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VALIDATING CAREER-READINESS FEATURES IN HIGH SCHOOL ASSESSMENTS

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Validating Career-Readiness Features in High School Assessments[1]

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Abstract: This report is the fourth in a series considering career-readiness factors within existing high school assessments. The primary goal of this study was to provide a preliminary validation of the career-readiness features identified in prior reports by exploring how different participant groups with different levels of experience in the career/vocational world perform on a selection of test items with high numbers of career-readiness features. Two exemplar careers, emergency medical technician (EMT) and web developer, were targeted for participation in this study. A total of 103 high school students, 111 community college students studying to become either EMTs or web developers, and 84 working EMTs or web developers participated in the study. A selection of ELA and math test items rated for career-readiness features were adapted into an 18-item test booklet. As expected, results indicated that workforce individuals scored significantly higher on the test than community college students, who in turn scored significantly higher on the test than high school students. These results suggest that having added experience in their field may lead to refining certain career-readiness skills found in high-school-level content-based assessments. Preparation for such assessments can help high school students prepare for college and/or a career, and inferences for both college and career readiness can be drawn from test performance.

Introduction

The national high school graduation rate is at an all-time high, with the national graduation rate exceeding 84% for the class of 2016 (EDFacts, 2018). However, if these graduates decide not to continue their education beyond high school, they can expect to earn about half of what their college-educated peers will earn annually. Many graduates lack the

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knowledge, skills, and attributes necessary to compete and succeed in fields such as advanced manufacturing; energy; healthcare; information technology; and science, technology, engineering, and mathematics, or STEM (Council of Chief State School Officers, 2013, 2014; O*NET Online, n.d.). There is a shortage of qualified job candidates in many high-demand, high-skill, and high-wage career categories (Executive Office of the President of the United States of America, 2014). Prior to 2012, American workers most often held a high school diploma but had no college experience. Since 2012, people with some college or an associate's degree have made up the largest share of the U.S. civilian labor force (Brundage, 2017). By 2020, it is expected that 65% of all jobs will require postsecondary education and training (Carnevale, Smith, & Strohl, 2013). In response, the Department of Education has emphasized the importance of college and career readiness.

One contributor to the shortage of qualified job candidates may be an underlying deficit in college and career readiness in the K-12 and postsecondary educational system. Classrooms still remain largely unconnected to the needs of employers and success in postsecondary education. With a large percentage of students requiring remediation in basic math and English skills prior to their freshman year, there is evidence that students are not equipped with the skills needed to begin college-level work (California State University, 2017). As noted in a recent report on the state of work readiness, higher levels of education do not always guarantee work readiness (Mattern et al., 2014, p. 4).

College and Career Readiness

The terms "college ready" and "career ready" are often used interchangeably, without grounding in evidence or validity. Furthermore, there is no federal definition of "college and career readiness." Rather, the government defines standards as "goals for what students should know and be able to do while learning academic content" (U.S. Department of Education, n.d.). Determining what college ready and career ready mean is left for the states. Content areas and academic achievement are typically used to define college and career readiness, but research suggests other personality variables such as conscientiousness and other noncognitive features may have predictive power (Mattern et al., 2014). There is growing interest in social and emotional learning (SEL) as it relates to career readiness (CASEL, 2017). These are processes through which students acquire and effectively apply the knowledge, attitudes, and skills necessary to understand and manage emotions and set and achieve goals (Dymnicki, Sambolt, & Kidron, 2013).

According to Mishkind, as of 2014, 33 out of 36 states and the District of Columbia used a single definition to span college and career readiness. In a recent policy summary, Mishkind categorized the skills reported by these states into six common categories: (a) academic knowledge; (b) critical thinking and/or problem solving; (c) social and emotional learning, collaborations and/or communication; (d) grit/resilience/perseverance; (e) citizenship and/or community involvement; and (f) other additional activities (Mishkind, 2014, pp. 1–3). Similar to

Mishkind's findings, the set of career-readiness features in this study could fall into such categories and span more than one. For example, our mathematical reasoning feature could be categorized as academic knowledge but could also be categorized as a critical thinking/problem solving skill. Our organizing, planning, and prioritizing work feature could be aptly grouped under SEL.

Unlike some other states, California does not have a clear definition of college and career readiness. The California Department of Education (CDE) previously outlined college- and career-ready standards. In 2014, the CDE published these 12 standards, known as *Standards for Career Ready Practice*. Some examples include "Apply technology to enhance productivity," "Practice personal health and understand financial literacy," and "Act as a responsible citizen in the workplace and the community."[2] While admirably inclusive, these standards may have challenges for implementation and measurement. In 2015, the CDE launched the California Career Readiness Initiative with "21 key objectives to support, sustain, and strengthen Career and Technical Education (CTE) in the State" (CDE, 2018b). Additionally, in February 2018, the CDE released guidelines for SEL which are "fundamental to academic success" and necessary to "truly" ensure college and career readiness. These guidelines include the ability to (a) set and achieve positive goals; (b) feel and show empathy for others; (c) establish and maintain positive relationships; (d) make responsible decisions; and (e) understand and manage emotions (CDE, 2018a).

As a part of California's new accountability system, the CDE has specified five separate paths (A–E) which may indicate whether a student is college or career ready (CDE, 2018b; p. 55). California has been part of a consortium implementing Smarter Balanced for standardized testing, ensuring students are ready for college success. Three of these pathways include achievement on Smarter Balanced Assessments. (See Appendix A for additional information on the five ways students can show college and career readiness as defined by the CDE.) In transitioning to Common Core State Standards, Smarter Balanced developed their assessments in consideration of college and career readiness (Smarter Balanced Assessment Consortium, 2015, p. 8).

In 2011, the U.S. Department of Education noted that under the reauthorization of the Elementary and Secondary Education Act (ESEA), states have developed assessments aligned with their standards, but they often did not adequately measure student knowledge and skills and provide timely feedback for parents and teachers. States were directed to develop and administer assessments which accurately measure student learning on college- and career-ready standards (U.S. Department of Education, 2011). A number of colleges are currently using scores from Smarter Balanced as evidence that students are ready for credit-bearing entry-level college courses without the need for remediation (Smarter Balanced Assessment Consortium, 2015). If scores accurately reflect criteria for career and college success, this may offer long-

[2]Prepared by the California Department of Education. The complete practices are available at http://www.careertech.org/

term value to students, schools, and ultimately, the workforce as a whole. It is with this goal that we undertook career-readiness feature analysis of existing test items. Our companion reports on career-readiness features discuss this process in more detail (Choi, Kao, Rivera, & Cai, 2018; Kao, Choi, Rivera, Madni, & Cai, 2018; Madni, Kao, Rivera, Baker, & Cai, 2018).

Career Growth and Education

In terms of job growth, there has been a shift toward skilled occupations which typically require some postsecondary education. Specifically, the greatest growth since the Great Recession of 2007 has been in management and healthcare occupations (Carnevale, Jayasundera, & Gulish, 2016). Carnevale et al. posited that economic recovery since the recession in the United States "has divided the country along a fault line demarcated by college education" (2016, p. 1). Those with at least some college education continue to gain shares in the job market, while blue-collar jobs in sectors like construction and manufacturing continue to lose millions of jobs. Jobs requiring an associate's degree will grow faster than those requiring a bachelor's degree through 2020 (U.S. Bureau of Labor Statistics, as cited by California Community Colleges, n.d.). Thus the current research aimed at exploring two careers as exemplars, emergency medical technicians (EMTs) and web developers. These two jobs project high growth and typically require some postsecondary education at the entry level, but not necessarily a bachelor's degree (U.S. Bureau of Labor Statistics, n.d.-a, n.d.-b). In the following subsections, we describe these two careers in brief.

EMTs. The U.S. Bureau of Labor Statistics forecasts strong growth for EMTs and paramedics in its Occupational Outlook Handbook. It reports a projected 15% change in employment from 2016 to 2026, higher than the average of 7% for all occupations (U.S. Bureau of Labor Statistics, 2017b). As of 2017, the nationwide median annual salary for this occupation was $33,380 (U.S. Bureau of Labor Statistics, 2017a).

Emergency medical services (EMS) are a vital part of the healthcare system, providing transportation and prehospital care in emergency and trauma situations. There are both public-sector and private-sector EMS providers. The private-sector EMS is composed of mostly for-profit companies, with two large companies operating 48% of private ambulances in California. Public sector EMS includes fire departments and municipal and county EMS services (Jacobs, Heller, Waheed, & Appel, 2017).

In California, there are three levels of EMS practitioners: EMTs, advanced EMTs, and paramedics (California Emergency Medical Services Authority, 2017). For this study we focused on EMTs. EMTs provide basic, noninvasive interventions in prehospital settings and transport patients to the hospital (National Association of Emergency Medical Technicians, 2018).

EMT training. Becoming an EMT or paramedic requires training, certification, and licensing. Training is offered at community colleges, universities, hospitals, and technical schools, as well as EMS, fire, and police academies. The National Registry of Emergency Medical Technicians (NREMT, 2018) certifies EMTs at the national level, but EMTs are licensed by states.

To qualify for NREMT certification, a student must complete a state-certified education program and pass the national exam (U.S. Bureau of Labor Statistics, 2017b).

Some programs are short-term and intensive, while others are more flexible and longer term (National Association of Emergency Medical Technicians, 2018). In California, education programs are certified by the California Emergency Medical Services Authority (EMSA). EMTs require 146 hours of didactic and skills training and 24 hours of clinical training, for a minimum of 170 hours of training. Paramedics require 450 hours of didactic and skills training, 160 hours of clinical training, and 480 hours of field internship, for a minimum of 1,090 hours of training (California Emergency Medical Services Authority, 2018a). After completing an approved EMT training program and passing the NREMT exam, one can apply for certification at a local EMS agency (California Emergency Medical Services Authority, 2018b). California EMT certifications are valid for two years and require ongoing continued education to renew the license.

Web developers. At the time of this report, the BLS projected a 13% change in employment from 2016 to 2026, which is much higher than the average of 7% for all occupations (U.S. Bureau of Labor Statistics, 2017c). In May 2016, the nationwide median annual salary for this occupation was $66,130 (U.S. Bureau of Labor Statistics, 2017a).

Web developers create and maintain websites and their infrastructure. Some web developers program aspects of the website that affect how it appears on the user's screen. These are referred to as front-end web developers. Others are responsible for the logic of the website, which is accessed indirectly by users interacting with the front-end of the website. These are called back-end developers. Some web developers program both the front-end and the back-end aspects of websites and are hence called full-stack web developers (U.S. Bureau of Labor Statistics, 2017c; Wales, 2014). While web developers may work at companies, the field is composed of a large number of freelancers (Hadad, 2018).

Web developer training. At the time the study was undertaken, the BLS listed an associate's degree as the typical education for entry-level web developers. Specific training or skill requirements for web developers vary based on the needs of an employer. A bachelor's degree in computer science, programming, or a related field may be required for more specialized web developer positions, as well as to advance into project management positions (U.S. Bureau of Labor Statistics, 2017c).

Another growing pathway beyond traditional degree programs is skill-based "bootcamps." Web developers require constant skill development. Bootcamps generally allow rapid entry into the field or allow workers to enhance their skills (Wilson, 2017). On the plus side, these programs offer skills that are focused on careers and current in-demand skills, require less time, and bridge high-tech workers with employers. Negatives include less emphasis on theoretical knowledge, no degree awarded, geographical availability, upfront payments, and high levels of attrition (Wilson, 2017).

One interesting question may surround the types of applicants these programs attract. A recent study noted that despite the well-known gender disparity in the field of computer science, 43% of postbaccalaureate "coding bootcamp" participants were women in 2016, significantly more than the 26% of computer science professionals overall (Siebel, 2018). Further, these programs may attract older participants beginning a second career. Little is known about the issues and barriers these students face (Thayer & Ko, 2017).

Purpose of the Study

The present study was one strand in a larger project exploring career-readiness indicators within the context of K-12 assessments. As described in our earlier report (Kao et al., 2018) we developed an initial set of career-readiness skills/features which were then used to rate a selection of Smarter Balanced test items. The purpose of the present study was to provide a preliminary validation of career-readiness features in high school assessment items by exploring the performance of different participant groups with different levels of experience in our two exemplar careers (EMT and web developer). A refined set of test items with high numbers of career-readiness features was administered to high school students, community college students enrolled in a certificate or degree program in one of the two exemplar careers, and adults working in one of the two exemplar careers. We were also interested in whether other background factors, including noncognitive factors, played a role in their performance. Because of the quasi-experimental nature of the design, results of this study are meant to be exploratory and inform future work. The following exploratory research questions guided this study:

1. Do participants with more experience in a career/vocation perform higher on test items that contain high numbers of career-readiness features?
2. What background factors play a role in the performance on test items that contain high numbers of career-readiness features?

We expected that the participants with work experience would perform higher than the community college students, who in turn would perform higher than the high school students.

Method

Participants

A total of 298 participants were included in the analyses for this study: 103 Grade 12 high school (HS) participants, 111 community college (CC) students, and 84 working adults (hereinafter: workforce participants or WF). Of the 111 community college students, 64 were enrolled in EMT programs and 47 were enrolled in web development programs. Of the 84 workforce participants, 45 were EMTs and 39 were web developers. Table 1 provides general demographic information of the participants by subgroup and by career domain (i.e., EMT and web development).

Table 1

Demographic Information by Subgroup and by Career Domain

		Community college		Workforce		
	High school	EMT	Web developer	EMT	Web developer	Total
N	103	64	47	45	39	298
Age range	16–18	18–45	19–56	19–42	20–50	16–56
Age mean (*SD*)	17.0 (0.4)	22.6 (4.8)	27.8 (7.6)	24.6 (5.0)	33.8 (9.8)	23.2 (7.9)
Female	52.9%	23.8%	25.5%	13.6%	25.6%	32.9%
Male	47.1%	76.2%	72.3%	86.4%	74.4%	66.8%
Nonbinary	0	0	2.1%	0	0	0.3%
American Indian or Alaskan Native	0	0	0	0	0	0
Asian or Pacific Islander	3.9%	7.9%	13.0%	14.0%	53.8%	14.3%
Black or African American	16.5%	3.2%	2.2%	2.3%	5.1%	7.8%
Hispanic or Latino/a	47.6%	22.2%	30.4%	23.3%	10.3%	31.0%
White or Caucasian	10.7%	42.9%	19.6%	51.2%	12.8%	25.2%
Other	1.0%	7.9%	2.2%	0	5.1%	3.1%
More than one race/ethnicity	20.4%	15.9%	32.6%	9.3%	12.8%	18.7%

Note. There were missing cases in some categories; percentages were computed on valid cases. Participant write-in responses for race/ethnicity included: Arabic, Armenian, East Indian, Guyanese, Indian, Italian, Jordanian, Middle Eastern, Native American, North African, Pakistani, Persian, Sri Lankan.

Participant recruitment varied depending on the subgroup and the career domain (i.e., EMT or web developer). Information on participant recruitment is detailed in the following subsections.

High School Recruitment

A total of 103 Grade 12 students representing four schools (Schools A, B, D,[3] and E) in Southern California participated in the study. Effort was made to recruit participants from schools with varied demographic and socioeconomic background profiles that roughly matched demographics across the state. School A is a small charter school in a large city, serving Grades 6 through 12 (n = 17 participants). Schools B and D are large public high schools in small cities, serving Grades 9 through 12 (n = 25 and n = 31, respectively). School E is a large public high

[3]School C participated in the cognitive lab interviews discussed in a prior report (Madni et al., 2018), which also included Schools A and B. School C did not participate in the present study.

school in a large city, serving Grades 9 through 12 (*n* = 30). Students from School B were enrolled in the Advancement Via Individual Determination (AVID) program. Students from Schools D and E were enrolled in Career Technical Education. With appropriate permissions from the school districts, principals, and teachers, where applicable, students who volunteered and returned signed parent permission forms participated in the study.

Community College Recruitment

As general criteria for recruitment, community college students had ideally completed at least 20% of their program. Participants who had recently graduated but had not started working in their field were also included. This requirement helped ensure that participant experience in the domain was meaningfully different from high school and workforce groups.

In order to ensure a diverse sample, a list of potential community colleges was initially created using information from the California Registry of Community Colleges. Community college recruitment for EMT and web development students happened simultaneously. Because of school-specific programs and degrees, some sites contributed participants to more than one participant subgroup and some sites contributed to only one. Students from a total of four external sites (Sites F, G, H, and J, described further below) participated. For the purposes of this study, all participants in this group regardless of program or site (certificate or degree) are referred to as "community college."

EMT. EMT students were recruited from either Site F or Site G. Site F is a small community college located in a small city in Southern California, which also has a program for web development. The EMT program consists of two courses taken sequentially over two semesters. The first course is an introduction to the EMS system and the second course contains the majority of the content.

Site G is a non-community-college-based training program with more than one campus in a large city, and offers various emergency medicine certificates in a variety of course formats (including online). The EMT program consists of four courses taken as corequisites which could be taken in either a month-long accelerated format, or a longer, hybrid online and classroom format. Sixty-five EMT students participated in the study, however one participant was excluded from the final analyses because of prior work experience as an EMT. Thus, the final number of community college EMTs included in the analyses was 64 (21 from Site F and 43 from Site G).

Web developer. Web developer students came from one of three sources: Site F is the same small community college in which we also recruited EMT students described above; Site H is a large community college located in a large suburb; and Site J is a "coding bootcamp," an intensive, short-term skills training program for web development.

The field of web development is broader and less defined than the field of emergency medicine. Because of the breadth and diversity within the field of web development,

researchers determined that it would be impractical to require programs to have every skill and ability named under O*Net's description of web developers. Thus, in order to select programs to target for the present study for web development, researchers met with subject-matter experts and developed criteria based on which features were most critical to the job description and likely to appear in a syllabus or course description. For example, while working on a team or managing people may be an important component of a web development job, it is not job specific or likely to be taught as a component of a limited degree or certificate.

Based on this foundational research, the educational programs in web development were targeted based on the following criteria: Programs were named "web development" or were in an appropriate department (e.g., computer science) and included coursework in (a) programming language(s); (b) web design/browser interface; and (c) back-end functions. Additionally programs were required to include some in-person coursework (not exclusively online) and be a part of a certificate or degree program not intended to exceed two years in length. Two researchers evaluated each program curriculum based on the above criteria. Programs which were labeled web development or met two of the three criteria were targeted for recruitment. Additionally, within the field of web development and technology, another common educational route emerged in the form of coding bootcamps. Given their growing popularity in this sector, researchers targeted local bootcamps, all of which met the criteria described above. One of these bootcamps was included in the study.

At Site F, the program is a general computer-related Associate of Science degree with an emphasis in web design. This degree includes courses covering web page programming and design, CSS, Java, C++, Dreamweaver, Flash, Adobe Photoshop, and Adobe Illustrator. Site H's web development program culminated in a certificate. The required courses for this certificate covered topics such as HTML, CSS, Javascript, web servers, and web programming. Site J, the bootcamp, offered a full-time curriculum lasting 14 weeks. At the time of our study, students learned front-end development and back-end development with Python, and chose two of the following: MEAN, Ruby on Rails, Java, C#/.NET, or iOS.

Fifty-eight community college students participated as web developer students in this study. Despite caution in recruitment, 11 participants did not meet certain requirements based on examination of background surveys and were excluded from the final analyses. Six were excluded because they reported studying programs unrelated to web development (such as building administration and cybersecurity). Two were excluded because they had prior work experience as EMTs. Two others were excluded because they currently held part-time jobs in web development. Another person was excluded because not enough information was provided to suggest that he was enrolled in the correct program. Thus, the final number of community college web development students included in the analyses was 47 (10 from Site F, 18 from Site H, and 19 from Site J).

Workforce Recruitment

For both career domains, we initially required that participants were (a) currently working as either an EMT or web developer, and (b) had at least six months of work experience in the respective domain. However, due to the various challenges of recruiting working adults, minor exceptions were made to the first criterion, in that those unemployed for under a month were included.

EMT. Workforce EMTs were recruited from a variety of sources. An additional criterion for EMTs was possession of a current California EMT license. Almost half (*n* = 24) came from a full-time paramedic program at Site H described above. The paramedic program was in its second day, and through informal conversations with the instructor and the participants, all students had recently quit their jobs as EMTs in order to enroll. A current EMT license and over 1,200 hours of experience working as an EMT was required for admission to the program. Because of the program enrollment criteria, and because the program had only just begun, we felt it was appropriate to include these participants in our study.

Other participants were recruited through program alumni listservs and EMT recertification courses, with the assistance of program personnel. Four participants were affiliated with Site F as instructors. Additionally, ambulance services, hospitals, and other businesses employing EMTs were contacted.

Fifty-one people participated in our study as workforce EMTs. Upon further examination of background surveys, six participants were excluded from the final analyses because of job titles which would not provide the necessary experience in the domain. These job titles included emergency department technician, emergency room coordinator, diver medic, ocean lifeguard, and U.S. Forest Service. Thus, the final number of participants included in the final analyses for all workforce EMTs was 45.

Web developer. Working web developers were recruited through program alumni listservs, general technical listservs, technology-related events, and affiliated businesses. We also hosted an event advertised online through tech-related social media. A few were also referred to us by a technical employment staffing agency. Criteria for recruitment were similar to that of student web developers, in that participants needed to have experience in at least two of the following: programming language(s), web design/browser interface, and either front-end or back-end functions.

Forty-five people participated in our study as workforce web developers. However, upon further examination of background surveys, six participants were excluded from the final analyses. Three were excluded because their job titles appeared unrelated to web development (i.e., software engineer, computer support, computer science teaching assistant). Two were excluded because they had less than six months of work experience. One was excluded because he had been unemployed for more than six months (based on informal conversation with

participant). Thus, the final number of participants included in the final analyses for workforce web developers was 39.

Instruments and Measures

Test instrument. An 18-item test instrument was adapted from Smarter Balanced summative computer adaptive test items into a paper-and-pencil-based administration. All items were from either 2015 and/or 2016 Grade 11 test administrations. Half of the items covered English language arts (ELA) while the other half covered mathematics. Two forms (Form E and Form M) were created to counterbalance the content areas and control for the effect of content order, as well as discourage cheating. Form E began with English language arts items while Form M began with math items. A break was inserted in between content areas, prompting participants to take a brief break if needed.

In selecting the items, priority was given to selecting test items with high numbers of career-readiness features, as described in our prior report (Kao et al., 2018). Consideration was also given for logistics and feasibility of a paper-based administration. Early selections of test items were internally tested on undergraduate students for timing and feasibility. Results of these trial runs led to a few changes in item selections, including the omission of a constructed-response writing item which took too much time (an average of 22 minutes) to complete.

We also considered Smarter Balanced content claims. Content claims are summary statements about the knowledge and skills students are expected to demonstrate on the assessment related to a particular aspect of the standards. For the present study, we considered the four Smarter Balanced ELA claims and the four Smarter Balanced math claims to ensure that our test instrument had adequate representation of each claim. However, items representing Smarter Balanced ELA Claim 3, Speaking and Listening, were not selected due to logistical and feasibility concerns for administration. Thus, the nine ELA items included in the present study consisted of the other three Smarter Balanced ELA claims (three Claim 1, three Claim 2, and three Claim 4 items). Selected math items represented each of the four math claims (three Claim 1, two Claim 2, two Claim 3, and two Claim 4).

Table 2 provides detailed information for each of the items included in our test instrument, including number of career-readiness features, Smarter Balanced claims, Smarter Balanced item type, depth of knowledge[4] ratings, item response theory (IRT) item difficulty estimate (based on the *b* parameters from the Smarter Balanced operational IRT model), scoring, and mean performance from participants in the current sample. Each item was worth one point except for Math Item 9, which was worth two points, for a maximum total raw test score of 19 points.

[4]Depth of knowledge is the level of cognitive demand or cognitive complexity required by a standard, target, or item, based on the work by Webb (1997). For more information related to Smarter Balanced items, please see www.smarterbalanced.org

Table 2

Information on Smarter Balanced Claims, Item Type, Depth of Knowledge, Item Difficulty, Scoring, and Mean Performance From Present Study by Item Number

									Performance of sample in present study		
Area	Item number	Number of career-readiness features	Claim number	Claim description	Item type	Depth of knowledge	Item difficulty (IRT-B)	Scoring (points possible)	*n*	*M*	*SD*
ELA	1	9	4	Research/Inquiry	mc	2	0.61	1	298	.59	.49
	2	5	2	Writing	mc	2	0.68	1	297	.72	.45
	3	6	1	Reading	ebsr	3	2.03	1	297	.54	.50
	4	6	2	Writing	ms	2	2.24	1	297	.38	.49
	5	5	1	Reading	htq	2	1.11	1	263	.77	.42
	6	7	1	Reading	mc	4	1.89	1	297	.42	.49
	7	6	4	Research/Inquiry	ms	2	2.05	1	295	.42	.50
	8	7	4	Research/Inquiry	mc	2	1.00	1	297	.53	.50
	9	7	2	Writing	mc	2	1.73	1	296	.34	.48
Math	1	9	1	Concepts & Procedures	mc	2	0.09	1	298	.74	.44
	2	10	2	Problem Solving	eq	2	2.79	1	285	.27	.45
	3	10	1	Concepts & Procedures	gi	2	2.56	1	292	.32	.47
	4	12	4	Modeling & Data Analysis	eq	3	2.33	1	281	.44	.50
	5	11	1	Concepts &	mi	2	2.73	1	288	.26	.44

Area	Item number	Number of career-readiness features	Claim number	Claim description	Item type	Depth of knowledge	Item difficulty (IRT-B)	Scoring (points possible)	Performance of sample in present study		
									n	*M*	*SD*
				Procedures							
	6	10	2	Problem Solving	eq	2	2.83	1	275	.30	.46
	7	10	3	Communicating Reasoning	mc	3	0.21	1	287	.71	.46
	8	11	4	Modeling & Data Analysis	eq	2	2.86	1	266	.18	.39
	9	11	3	Communicating Reasoning	gi	3	1.72	2	295	1.04	0.87

Note. Smarter Balanced item type abbreviations: ebsr = evidence-based selected response; eq = equation or numeric; gi = grid item; htq = hot text; mc = multiple choice; ms = multiple select. Depth of Knowledge ratings: 1 = recall and reproduction; 2 = basic skills and concepts; 3 = strategic thinking and reasoning; 4 = extended thinking. For more information on Smarter Balanced test items, please visit www.smarterbalanced.org

For a paper-based administration, some minor modifications from the computer-based items were necessary. For instance, ELA Item 5 was a “hot text” (htq) item in which the test taker must “mouse over” a paragraph to find the clickable answer choices (in this case, a single word) and select one answer. In our paper version, we highlighted the three answer choices and asked participants to circle the correct word. Among the math items, “equation” (eq) type items were modified to add a blank line or box for participants to handwrite their final answers (original items provided a numeric keypad for test takers to click). “Grid item” (gi) type items required minor layout changes, and wording changes from “select” to “circle.” All other items were printed in their original formats to the extent possible. Each item spanned one or two pages of the test booklet. The test was printed double-sided in booklet format with saddle stitching.

Table 3 shows the career-readiness features rated (as described in Kao et al., 2018) for each of the 18 items selected for the present study. A total of 19 key career-readiness features were represented across the 18 test items. Each item contained between five and 12 features, with an average of 8.4. ELA items contained an average of 6.4 features while math items contained an average of 10.4 features.

Table 3

Career-Readiness Features by Test Item

Feature	ELA item number									Math item number									Total
	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	
Reading comprehension	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	18
Deductive reasoning	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	17
Importance of being exact or accurate	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	17
Inductive reasoning	X		X			X		X		X	X		X	X	X	X	X		11
Time sharing	X	X	X	X	X	X	X	X	X			X							10
Written comprehension	X	X	X	X	X	X	X	X	X										9
Number facility										X	X	X	X	X	X	X	X	X	9
Processing information										X	X	X	X	X	X	X	X	X	9
Mathematical reasoning										X	X	X	X	X	X	X	X		8
Analyzing data or information										X		X	X	X	X	X	X	X	8
Making decisions and solving problems	X			X			X		X				X		X				6
Complex problem solving										X	X		X	X	X		X		6
Identifying objects, actions, or events											X			X		X	X	X	5
Flexibility of closure	X					X			X				X						4
Getting information					X			X				X						X	4
Organizing, planning, and prioritizing work													X	X		X		X	4
Estimating the quantifiable characteristics											X					X	X		3
Critical thinking	X																	X	2
Active learning												X						X	2
Total	9	5	6	6	5	7	6	7	7	9	10	10	12	11	10	10	11	11	

Table 4 shows the definitions of the 19 career-readiness features (in alphabetical order) that were found in the items investigated in the present study, along with respective O*NET importance ratings by career domain (EMT and web developer). Importance ratings indicate the degree to which a descriptor is important to the occupation out of 100, and are based on survey responses collected by the U.S. Department of Labor.

Table 4

*Career-Readiness Feature Descriptions and O*NET Importance Ratings*

Feature	Description	O*NET importance rating	
		EMT	Web developer
Active learning	Understanding the implications of new information for both current and future problem-solving and decision-making.	72	63
Analyzing data or information	Identifying the underlying principles, reasons, or facts of information by breaking down information or data into separate parts.	64	64
Complex problem solving	Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions.	63	66
Critical thinking	Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions, or approaches to problems.	75	69
Deductive reasoning	The ability to apply general rules to specific problems to produce answers that make sense.	75	72
Estimating the quantifiable characteristics	Estimating sizes, distances, and quantities; or determining time, costs, resources, or materials needed to perform a work activity.	61	58
Flexibility of closure	The ability to identify or detect a known pattern, figure, object, word, or sound that is hidden in other distracting material.	56	53
Getting information	Observing, receiving, and otherwise obtaining information from all relevant sources.	81	87
Identifying objects, actions, or events	Identifying information by categorizing, estimating, recognizing differences or similarities, and detecting changes in circumstances or events.	81	67
Importance of being exact or accurate	Being very exact or highly accurate is important to performing this job.	62[a]	42[a]
Inductive reasoning	The ability to combine pieces of information to form general rules or conclusions.	75	63
Making decisions and solving problems	Analyzing information and evaluating results to choose the best solution and solve problems.	88	81

Feature	Description	O*NET importance rating	
		EMT	Web developer
Mathematical reasoning	The ability to choose the right mathematical methods or formulas to solve a problem.	41	53
Number facility	The ability to add, subtract, multiply, or divide quickly and correctly.	38	44
Organizing, planning, prioritizing work	Developing specific goals and plans to prioritize, organize, and accomplish your work.	68	73
Processing information	Compiling, coding, categorizing, calculating, tabulating, auditing, or verifying information or data.	69	78
Reading comprehension	Understanding written sentences and paragraphs in work related documents.	63	66
Time sharing	The ability to shift back and forth between two or more activities or sources of information.	53	22
Written comprehension	The ability to read and understand information and ideas presented in writing.	63	66

[a]Importance of being exact or accurate refers to the percentage of respondents reporting it as "extremely important." The other ratings indicate the degree to which a descriptor is important to the occupation out of 100. For more information on ratings, see www.onetonline.org

Background surveys. Four surveys were developed: one for high school students, one for community college students, and two for workforce participants. All four background surveys began with a 10-item General Self-Efficacy (GSE) scale (Schwarzer & Jerusalem, 1995), which measures "perceived self-efficacy," or the belief that one can perform novel or difficult tasks and facilitates goal setting, effort investment, persistence in the face of barriers, and recovery from setbacks. Samples from 23 nations (using translated versions) had Cronbach's alphas ranging from .76 to .90. The purpose of including the GSE was to explore any potential noncognitive factors on test performance, with implications for career readiness. Additional detail on each background survey is described below. The surveys are included in Appendix B, Appendix C, Appendix D, and Appendix E.

High School Survey

In addition to the GSE, the high school background survey contained 13 items: six questions about education and career interests, and seven general demographic questions: age, grade level, gender, frequency of languages other than English spoken at home (as a proxy for English learner, or EL), number of computers or laptops at home (as a proxy for

socioeconomic status), race/ethnicity, and parent or guardians' highest level of education (as a second proxy for socioeconomic status). See Appendix B for the survey.

Community College Survey

This survey included the GSE scale as well as 16 items querying interests and education, including name of their program, degrees obtained and to be obtained, length of program, course names, employment status, and job titles if any. Some items were used to ascertain participant eligibility. Four demographic questions were also included (age, gender, frequency of languages other than English spoken at home when growing up, and race/ethnicity). See Appendix C for the survey.

Workforce EMT Survey

This survey included the GSE scale along with 12 items querying education/training (including degrees held, EMT refresher course dates, current education program enrollment, and future education goals) and employment (including job status/hours worked, job titles, and management experience). Four demographic questions were also included (age, gender, frequency of languages other than English spoken at home when growing up, and race/ethnicity). See Appendix D for the survey.

Workforce Web Developer Survey

In addition to the GSE, 16 items queried education/training (including degrees held, self-directed course descriptions, and future education goals) and employment (including job status/hours worked and job titles). Web developers were also asked to list their experience in managing a team, working individually, programming, web design, and back-end development, as well as rate their expertise for each. Four demographic questions were also included (age, gender, frequency of languages other than English spoken at home when growing up, and race/ethnicity). See Appendix E for the survey.

Research Design

This study used a quasi-experimental between-subjects design in order to explore differences in performance of test items exhibiting career-readiness features across three different subgroups: high school students, community college students, and workforce participants.

Procedure

Timeframe. Data collection was conducted between October 2017 and March 2018. High school data collection took place in October and November. Community college data collection took place primarily in December and January, while workforce data collection took place primarily in February and March. For high school participants, data collection was scheduled with deference to school scheduling and assessment concerns. For community college

participants, data collection was scheduled after the school semester began to help ensure participants met criteria for program enrollment.

Location. All high school data collection occurred in high school classrooms. Students from both Schools A and E were regular after-school program participants and participated in our study during after-school hours. Students from both Schools B and D participated during regular classroom hours. Data collection for the other subgroups occurred either in participants' classrooms, or participants came to our onsite research lab. More specifically, participants from Sites F, H, and J took the study in their respective classrooms. Participants from Site G participated either on their campus or at our onsite research lab. Participants from other sources participated in the study at our onsite research lab.

Classroom-based data collection was coordinated with the help of the teachers or instructors. Participants who came to our research lab generally scheduled themselves through a web-based calendar or were referred to us by the employment staffing agency described earlier. The web-based calendar was accessed through an online screening survey which filtered out those who did not meet the basic criteria for participation.

Administration. The test instrument and background survey were designed to be administered together in approximately one hour. Participants were first introduced to the study and then gave informed consent. They were asked to sign a nondisclosure agreement per Smarter Balanced, and then asked to silence their cellular phones and place them in individual, clear plastic pencil boxes for added security. High school students under age 18 also returned signed parent permission forms prior to test administration. Participants were administered the test first, then the background survey. Participants randomly received either test Form E or Form M.[5] Completed test booklets were collected before administering the survey. Participants were allowed to write anywhere in the test booklet and marked answers directly into the test booklet in either pen or pencil. No calculators were allowed. After completion of the survey, participants were given a gift card and their phones were returned.

Incentives. High school students were given a $25 Visa gift card, while community college students were given a $40 Amazon gift card, and workforce participants were given a $65 Amazon gift card. The onsite participants were also provided paid parking, if needed.

Data entry and scoring. Raw responses from the test instrument and the four background surveys were entered in pairs, with one researcher reading aloud and a second researcher electronically entering. A third researcher entered a random selection of 20% as a reliability check, with over 98% agreement for each instrument. Any errors found were corrected. The test instrument contained one open-ended response (Math Item 6, an equation), which was scored by three researchers with 94.1% interrater agreement. All other test items were converted into scores using statistical software.

[5]Roughly half of the participants within each subgroup received Form E, while the other half received Form M. Independent *t*-test results showed no significant differences between the two forms on overall test performance.

Using multiple-group item response theory (IRT) analysis with the two-parameter logistic (2PL) model (Smarter Balanced's operational IRT model), we applied Smarter Balanced item parameters from the calibrated item pool to create estimated IRT scaled scores for additional analyses. The 2PL model's item parameters were constrained to their calibrated values from the operational item pool. The population means and variances were freely estimated from the item response data. flexMIRT® (Houts & Cai, 2016) was used for the IRT analyses. Expected a posteriori (EAP) scaled scores were estimated. We note that we do not seek to replicate Smarter Balanced's operational scoring approach because the items were purposefully selected and the sampling was not random. EAP scores are Bayesian estimates that have more superior statistical properties when the number of items is not large (Thissen & Wainer, 2001).

Data analysis. Descriptive statistics and correlations were conducted on the test data and the survey data. Analyses of variance and regression modeling were conducted on the test scores (both raw scores and IRT scaled scores) in order to explore differences across the subgroups.

Results

Detailed results from the background surveys are presented in Appendix F. These include General Self-Efficacy scores and additional demographic information for each of the three subgroups, and education, training, and work experience for the community college and workforce subgroups.

As described in the Method section, the maximum raw score on our paper-based test was 19 (9 points for ELA and 10 points for math). Table 5 shows the descriptive results of the raw test scores by subgroup and by content area.

Table 5

Descriptive Results of the Raw Test Scores by Subgroup and by Content Area

Subgroup	Content area	*n*	Minimum	Maximum	*M*	*SD*
High school	ELA	103	0	8	3.90	1.77
	Math	103	0	9	3.26	2.24
	Total	103	0	17	7.17	3.52
Community college	ELA	111	0	9	4.75	1.81
	Math	111	0	10	3.98	2.57
	Total	111	1	18	8.73	3.77
Workforce	ELA	84	1	9	5.29	1.89
	Math	84	0	10	5.37	2.65
	Total	84	2	18	10.65	4.10

As described in the Method section, IRT scores were created by applying Smarter Balanced item parameters to the raw scores. Table 6 shows descriptive results of the IRT scaled scores.

Table 6

Descriptive Results of IRT Scores by Subgroup and by Content Area

Subgroup	Content area	*n*	Minimum	Maximum	*M*	*SD*
High school	ELA	103	0.047	2.720	1.266	0.623
	Math	103	-0.375	3.263	0.999	0.941
	Total	103	-0.734	3.349	1.114	0.857
Community college	ELA	111	0.474	3.255	1.878	0.669
	Math	111	-0.322	4.142	1.507	1.140
	Total	111	0.012	3.677	1.724	0.790
Workforce	ELA	84	0.748	3.668	2.318	0.754
	Math	84	0.351	4.210	2.380	1.005
	Total	84	0.339	4.420	2.354	0.978

Analyses of variance and regression analyses were conducted on the raw test scores as well as the IRT scores. Overall findings were similar, however we report results from the

analyses conducted on IRT scores because they are more sensitive in detecting group differences.

In a one-way analysis of variance conducted on the overall total score, results indicated significant differences between the subgroups on the total test score, $F(2, 295) = 47.19$, $p < .001$. Post hoc comparisons using Tukey HSD indicated that the workforce subgroup performed significantly higher than the community college subgroup ($p < .001$) and significantly higher than the high school subgroup ($p < .001$). The community college subgroup also performed significantly higher than the high school subgroup ($p < .001$).

On the ELA score, a one-way analysis of variance showed significant differences between the subgroups, $F(2, 295) = 57.00$, $p < .001$. Post hoc comparisons using Tukey HSD indicated that the workforce subgroup performed significantly higher than the community college subgroup ($p < .001$) and significantly higher than the high school subgroup ($p < .001$). The community college subgroup also performed significantly higher than the high school subgroup ($p < .001$).

On the math score, a one-way analysis of variance also showed significant differences between the subgroups, $F(2, 295) = 41.41$, $p < .001$. Post hoc comparisons using Tukey HSD indicated that the workforce subgroup performed significantly higher than the community college subgroup ($p < .001$) and significantly higher than the high school subgroup ($p < .001$). The community college subgroup also performed significantly higher than the high school subgroup ($p < .01$).

Table 7 shows regression results, comparing the three subgroups on the IRT scores for ELA, math, and the total. High school was designated as the reference group.

Table 7

Results From Regressions Comparing Subgroup Performance on IRT Scores by Content Area

Area	Model	B	*SE*	β	*t*	*p*
ELA	(Constant)	1.266	.067		18.926	<.001
	CC vs. HS	0.612	.093	.372	6.587	<.001
	WF vs. HS	1.052	.100	.595	10.539	<.001
Math	(Constant)	0.999	.102		9.782	<.001
	CC vs. HS	0.507	.142	.210	3.575	<.001
	WF vs. HS	1.380	.152	.532	9.055	<.001
Total	(Constant)	1.114	.086		13.001	<.001
	CC vs. HS	0.610	.119	.297	5.128	<.001
	WF vs. HS	1.240	.128	.561	9.702	<.001

Note. HS = high school, CC = community college, WF = workforce. R square for ELA = .28; R square for Math = .22, R square for Total = .24.

Career Domains

Additional analyses were conducted on the two different career domains. Table 8 and Table 9 show the means and standard deviations of the raw test scores and the IRT scores, respectively, by career domain and by subgroup.

Table 8

Raw Test Score Means (SD) by Career Domain and by Subgroup

		EMT		Web developer	
Area	High school (*n* = 103)	Community college (*n* = 64)	Workforce (*n* = 45)	Community college (*n* = 47)	Workforce (*n* = 39)
ELA	3.90 (1.77)	4.77 (2.02)	4.71 (1.85)	4.72 (1.50)	5.95 (1.72)
Math	3.26 (2.24)	3.89 (2.82)	4.24 (2.51)	4.11 (2.20)	6.67 (2.20)
Total	7.17 (3.52)	8.66 (4.15)	8.96 (3.95)	8.83 (3.23)	12.62 (3.37)

Table 9

IRT Score Means (SD) by Career Domain and by Subgroup

		EMT		Web developer	
Area	High school (*n* = 103)	Community college (*n* = 64)	Workforce (*n* = 45)	Community college (*n* = 47)	Workforce (*n* = 39)
ELA	1.266 (0.623)	1.868 (0.736)	2.072 (0.741)	1.892 (0.574)	2.603 (0.672)
Math	0.999 (0.941)	1.432 (1.223)	1.958 (0.945)	1.608 (1.020)	2.866 (0.849)
Total	1.114 (0.857)	1.689 (0.865)	1.941 (0.940)	1.770 (0.680)	2.830 (0.794)

EMT. A one-way analysis of variance on total IRT score was conducted comparing the performance of high school students and community college EMT students and workforce EMTs (i.e., web developers were excluded from the analyses). Results were significant, $F(2, 209) = 16.94$, $p < .001$. Post hoc comparisons using Tukey HSD revealed significant differences in performance between high school students and community college EMT students ($p < .001$) and between high school students and workforce EMTs ($p < .001$). No significant differences were detected between community college EMTs and workforce EMTs on total test score.

A similar pattern of performance was found on the ELA score. A one-way analysis of variance showed significant differences between the subgroups, $F(2, 209) = 27.79$, $p < .001$. Post hoc comparisons using Tukey HSD revealed significant differences in performance between high school students and community college EMT students ($p < .001$) and between high school students and workforce EMTs ($p < .001$). No significant differences were detected between community college EMTs and workforce EMTs on the ELA score.

On the math score, a one-way analysis of variance also showed significant differences between the subgroups, $F(2, 209) = 13.85$, $p < .001$. Post hoc comparisons using Tukey HSD indicated that the workforce subgroup performed significantly higher than the community college subgroup ($p < .05$) and significantly higher than the high school subgroup ($p < .001$). The community college subgroup also performed significantly higher than the high school subgroup ($p < .05$).

Web developer. A one-way analysis of variance on total IRT score was conducted comparing the performance of high school students and community college web developer students and workforce web developers. Results were significant, $F(2, 186) = 65.46$, $p < .001$. Post hoc comparisons using Tukey HSD indicated that the workforce web developers performed significantly higher than the community college web developer students ($p < .001$) and the high school students ($p < .001$). Community college web developer students also performed significantly higher than the high school students ($p < .001$).

A similar pattern of performance was found on the ELA score. A one-way analysis of variance showed significant differences between the subgroups, $F(2, 186) = 68.46$, $p < .001$. Post hoc comparisons using Tukey HSD indicated that the workforce web developers performed significantly higher than the community college web developer students ($p < .001$) and the high school students ($p < .001$). Community college web developer students also performed significantly higher than the high school students ($p < .001$).

One-way analysis of variance on the math score also showed significant differences between the subgroups, $F(2, 186) = 55.56$, $p < .001$. Post hoc comparisons using Tukey HSD indicated that the workforce subgroup performed significantly higher than the community college subgroup ($p < .001$) and significantly higher than the high school subgroup ($p < .001$). The community college subgroup also performed significantly higher than the high school subgroup ($p < .01$).

Bachelor's Degrees

Based on background survey responses, we found that many of the non-high school participants already possessed bachelor's degrees or higher, which suggests potential education and training beyond what is needed to become an EMT or a web developer. Since our exemplar careers were initially selected because they do not require a bachelor's degree, we conducted further exploration into participants with such degrees.

There was a moderate positive correlation between the total IRT score and (any) bachelor's degree (and higher), $r(297) = .44$, $p < .001$. There was also a slight positive correlation between the total test score and participant age, $r(294) = .32$, $p < .001$. Participant age was positively correlated with bachelor's degree, $r(294) = .60$, $p < .001$.

Table 10 and Table 11 show the raw test score means and IRT score means, respectively, of participants with and without bachelor's degrees or higher[6] by subgroup and by career domain.

[6]Among community college participants, two EMT students and two web development students also held degrees above a bachelor's. Among the workforce participants, six web developers held degrees above a bachelor's. No workforce EMTs held degrees above a bachelor's.

Table 10

Raw Test Score Means of Participants With and Without Bachelor's Degrees or Higher by Subgroup and by Career Domain

Career domain	Bachelor's + degrees	Community college			Workforce		
		n	*M*	*SD*	*n*	*M*	*SD*
EMT	No	44	7.80	3.94	35	8.34	3.61
	Yes	19	10.47	4.14	10	11.10	4.53
Web developer	No	29	8.07	3.13	7	13.00	4.00
	Yes	18	10.06	3.10	32	12.53	3.28
Total	No	73	7.90	3.62	42	9.12	4.03
	Yes	37	10.27	3.63	42	12.19	3.61

Note. There was one missing case for community college EMT.

Table 11

IRT Score Means of Participants With and Without Bachelor's Degrees or Higher by Subgroup and by Career Domain

Career domain	Bachelor's + degrees	Community college			Workforce		
		n	*M*	*SD*	*n*	*M*	*SD*
EMT	No	44	1.516	0.837	35	1.784	0.850
	Yes	19	2.072	0.845	10	2.488	1.079
Web developer	No	29	1.601	0.670	7	2.990	1.064
	Yes	18	2.043	0.618	32	2.795	0.739
Total	No	73	1.550	0.771	42	1.985	0.986
	Yes	37	2.058	0.733	42	2.722	0.828

Note. There was one missing case for community college EMT.

Analysis of variance after excluding participants with bachelor's degrees (n = 218 [103 high school, 73 community college, 42 workforce]) was conducted on the total IRT score, which showed significant differences between the subgroups $F(2, 215) = 16.57$, $p < .001$. Post hoc comparisons using Tukey HSD indicated that the workforce subgroup performed significantly higher than the community college subgroup ($p < .05$) and significantly higher than the high school subgroup ($p < .001$). The community college subgroup also performed significantly higher than the high school subgroup ($p < .01$). This pattern of results is similar to the pattern of results for the overall sample.

Exploring Background Factors Within Subgroups

In addition to differences across the three subgroups, there may be differences within each subgroup that play a role in the performance of our test instrument. Such differences are worth preliminary exploration in spite of small sample sizes to inform future research.

High school participants. As described in the Method section, our sample of high school students consisted of 52.9% female and 47.1% male participants, which is roughly consistent with the national pattern. Female high school students scored significantly lower (n = 54, M = 6.44, SD = 3.24) on our test instrument than male students (n = 48, M = 8.02, SD = 3.68), $t(100) = 2.30$, $p < .05$. This is different from the general trend of student performance in the state of California for Grade 11, in which during Spring 2017 testing, 65% of females and 54% of males met or exceeded standards in ELA, and 33% of females and 32% of males met or exceeded standards in math (California Department of Education, 2017). In our sample, no significant differences were found between females and males on ELA items, while female participants performed significantly lower on the math items (M = 2.80, SD = 1.99) than their male peers, (M = 3.83, SD = 2.39), $t(100) = 2.39$, $p < .05$.

There were no significant correlations between total test score, General Self-Efficacy score, high school site, or EL proxy. Students who reported never speaking a language other than English at home were more likely to have a higher General Self-Efficacy score.

Community college participants. There were no significant correlations between total test score, General Self-Efficacy score, or gender for our community college participants. This was true within both career domains.

Workforce participants. Among the 45 workforce EMT participants, 25 reported being currently enrolled in a program to become a paramedic. Those who reported being enrolled in a paramedic program performed significantly lower (M = 6.36, SD = 2.45) than those who did not (M = 12.20, SD = 2.93), $t(43) = 7.29$, $p < .001$. As described in our Method section, 24 of these 25 paramedic students were from the same source and participated in the study at the same time, on the evening of the second day of an intensive, full-time program. Admission to this program requires current EMT certification and over 1,200 hours of experience working as an EMT. The instructor and several participants (during informal conversations) reported that the students had all quit their jobs as EMTs within the past couple of weeks. However, due to the unexpected participant recruitment source, the exact length of time that had elapsed since quitting was not captured in our background survey.

There were no significant correlations between total test score, General Self-Efficacy score, participant age, gender, length of work experience, or experience managing a team for our workforce EMT participants.

Among the workforce web developers, there was a moderate negative correlation with the total test score and reported age (measured in years), $r(39) = -.37$, $p < .05$. As reported in

the Method section, the age range of the workforce web developers in this study was 20 to 50, with a mean of 33.8 (*SD* = 9.8), and a median of 32.0. Female participants performed significantly higher (*n* = 10, *M* = 14.60, *SD* = 2.32) than male participants (*n* = 29, *M* = 11.93, *SD* = 3.43), $t(37) = -2.28$, $p < .05$. This trend is opposite from the trend for our high school participants.

There were no significant correlations between the total test score, General Self-Efficacy score, employment status (i.e., those employed 20 or more hours a week vs. those employed less than 20 hours a week), length of work experience, or experience managing a team for our workforce web developers.

Discussion

The purpose of this study was to serve as a preliminary validation of the career-readiness features found in a targeted set of Grade 11 assessment items by exploring performance of participants with varying levels of experience in two exemplar careers (EMT and web developer). As expected, results indicated that workforce individuals scored significantly higher on the test than community college students, who in turn also scored significantly higher than high school students. Results suggest that having added experience in a field leads to refining certain career-readiness skills found in high-school level content-area assessments.

The quasi-experimental nature of the design, along with the small sample size of this study, begs caution in the interpretation of results. We recognize that the three subgroups have inherent differences beyond simply "career experience" that may never be captured, even in a controlled study. For instance, it may not be possible to fully disentangle the effects of age and experience. Some skills, such as deductive and inductive reasoning, may be honed through other life experiences. Others are honed in college, regardless of the field of study. Further, it is possible that there may be some skew within the community college group, as some lower scorers may also never complete their degree and join the workforce in the given domain, but impact current scores. Our sample consisted of a high number of participants who held bachelor's degrees and above, including community college students, who may have returned to school for a career change. Coincidentally, two web developer students (who were excluded from the final analyses) had prior careers as EMTs, reflecting the general transient nature of some careers, especially ones that do not require extensive education or training. Our initial goals in selecting these two exemplar careers were precisely because they did not require four-year degrees, but perhaps the reality of the 21st century is that obtaining a bachelor's helps young adults with the knowledge, skills, and attributes necessary to remain competitive in the market.

Touched upon briefly in our background survey (see Table F19 in Appendix F) was the motivation for choosing a career. Not surprisingly, a high number of those who selected "salary" were web developers while a high number of those who selected "help people" were

EMTs, especially given that the median salary of web developers is roughly double that of EMTs. Those motivated to have a career that earns more may also be more motivated to obtain a four-year degree. Though only a few EMTs in our sample held bachelor's degrees, those who did scored higher on our test. In general, participants with bachelor's degrees scored higher than those without. After excluding participants with bachelor's degrees, the pattern of results was similar to the whole sample, in that workforce individuals scored significantly higher than community college students, who in turn scored significantly higher than high school students. This strengthens the suggestion that added work experience can lead to performing higher on test items found to contain many career-readiness features.

In exploring background factors, we found, surprisingly, no significant relationships between self-efficacy and test performance. However, EMTs were more likely to report higher self-efficacy than web developers—perhaps important in a career where salary is low but motivation to "help people" is high.

Among workforce web developers, there was a moderate negative correlation of test performance with age, which suggests that an increase in age does not necessarily mean greater career-readiness skills. Skills needed to "be ready" do not mean skills needed to continue in or excel at a career. Those would be beyond the scope of the present study.

Finally, a notable finding was the trend of female workforce web developers performing significantly higher than male workforce web developers, despite being underrepresented in this field in both our sample and in the general population. This trend is opposite from the trend of our female high school participants (who performed significantly worse than their male peers). Though the sample size was small, it leads to other questions that might be explored in future work. Do women pursuing careers as web developers have to be "more ready" at needed skills in order to be hired or to be successful? Or are women who excel at math more likely to consider web development as a career? Such questions remain unanswered for the moment.

Limitations and Future Work

This study has several limitations. As discussed earlier, there are inherent differences between the three subgroups beyond career experience. It would be challenging to completely isolate the effect of career experience in a true experiment, as participants have varying life experiences that confound the effect of work experience. In addition, while the initial goal of the study was to compare participant subgroups across both career domains, the two career domains invariably have differences that cannot be ignored. One is commonly viewed as a "stepping stone" job toward other careers, and the other is more likely to be a long-term career. A study on careers that are more similar to each other in training, median salary, long-term prospects, etc. may have yielded different results.

Web developer, as a career, is also less well-defined than EMT. EMTs take very specific courses that follow national standards and must carry a license. Web development is broad and

encompasses a variety of tasks and activities that fall under the umbrella term. Our efforts to narrow criteria for recruitment were met with challenges in reaching our targeted *N*, and our final sample included participants with varying training, skill sets, and experience—at least in contrast with the more well-defined EMT. Overall, EMTs were also younger than web developers. EMTs were also typically working under 40 hours a week, which reflects the nature of the field.

Nearly half of our workforce EMT sample came from one source—the second day of a community college-based paramedic program. As reported in the Results section, these participants performed significantly lower than the other workforce EMTs, and the workforce EMTs overall did not perform significantly different from the community college EMTs. This was a self-selected group who all elected to quit their jobs as EMTs and advance into the "next step" as paramedics. There may be differences between those who choose to become paramedics and those who do not. Those who do not may have medical school or other pursuits as an end goal. Or this may be related to the community and the type of students attracted to such a program. Or it may be because this was an intensive, full-time program that began early in the morning, and we were conducting the study in the evening, after a long day, and participants were mentally strained. Ideally, our sample should have represented a greater variety of sources, which may have yielded different results.

Although we began with a set of 36 career-readiness features at the outset, 19 were represented in the present study. Remaining features should be reconsidered in a validation study. Additionally, while we selected test items with high numbers of features for examination, it is important to note that the features are not necessarily mutually exclusive. As shown in our companion report (Kao et al., 2018), some features were significantly correlated with one another, depending on the content area. Reading comprehension in math, for example, was moderately correlated with analyzing data or information. In ELA, critical thinking was moderately correlated with making decisions and solving problems. Future work should investigate these relationships further and consider the weight each career-readiness feature has within a test item.

There is a general self-selection bias in such research studies, in that all participants were aware of the gift card incentive during the recruitment process. Those not swayed by the incentive may feel the need to be of help to research. These factors are worth mentioning, but are beyond the scope of the present study.

There are also limitations to our test instrument. Ultimately, the test items were adapted from a computer-based test, and administered in a setting for which they were not designed. In the computer-adaptive test, test takers are given items based on their answers to the previous item. This was not possible for the present study. Further, while the decisions we made on the test items were based on the presence of career-readiness features, it is not possible to separate the confounding effect of content knowledge. Mathematics, especially, can be challenging for individuals who have not recently taken a course in mathematics (and

challenging even for those who have). English language arts may have less of a confounding effect in this regard. However, those far removed from standardized test taking (due to age or alternate or international schooling) have their own unique issues and barriers.

Future work might consider exploring features through computer-adaptive testing. This might also allow the exploration of a greater number of test items. Future work might also compare one exemplar career with a control group consisting of a variety of careers in order to identify specific features relevant to that career. Future feature analysis studies might also be devoted to more fast-growing female-dominated professions, such as dental assistants, dieticians, or cosmetologists.

Despite limitations, results from this study provide information that experience in a field is associated with higher performance on test items that contain large numbers of career-readiness features. Test items measuring English language arts and mathematics do contain indicators of career readiness. Inferences about career readiness, as well as college readiness, can be drawn from test scores. Preparation for such assessments can hone these skills and thus help high school students prepare for college and/or career.

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Appendix A:
College/Career Indicator Performance Levels

Criteria
Prepared Level: Does the graduate meet at least 1 measure below?
A. Career Technical Education (CTE) Pathway Completion **plus one** of the following criteria: ○ Smarter Balanced Summative Assessments: At least a Level 3 "Standard Met" on ELA or Mathematics and at least a Level 2 "Standard Nearly Met" in the other subject area ○ One semester/two quarters of Dual Enrollment with passing grade (Academic/CTE subjects)
B. At least a Level 3 "Standard Met" on both ELA and Mathematics on Smarter Balanced Summative Assessments
C. Completion of two semesters/three quarters of Dual Enrollment with a passing grade (Academic and/or CTE subjects)
D. Passing Score on two Advanced Placement (AP) Exams or two International Baccalaureate (IB) Exams
E. Completion of courses that meet the University of California (UC) a–g criteria **plus one** of the following criteria: ○ CTE Pathway completion – Smarter Balanced Summative Assessments: At least a Level 3 "Standard Met" on ELA or Mathematics and at least a Level 2 "Standard Nearly Met" in the other subject area ○ One semester/two quarters of Dual Enrollment with passing grade (Academic/CTE subjects) ○ Passing score on one AP Exam **OR** on one IB Exam
Approaching Prepared Level - Does the graduate meet at least 1 measure below?
A. High School Diploma and any one of the following: ○ CTE Pathway completion ○ Scored at least Level 2 "Standard Nearly Met" on both ELA and Mathematics Smarter Balanced Summative Assessments ○ Completion of one semester/two quarters of Dual Enrollment with passing grade (Academic/CTE subjects) ○ Completion of courses that meet the UC or CSU a-g criteria
Not Prepared Level
Student did not meet any measure above or did not graduate, so considered NOT PREPARED

Note. From "College/Career Indicator," by The California Department of Education, 2018 (https://www.cde.ca.gov/ta/ac/cm/cci.asp).

Appendix B:
High School Background Survey

Please check one of the four boxes for each item below.

1. I can always manage to solve difficult problems if I try hard enough.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

2. If someone opposes me, I can find the means and ways to get what I want.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

3. It is easy for me to stick to my aims and accomplish my goals.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

4. I am confident that I could deal efficiently with unexpected events.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

5. Thanks to my resourcefulness, I know how to handle unforeseen situations.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

6. I can solve most problems if I invest the necessary effort.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

7. I can remain calm when facing difficulties because I can rely on my coping abilities.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

8. When I am confronted with a problem, I can usually find several solutions.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

9. If I am in trouble, I can usually think of a solution.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

10. I can usually handle whatever comes my way.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

Education & Interests

1. Do you plan to pursue additional schooling **after** you graduate from high school?

☐ No additional school
☐ Community College
☐ Vocational or certificate program
☐ Four-year university
☐ Other, please describe_____

2. Which of the following jobs would you be interested in having, **after** you complete **all education or training**? (You can check more than one!)

☐ Registered nurse
☐ Web administrator
☐ Dental hygienist
☐ Biomedical engineer
☐ Genetic counselor
☐ Physical therapist
☐ Web developer
☐ Medical assistant
☐ Tutor
☐ Computer and information systems manager
☐ Emergency Medical Technician (EMT)
☐ Video game designer
☐ Music therapist
☐ Spa manager
☐ Climate change analyst
☐ Computer systems analyst
☐ Other, please describe_____

3. What are the most important reasons why you might choose a specific career? (Check up to **three**!)

☐ Interest in field
☐ Location
☐ Salary/compensation
☐ Less training or additional school needed
☐ Rapid growth/number of jobs available
☐ Motivated to help society/people
☐ Other, please describe_____

4. What kinds of grades do you usually get in your classes? Please check one.

- ☐ Mostly A's
- ☐ A's and B's
- ☐ Mostly B's
- ☐ B's and C's
- ☐ Mostly C's or lower

5. What kinds of grades do you usually get in your **English or language arts classes**? Please check one.

- ☐ Mostly A's
- ☐ A's and B's
- ☐ Mostly B's
- ☐ B's and C's
- ☐ Mostly C's or lower

6. What kinds of grades do you usually get in your **math classes**? Please check one.

- ☐ Mostly A's
- ☐ A's and B's
- ☐ Mostly B's
- ☐ B's and C's
- ☐ Mostly C's or lower

Background

1. How old are you in years?

☐ 16 ☐ 17 ☐ 18 ☐ 19 or older

2. Grade: ☐ 11th ☐ 12th

3. Gender:

_____

4. How often do people in your home talk to each other in a language **other than** English?

☐ Never ☐ Once in a while ☐ About half of the time ☐ All or most of the time

5. How many computers or laptops are in your home? (Only count the ones that are working)

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 or more

6. With which of the following groups do you most strongly identify? (It's okay to pick more than one!)

☐ American Indian or Alaska Native
☐ Asian or Pacific Islander
☐ Black or African American
☐ Hispanic / Latino/a
☐ White or Caucasian
☐ Other, please describe
_____

7. What is the **highest level of education** your parents or guardians completed? Please choose a box for each of the parents/guardians you live with.

If you live with more than two parents/guardians, think about the two you spend the most time living with. If you live with only one parent/guardian, you can leave the second column blank. If you are not sure, please check the box that says "Not sure/don't know."

Parent or Guardian #1:	Parent or Guardian #2:
☐ Less than high school	☐ Less than high school
☐ High school graduate or GED (equivalent)	☐ High school graduate or GED (equivalent)
☐ Some college (no degree)	☐ Some college (no degree)
☐ Associate's or 2-year college degree	☐ Associate's or 2-year college degree
☐ Bachelor's or 4-year college degree	☐ Bachelor's or 4-year college degree
☐ Master's degree	☐ Master's degree
☐ Advanced/professional degree (example: MD)	☐ Advanced/professional degree (example: MD)
☐ Not sure/don't know	☐ Not sure/don't know

Thank you!

Appendix C:
Community College Background Survey

Please check one of the four boxes for each item below.

1. I can always manage to solve difficult problems if I try hard enough.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

2. If someone opposes me, I can find the means and ways to get what I want.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

3. It is easy for me to stick to my aims and accomplish my goals.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

4. I am confident that I could deal efficiently with unexpected events.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

5. Thanks to my resourcefulness, I know how to handle unforeseen situations.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

6. I can solve most problems if I invest the necessary effort.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

7. I can remain calm when facing difficulties because I can rely on my coping abilities.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

8. When I am confronted with a problem, I can usually find several solutions.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

9. If I am in trouble, I can usually think of a solution.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

10. I can usually handle whatever comes my way.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

Interests and Education

1. In what field or program are you currently pursuing a degree or certification?

☐ Emergency Medical Technician (EMT) ☐ Web development

☐ Other (please describe):_____

2. What are the most important reasons you are interested in the job area you chose? (Please check up to **three** reasons)

☐ Interest in field ☐ Less training or additional school needed

☐ Location ☐ Rapid growth/number of jobs available

☐ Salary/compensation ☐ Motivated to help society/people

☐ Other, please describe_____

3. What kind of degree or certificate will you receive when you complete the program that you are currently enrolled in? Please specify.

☐ Certificate, in:_____

☐ Associate's degree, in:_____

☐ Other, please describe:_____

4. How **long in total is your program?** Please list in terms of years and months, or semesters, if applicable:

_____years, _____months OR _____semesters OR_____hours

5. How far along are you in the program?

_____years, _____months OR _____semesters OR_____hours

6. Are your courses conducted online or in person?

☐ Online only ☐ In person only ☐ Both online and in person

7. Please list the courses you have completed relevant to your specific program of study:

_____

_____

_____

_____

_____

8. Do you plan to pursue additional schooling **after** you finish your current program?

☐ No additional school
☐ Community college
☐ Vocational or certificate program
☐ Four-year university
☐ Other, please describe_____

9. Do you hold degrees or certificates in other fields? If yes, please check all that apply and describe:

☐ No, no other degrees or certificates
☐ Yes, high school diploma or GED
☐ Yes, certificate in:_____
☐ Yes, two-year or Associate's degree in:_____
☐ Yes, four-year or Bachelor's degree in: _____
☐ Yes, other (please describe):_____

10. Are you currently enrolled in a program **other than** EMT or web development?
(For example: Certificate in Accounting, Associate's in Nursing, Bachelor's in Anthropology, etc.)

_____

Employment

1. Which of the following categories best describes your current employment status?

☐ Employed, working 40 or more hours per week
☐ Employed, working 20-39 hours per week
☐ Employed, working 1-19 hours per week
☐ Not employed, looking for work
☐ Not employed, NOT looking for work
☐ Other (please describe): _____

2. Are you currently employed in a field related to your program of study?

☐ Yes, job title: _____
☐ No, not currently employed
☐ No, currently employed in (please describe): _____

Background

1. How old are you in years?

_____

2. Gender:

_____

3. Growing up, how often did people in your home talk to each other in a language **other than** English?

☐ Never ☐ Once in a while ☐ About half of the time ☐ All or most of the time

4. With which of the following groups do you most strongly identify? (It's okay to pick more than one!)

☐ American Indian or Alaska Native
☐ Asian or Pacific Islander
☐ Black or African American
☐ Hispanic / Latino/a
☐ White or Caucasian
☐ Other, please describe _____

Thank you!

Appendix D:
EMT Background Survey

Please check one of the four boxes for each item below.

1. I can always manage to solve difficult problems if I try hard enough.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

2. If someone opposes me, I can find the means and ways to get what I want.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

3. It is easy for me to stick to my aims and accomplish my goals.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

4. I am confident that I could deal efficiently with unexpected events.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

5. Thanks to my resourcefulness, I know how to handle unforeseen situations.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

6. I can solve most problems if I invest the necessary effort.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

7. I can remain calm when facing difficulties because I can rely on my coping abilities.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

8. When I am confronted with a problem, I can usually find several solutions.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

9. If I am in trouble, I can usually think of a solution.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

10. I can usually handle whatever comes my way.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

Education

1. What degrees or certificates do you hold? (Check all that apply)

   ☐ High school diploma or GED
   ☐ Certificate in: _____
   ☐ Two-year or Associate's degree in: _____
   ☐ Four-year or Bachelor's degree in: _____
   ☐ Master's degree in: _____
   ☐ Other, please describe: _____
   ☐ Not applicable

2. Do you feel that your education prepared you for your current employment?

   ☐ Yes ☐ No ☐ Mixed

   Please explain why:
   _____
   _____

3. When was the last time you completed continuing education courses to renew your EMT license? If this is not applicable, please write N/A.

   Date (Month/Year):_____

4. Other than continuing education courses, are you currently enrolled in an educational program? (For example: Paramedic course, Associate's in Nursing, Bachelor's in Anthropology, etc.)

   _____

5. Do you plan to pursue any additional schooling? (Not including continuing education requirements).

☐ No additional school
☐ Community college
☐ Vocational or certificate program
☐ Four-year university
☐ Other, please describe_____

Employment

1. Which of the following categories best describes your current employment status, **as an EMT**?

☐ Employed, working 40 or more hours per week
☐ Employed, working 20-39 hours per week
☐ Employed, working 1-19 hours per week
☐ Not employed, looking for work
☐ Not employed, NOT looking for work
☐ Other (please describe): _____

2. What is your current job title? If you are not currently employed, what was your most recent job title?

_____

3. Do you currently have **other** occupations aside from EMT? **If yes**, please list them below and write the number of hours per week for each occupation. **If no**, please write N/A.

Other Current Occupations:	Number of hours per week:

4. What are the most important reasons you are interested in the job area you chose? (Please check up to **three** reasons)

☐ Interest in field
☐ Location
☐ Salary/compensation
☐ Less training or additional school needed
☐ Rapid growth/number of jobs available
☐ Motivated to help society/people
☐ Other, please describe_____

5. How many years/months have you worked as an EMT?

Years_____ Months_____

6. Have you ever managed a team of EMTs? If so, please indicate years and months spent managing a team:

☐ No ☐ Yes: Years_____Months_____

7. What are your employment goals for the next few years? (Check all that apply)

☐ Continue working as an EMT

☐ Pursue a career as an advanced EMT or paramedic

☐ Pursue other healthcare careers

☐ Pursue a career NOT related to healthcare

☐ Other, please describe:_____

Background

1. How old are you in years?

_____

2. Gender:

_____

3. Growing up, how often did people in your home talk to each other in a language other than English?

☐ Never ☐ Once in a while ☐ About half of the time ☐ All or most of the time

4. With which of the following groups do you most strongly identify?

☐ American Indian or Alaska Native
☐ Asian or Pacific Islander
☐ Black or African American
☐ Hispanic / Latino/a
☐ White or Caucasian
☐ Other, please describe _____

Thank you!

Appendix E:
Web Developer Background Survey

Please check one of the four boxes for each item below.

1. I can always manage to solve difficult problems if I try hard enough.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

2. If someone opposes me, I can find the means and ways to get what I want.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

3. It is easy for me to stick to my aims and accomplish my goals.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

4. I am confident that I could deal efficiently with unexpected events.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

5. Thanks to my resourcefulness, I know how to handle unforeseen situations.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

6. I can solve most problems if I invest the necessary effort.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

7. I can remain calm when facing difficulties because I can rely on my coping abilities.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

8. When I am confronted with a problem, I can usually find several solutions.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

9. If I am in trouble, I can usually think of a solution.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

10. I can usually handle whatever comes my way.

☐ Not at all true ☐ Hardly true ☐ Moderately true ☐ Exactly true

Education

1. What degrees or certificates do you hold? (Check all that apply)

   ☐ High school diploma or GED
   ☐ Certificate in: _____
   ☐ Two-year or Associate's degree in: _____
   ☐ Four-year or Bachelor's degree in: _____
   ☐ Master's degree in: _____
   ☐ Other, please describe: _____
   ☐ Not applicable

2. Have you completed any non-degree or self-directed courses in web development? If yes, please list course titles or describe in brief.

   _____

   _____

   _____

3. Do you feel that your education prepared you for your current employment?

   ☐ Yes ☐ No ☐ Mixed

   Please explain why:

   _____

   _____

4. Do you plan to pursue any additional school or training?

☐ No additional school
☐ Vocational or certificate program
☐ Community college
☐ Four-year university
☐ Other, please describe_____

5. Are you currently enrolled in an educational program? (including online, MOOC, degrees, etc.) Please list.

_____

_____

Employment

1. Which of the following categories best describes your current employment status, **in web development**?

☐ Employed, working 40 or more hours per week
☐ Employed, working 20-39 hours per week
☐ Employed, working 1-19 hours per week
☐ Not employed, looking for work
☐ Not employed, NOT looking for work
☐ Other (please describe):
_____

2. What is your current job title? If not currently employed, what was your most recent job title?

_____

3. Do you currently have **other** occupations **not** related to web development? **If yes**, please list them below and write the number of hours per week for each occupation. **If no**, please write N/A.

Other Current Occupations:	Number of hours per week:

4. What are the most important reasons you are interested in the job area you chose? (Please check up to **three** reasons)

☐ Interest in field
☐ Location
☐ Salary/compensation
☐ Other, please describe_____
☐ Less training or additional school needed
☐ Rapid growth/number of jobs available
☐ Motivated to help society/people

5. How many years/months have you worked in web development?

Years_____ Months_____

6. Please indicate the overall length of time in years and months that you worked in each role or worked with each skill in the table below. Please give an example of a program or skill for each area (For example: CSS for Web design, graphics, GUI). If you haven't had experience in a role or skill, please write N/A.

Role/Skill	**Years/ Months**	**Example**
Managing a team		
Working individually		
Programming		
Web Design/ graphics/ GUI		
Back-end		

7. Please indicate your overall skill level for each role and skills related to web development below by using a scale ranging from "1" for novice to "4" for expert.

Role/Skill	**Novice 1**	**Beginner 2**	**Intermediate 3**	**Expert 4**
Managing a team				
Programming				
Web Design/ graphics/ GUI				
Back-end				

Background

1. How old are you in years?

_____

2. Gender:

_____

3. Growing up, how often did people in your home talk to each other in a language other than English?

☐ Never ☐ Once in a while ☐ About half of the time ☐ All or most of the time

4. With which of the following groups do you most strongly identify?

☐ American Indian or Alaska Native
☐ Asian or Pacific Islander
☐ Black or African American
☐ Hispanic / Latino/a
☐ White or Caucasian
☐ Other, please describe _____

Thank you!

Appendix F:
Survey Results

Table F1

General Self-Efficacy (GSE) Scale Means and Standard Deviations by Subgroup

Item	High school (*n* = 102-103)	Community college (*n* = 114-115)	Workforce (*n* = 83-84)
I can always manage to solve difficult problems if I try hard enough.	3.10 (.52)	3.23 (.61)	3.48 (.50)
If someone opposes me, I can find the means and ways to get what I want.	2.97 (.59)	2.88 (.77)	2.79 (.68)
It is easy for me to stick to my aims and accomplish my goals.	3.17 (.63)	3.31 (.69)	3.29 (.69)
I am confident that I could deal efficiently with unexpected events.	3.18 (.65)	3.34 (.75)	3.43 (.65)
Thanks to my resourcefulness, I know how to handle unforeseen situations.	3.12 (.65)	3.37 (.63)	3.46 (.59)
I can solve most problems if I invest the necessary effort.	3.39 (.63)	3.59 (.53)	3.67 (.47)
I can remain calm when facing difficulties because I can rely on my coping abilities.	3.04 (.75)	3.39 (.71)	3.46 (.65)
When I am confronted with a problem, I can usually find several solutions.	3.18 (.67)	3.30 (.70)	3.49 (.55)
If I am in trouble, I can usually think of a solution.	3.28 (.62)	3.47 (.65)	3.49 (.53)
I can usually handle whatever comes my way.	3.22 (.59)	3.40 (.62)	3.45 (.52)
Total GSE	31.66 (3.41)	33.31 (4.23)	33.99 (3.82)

Note. There were a few missing cases. Total GSE was calculated only when participant provided a valid response to all 10 items.

Table F2

Key Demographic Indicators for High School Profiles, Percentage by School

Context	*n*	Female (%)	Most frequently reported ethnicity (%)	Parent with bachelor's degree or higher (%)
School A: small charter school in a large city	17	41.2	Hispanic (94.1)	0.0
School B: large public high school in a small city	25	44.0	Hispanic (94.1)	16.0
School D: large public high school in a small city	31	51.6	Two or more ethnicities (32.3)	29.0
School E: a large public high school in a large city	30	70.0	Hispanic (53.3)	32.3

Table F3

High School Demographic Frequencies by School

Background variables	School A (*n* =17)	School B (*n* = 25)	School D (*n* = 31)	School E (*n* = 30)	All schools (%)
Age (*n* = 103)					
16	1	1	1	4	7 (6.8)
17	16	19	27	25	87 (84.5)
18	0	5	3	1	9 (8.7)
Gender (*n* = 102)					
Female	6	11	16	21	54 (52.4)
Male	10	14	15	9	48 (46.6)
Working computers/laptops at home (*n* = 103)					
0	0	2	0	2	4 (3.9)
1	8	3	5	11	28 (26.2)
2	6	9	11	9	35 (34.0)
3	2	7	11	2	22 (21.4)
4 or more	1	4	4	5	14 (13.6)
Ethnicity (*n =103)*					
American Indian or Alaska Native	0	0	0	0	0
Asian or Pacific Islander	1	2	0	1	4 (3.9)
Black or African American	0	2	8	7	17 (16.5)
Hispanic/Latina/o	15	9	9	16	49 (47.6)
White or Caucasian	1	5	4	1	11 (10.7)
Other	0	1	0	0	1 (1.0)
Two or more ethnicities selected	0	6	10	5	21 (20.4)

Table F4

High School Self-Reported Grades Frequencies by School

Grades	School A (*n* =17)	School B (*n* = 25)	School D (*n* = 31)	School E (*n* = 30)	All schools (%)
All classes (*n* = 101)					
Mostly A's	3	0	4	6	13 (12.9)
Mostly A's and B's	7	16	12	10	45 (44.6)
Mostly B's	3	5	3	3	14 (13.9)
Mostly B's and C's	4	2	9	10	25 (24.8)
Mostly C's or lower	0	0	3	1	4 (4.0)
English classes (*n* = 102)					
Mostly A's	4	5	11	12	32 (31.4)
Mostly A's and B's	7	12	9	7	35 (34.3)
Mostly B's	5	5	5	4	19 (18.6)
Mostly B's and C's	1	2	3	5	11 (10.8)
Mostly C's or lower	0	0	3	2	5 (4.9)
Math classes (*n* = 102)					
Mostly A's	5	5	6	3	19 (18.6)
Mostly A's and B's	5	6	7	9	27 (24.5)
Mostly B's	1	2	5	5	13 (12.7)
Mostly B's and C's	4	7	6	9	26 (25.5)
Mostly C's or lower	2	5	7	4	18 (17.6)

Table F5

High School Interest in Bright Outlook Careers, Frequencies by School

Career	School A (*n* =17)	School B (*n* = 25)	School D (*n* = 31)	School E (*n* = 30)	All schools (%)
Medical related					
Registered nurse	4	3	4	3	14 (16.5)
Dental hygienist	0	1	0	1	2 (2.4)
Biomedical engineer	1	3	1	2	7 (8.2)
Genetic counselor	0	2	0	0	2 (2.4)
Physical therapist	2	3	2	2	9 (10.6)
Medical assistant	3	3	2	5	13 (15.3)
Emergency medical technician	0	2	3	0	5 (5.9)
Tech-related					
Web administrator	0	0	1	0	1 (1.2)
Web developer	2	2	3	0	7 (8.2)
Computer and information systems manager	2	1	2	0	5 (5.9)
Video game designer	2	3	5	0	10 (11.8)
Computer systems analyst	3	2	0	0	5 (5.9)
Unrelated					
Tutor	1	0	2	0	3 (3.5)
Music therapist	0	0	0	0	1 (1.2)
Spa manager	1	0	0	0	1 (1.2)
Climate change analyst	0	0	0	0	0 (0.0)

Note. Students selected more than one.

Survey results pertaining to the web development community college participants are also presented by bootcamp participants (Site J) and traditional community college participants (Sites F and H).

Table F6

Frequency and Percentage of Community College Response to Survey Question, "Are your courses conducted online or in person?" by Career Domain

		Web development (*n* = 47)		
Response	EMT (*n* = 62)	Bootcamp (*n* = 19)	Traditional (*n* = 28)	Total
Online only	0	0	1 (100.0)	1 (100.0)
In person only	38 (65.51)	7 (12.06)	13 (22.41)	58 (100.0)
Online and in person	25 (49.01)	12 (23.52)	14 (27.45)	51 (100.0)

Note. Two EMTs did not report courses.

Table F7

Community College Responses to Survey Question, "Please list the courses you have completed relevant to your specific program of study," by Career Domain

		Web development	
Response	EMT (*n* = 63)	Bootcamp (*n* = 19)	Traditional (*n* = 28)
Mean number of courses reported	1.82	1.31	2.92
Examples	Anatomy, CPR, Fire Tech, Physiology	Web fundamentals, Python	Computer Science, HTML, CSS, Java

Note. One EMT did not report courses.

Table F8

Frequency and Percentage of Community College Future Schooling Plans by Career Domain

		Web development (*n* = 47)		
	EMT[a] (*n* = 63)	Bootcamp[b] (*n* = 19)	Traditional[c] (*n* = 28)	Total (*n* = 109)
No additional schooling	12 (46.0)	7 (26.9)	7 (26.2)	26 (100.0)
Community college	9 (81.8)	0	2 (18.2)	11 (100.0)
Vocational or certificate program	9 (56.3)	2 (12.5)	5 (31.3)	16 (100.0)
Four-year university	18 (56.3)	2 (6.3)	12 (37.5)	32 (100.0)
Other	15 (42.9)	8 (32.0)	2 (8.0)	25 (100.0)

Note. Only the highest degree or the "other" category are reported.

[a]For Other, EMT students reported paramedic school, Master's in physician assistant, medical school, or grad school, or "possibly, undecided." Vocational programs were Fire Academy or paramedic school. One EMT student did not answer this question.

[b]For Other, bootcamp web development students reported languages, online courses or MOOCs, MBA, or Master's degree/PhD in data science, or "possibly." Vocational programs were unspecified.

[c]For Other, community college web development students reported MOOC or unspecified grad school. Vocational programs were unspecified.

Table F9

Community College Highest Education Attained by Career Domain and School

		Web development (*n* = 47)		
	EMT (*n* = 64)	Bootcamp (*n* = 19)	Traditional (*n* = 28)	Total (*n* = 111)
High school or none	38	3	15	56
Certificate	4	0	4	8
Associate's	2	5	1	8
Bachelor's	18	9	7	34
Master's	1	1	1	3
Other	1	1	0	2
All	64	19	28	111

Note. It should be observed that in both career domains, participants frequently reported multiple lower degrees or certifications. Only the highest degree or the "other" category are reported.

Table F10

Frequency and Percentage of Community College Current Employment Status by Career Domain

Employment status	EMT (*n* = 63)	Web development (*n* = 46)		Total (*n* = 110)
		Bootcamp (*n* = 19)	Traditional (*n* = 28)	
Employed, working 40 or more hours a week	5 (38.5)	0	8 (61.5)	13 (100.0)
Employed, working 20-39 hours a week	17 (77.3)	0	5 (22.7)	22 (100.0)
Employed, working 1-19 hours a week	17 (63.0)	2 (7.7)	7 (26.9)	26 (100.0)
Not employed, looking for work	14 (56.0)	5 (20.0)	6 (24.0)	25 (100.0)
Not employed, NOT looking for work	8 (38.1)	11 (52.4)	2 (9.5)	21 (100.0)
Other	2 (8.7)	1 (4.3)	0	23 (100.0)

Note. One EMT student did not answer this question. Employment refers to jobs not related to their current field of study.

Table F11

Frequency and Percentage of Workforce Highest Education Attained by Career Domain

Highest education attained	EMT (*n* = 45)	Web developer (*n* = 39)
High school	7 (15.6)	5 (12.8)
Certificate	17 (37.8)	1 (25.6)
Associate	11 (24.4)	0 (0.0)
Bachelor's	10 (22.2)	25 (64.1)
Master's	0 (0.0)	6 (15.4)
Other	0 (0.0)	0 (0.0)
All	45 (100.0)	39 (100.0)

Note. It should be observed that in both career domains, participants frequently had multiple lower degrees or certifications. For example, 30 EMTs reported certificates but a degree "outranked" a certificate. For the web development group, participants listed many previous and current enrollments in online skills classes, as well as some programs and certification courses.

Table F12

Frequency and Percentage of Workforce Response to Survey Question, "Do you feel that your education prepared you for your current employment?" by Career Domain

Response	EMT (*n* = 45)	Web developer (*n* = 39)	Total (*n* = 84)
Yes	30 (66.7)	13 (33.3)	43 (51.2)
No	7 (15.6)	3 (7.7)	10 (11.9)
Mixed	8 (17.8)	23 (59.0)	31 (36.9)

Table F12 shows the frequency and percentage of participant responses to the question, "Do you feel that your education prepared you for your current employment?" Participants were also asked to explain why. Below are a few examples of participant responses:

> *EMT*: Yes. It prepared me for about 60% of my jobs as an EMT. However, as medicine is an art (something that will always be evolving), I think my education has given me resources to critical think and problem solve for what I am not prepared for.
>
> *EMT*: No. Ed[ucation] system focuses on passing tests and not thorough understanding.
>
> *EMT*: Mixed. I feel most pertinent skills are learned on the job, while education provides an intro/opens doors to those jobs.
>
> *Web Developer*: Yes. Education helped me develop problem-solving skills and programming skills.
>
> *Web Developer*: No. I believe my core aptitudes in logic reasoning prepared me. I am working outside my field of study.
>
> *Web Developer*: Mixed. Textbook and online tutorials don't accurate meet real world scenarios. Learned by working.

Table F13

Frequency and Percentage of Workforce Response to Survey Question, "When was the last time you completed continuing education courses to renew your EMT license?" (n = 44)

Year	Frequency	%
Never	3	6.7
2018	23	51.1
2017	13	28.9
2016	5	11.1

Note. There was one missing case.

Table F14

Frequency and Percentage of Workforce Response to Survey Question, "Are you currently enrolled in an educational program?" by Career Domain

Response	EMT (*n* = 45)	Web developer (*n* = 39)	Total (*n* = 84)
Yes	34 (75.6)	12 (30.8)	47 (58.3)
No	11 (24.4)	27 (69.2)	38 (45.2)

Note. For EMTs, this question specified "other than continuing education courses." For web developers, this question gave "online, MOOC [massive online open course], degrees, etc." as examples.

Table F15

Frequency and Percentage of Currently Enrolled Educational Programs Reported by Workforce EMTs (n = 45)

Program	Frequency	%
Paramedic	25	55.6
Other	9	20.0
None	11	24.4

Note. Other educational programs included associate's or bachelor's degrees in various fields, including biology, business administration, health science, Middle Eastern studies, linguistics, neuroscience, and public safety.

Table F16

Frequency and Percentage of Workforce Future Schooling Plans by Career Domain

Future schooling plans	EMT *(n* = 45)	Web developer *(n* = 39)	Total *(n* = 84)
No additional schooling	1 (2.2)	19 (48.7)	20 (23.8)
Community college	3 (6.7)	0 (0.0)	3 (3.6)
Vocational or certificate program	6 (13.3)	6 (15.4)	12 (14.3)
Four-year university	19 (42.2)	0 (0.0)	19 (22.6)
Other	16 (35.6)[a]	14 (35.9)[b]	30 (35.7)

Note. Only the highest degree or "other" are reported.

[a]For Other, EMTs reported paramedic school, master's in computational linguistics, master's in physician assistant, Ph.D. in biochemistry, medical school, or grad school (unspecified field), or "possibly."

[b]For Other, web developers reported online courses, project management, master's degree (unspecified field), code academy, Amazon Web Services certification, or "don't know yet" or "if the opportunity arises."

Table F17

Frequency and Percentage of Current Employment Status as an EMT/Web Developer by Career Domain

Employment status	EMT (*n* = 45)	Web developer (*n* = 39)	Total (*n* = 84)
Employed, working 40 or more hours a week	14 (31.1)	29 (74.4)	43 (51.2)
Employed, working 20-39 hours a week	9 (20.0)	0 (0.0)	9 (10.7)
Employed, working 1-19 hours a week	7 (15.6)	6 (15.4)	13 (15.5)
Not employed, looking for work	1 (2.2)	4 (10.3)	5 (6.0)
Not employed, NOT looking for work	14 (31.1)	0 (0.0)	14 (16.7)
Other	0 (0.0)	0 (0.0)	0 (0.0)

Note. Participant responses may not be accurate. For instance, 24 of the EMTs were recruited from a full-time paramedic program in which, during informal conversation, we learned that they had all recently resigned to enroll; however, responses from the 24 varied widely. Additionally, three EMT respondents wrote in "recently resigned" or "full time school" or equivalent and were recoded into the "Not employed, not looking for work" category.

Table F18

Frequency and Percentage of Workforce Response to Survey Question, "Do you currently have other occupations [aside from EMT/not related to web development]?" by Career Domain

Response	EMT (*n* = 45)	Web developer (*n* = 39)	Total (*n* = 84)
Yes	15 (33.3)	5 (12.8)	20 (23.8)
No	26 (57.8)	20 (51.3)	46 (54.8)
Not reported	4 (8.9)	14 (35.9)	18 (21.4)

Note. For EMTs, other occupations included clinical or skills instructor, self-employed, tutor, lifeguard, ride-share driver, firefighter, handyman/plumber, dental technician, dishwasher, resident adviser, and performing artist. For web developers, other occupations included ride-share driver, electric scooter charger, film/TV composer, producer/artist relations, andenterprise resource planning developer.

Table F19

Frequency and Percentage of Workforce Response to Survey Question, "What are the most important reasons you are interested in the job area you chose?" by Career Domain

Response	EMT (*n* = 45)	Web developer (*n* = 39)
Interest in field	40 (88.9)	30 (76.9)
Location	6 (13.3)	7 (17.9)
Salary/compensation	15 (33.3)	25 (64.1)
Less training or additional school needed	0 (0.0)	5 (12.8)
Rapid growth/number of jobs available	8 (17.8)	19 (48.7)
Motivated to help society/people	40 (88.9)	6 (15.4)
Other	15 (33.3)[a]	1 (2.6)[b]

Note. Responses are not mutually exclusive. Participants were asked to choose up to three reasons, however a few marked four or five.

[a]For Other, EMT responses included passion, lifestyle, fits personality, stepping stone for future jobs, fire, experience in emergency settings, experience applicable to medicine, personal reasons, excitement, and brotherhood.

[b]For Other, the web developer response was "I like puzzles."

Table F20

Workforce Descriptive Results of Total Months Working in an Occupation by Career Domain

Response	*n*	Minimum	Maximum	*M*	*SD*
EMT	45	9	140	34.0	25.3
Web developer	39	6	270	87.2	77.2

Table F21

Frequency and Percentage of Workforce Experience Managing a Team in Occupation by Career Domain

Response	EMT (*n* = 45)	Web developer (*n* = 39)
Yes	9 (20.0)	20 (51.3)
No	36 (80.0)	19 (48.7)

Note. Responses to other skills for web developers are not reported due to inconsistencies in participant responses.

Table F22

Frequency and Percentage of Workforce Response to Survey Question, "Growing up, how often did people in your home talk to each other in a language other than English?" by Career Domain

Response	EMT *(n* = 45)	Web developer *(n* = 39)	Total *(n* = 84)
Never	17 (37.8)	9 (23.1)	26 (31.0)
Once in awhile	6 (13.3)	7 (17.9)	13 (15.5)
About half of the time	8 (17.8)	13 (13.3)	21 (25.0)
All or most of the time	13 (28.9)	10 (25.6)	23 (27.4)
Not reported	1 (2.2)	0 (0.0)	1 (1.2)

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