing program for girls in computer science (CS; DuBow et al. 2013) and the Hidden Genius Project targeting young black men, are other examples of efforts in this area. Research shows that these types of programs are particularly valuable for underrepresented youth who often lack peers and mentors in high-value occupations who share their identity.

An emerging area of intervention takes a targeted, and potentially more scalable, approach to building career-relevant social capital than more high-engagement job training, mentorship, and job-placement approaches. Rather than provision and assign training and mentorship resources, some programs are taking a focused asset-based approach to amplifying the agency of minority youth. At the university level, one example is the Google igniteCS program, which supports student-led teams to teach computer science to younger students in the community. While offering young students opportunities to learn CS, the program is actually targeted at retention in CS degree programs for underrepresented undergraduates. It embodies all three equity-oriented approaches by calling on the unique strengths of marginalized youth to advocate for CS in their community, and it enables a supportive community of like-minded peers. A qualitative study of the program shows strong outcomes of self-concept, self-efficacy, and belonging in CS (Mahmoudi, Squire, and Ito 2018). These outcomes suggest that opportunities for volunteerism and civic action can lead to strong identity outcomes because of the sense of pride, ownership, and efficacy that youth experience.

Other programs hone in specifically on youth capacities to recruit mentors. Rather than assigning mentors, apprenticeship, or project-based opportunities, the Youth Initiated Mentorship (YIM) approach, developed by the Center for Evidence-Based Mentorship, equips young people with tools and capacities to recruit mentors of their choosing (Spencer et al. 2016). The approach is informed by research that demonstrates that when youth have agency selecting mentors, and mentors share interests, the positive outcomes of youth mentoring are much higher than they would be otherwise. The YIM approach was productively employed for the National Guard Youth Challenge mentoring program (Haddad, Chen, and Greenberger 2011). The Connected Scholars Program took a related approach, offering workshops and training for first-generation college-bound students in how to reach out to faculty and enlist other forms of social support. Program experience was tied to increased self-efficacy and persistence in reaching out for support in college, as well as higher GPA (Schwartz et al. 2016, 2018).

Recommendations

Well-established youth-development and apprenticeship programs show strong evidence for occupational outcomes. These types of programs are resource intensive, however, suggesting that there could be productive ways of incentivizing and building capacity in other types of organizations, such as workplaces and civic institutions. Historically, it has primarily been organizations with educational missions such as museums and media organizations that have taken up programs of this kind.

Another area that potentially deserves more investment is volunteerism and civic action and other asset-based approaches that emphasize youth agency. These types of programs have not historically targeted vocational fields, but the Google igniteCS program suggests that this type of activity and affinity network could productively be employed for occupational identity development when focused on high-value fields such as CS and STEM. Opportunities to conduct projects for industry partners are efficacious for youth, but so is volunteering in communities while deploying occupational-relevant skills. This approach has the added benefit of being lower cost and thus more scalable than many other interventions in this area.

Finally, targeted approaches to social capital development, such as youth-initiated mentoring, show promise as a way of developing high-value social supports for young people further down the funnel of engagement. While these approaches do not provide the same high-engagement and intensive experiences as an apprenticeship or civic-action project, they are scalable approaches that help cultivate one of the most important types of support for occupational identity for underrepresented youth. The growth of online affinity networks represents another set of resources that are still largely

untapped for building social capital in occupational areas. Research and development in this area could unlock new ways of scaling these social capital–oriented interventions.

SUMMARY OF CONCLUSIONS

This report has reviewed a wide range of research and programmatic efforts to tease out what evidence exists and is still lacking on developing occupational identities for diverse youth.

In summary, we have suggested the following areas that deserve more research attention:

- Research on the influence of popular media representation on occupational identity is largely absent. Targeted studies of the influence of alternative representation on the self-concept of marginalized youth could be particularly valuable in suggesting new forms of intervention.

- Research on how parents and families mediate and influence occupational identity is sparse. The studies that do exist indicate a strong influence and high variability depending on class and cultural identity. This suggests that more targeted research in this area, particularly between culturally specific subgroups, could help in developing effectively targeted interventions.

- Although many educational programs consider and document occupational outcomes, very little research looks at specific program features in terms of occupational identity and outcomes. Targeted research on which components of programs are most effective would help focus investment.

- Understanding the impact of social capital on feelings of belonging in occupational fields is an understudied area. Current research is indicating the importance of social capital and belonging and targeted research in this area could help unlock new levers for influencing occupational identity, such as tapping online communities or the capacities of youth to recruit their own mentors.

- Across the board, more research on specific equity-oriented levers and influences would be helpful in targeting interventions for marginalized youth. While theory building around issues such as stereotype threat, implicit bias, and intersectionality have become more robust, more research needs to translate these understandings to occupational identity.

While difficult to pin to hard evidence, this review has also suggested areas of programmatic investment that seem particularly promising or underleveraged in both influencing and scaling influences on occupational identity.

- High-engagement programs that target marginalized youth and offer mentorship, training, and job-placement support are effective though resource intensive.

- Career exposure and apprenticeship programs in museums and other professional organizations are promising for building distributed capacity for influencing and expanding opportunities for occupational identity development.

- Many educational programs in and out of school target occupational identity development, but very few programs link formal and informal learning, which is a missed opportunity.

- Few educational programs are intentional and systematic in applying equity-oriented approaches to developing occupational identity. Deploying these approaches to large-scale programs that may not currently be equity focused could be a productive path to achieving equity goals.

- Very few interventions target influence through the family, although research indicates that parents exert a powerful influence in defining career aspirations and guiding their children's educational and career choices.

- Another underused form of engagement is asset-based approaches that stress youth agency, volunteerism, and civic action. Amplifying existing efforts in this area, and more innovation on youth-driven efforts, could yield more scalable and high-impact interventions.

In summary, this review underscores the importance of belonging, identity, and social capital in influencing occupational choices and opportunity for marginalized youth. While research clearly documents the importance of these social and cultural influences, programs rarely evaluate these influences on occupational identity outcomes, focusing instead on material supports, skill development, and academic outcomes. We recommend targeted research, in partnership with programs, that looks at specific equity-oriented, social, and cultural strategies in relation to occupational identity outcomes. In particular, we recommend targeted investment and research on areas that are promising and underleveraged. These include (1) family-based interventions, (2) capacity building for apprenticeship within diverse organizations, (3) linking formal and informal settings, and (4) asset-based approaches that stress youth agency. A concerted effort to link research to evidence-based strategies in organizations could yield significant and scalable approaches to expanding pathways to vocational opportunities for marginalized youth.

ACKNOWLEDGEMENTS

ABOUT THE CONNECTED LEARNING LAB

The Connected Learning Lab (CLL) is dedicated to studying and mobilizing learning technologies in equitable, innovative, and learner-centered ways. Based at the University of California, Irvine, the CLL supports interdisciplinary research and design and partnerships with a broad network of educational practitioners and technologists. The CLL's focus is defined by the "connected" in connected learning, which refers to both social relationships and emerging digital and networked technologies. The Connected Learning Alliance, a project of the CLL, is dedicated to building a cross-sector network of organizations dedicated to the spread of connected learning.

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