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Re-examining Adult Education and Training Participation by Education, Literacy, Gender, and Race/Ethnicity in the U.S.

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Abstract

This study examined the associations between adult education and training (AET) participation, educational attainment, literacy skills, gender, and race/ethnicity among the U.S. adult population aged 25 to 65 years old (n = 5,450). Given the socioeconomic advancements of women and racial/ethnic minorities in the last few decades, including higher educational attainment, increased labor force participation, and greater income, and as new data becomes available, it is important to re-examine AET participation by

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gender and race/ethnicity in the U.S while controlling for educational attainment and literacy skills. This study employed the 2012/2014 Program for International Assessment of Adult Competencies (PIAAC) public-use file (PUF). Binary logistic regression was used to examine (1) any AET, (2) formal AET, and (3) non-formal AET across all variables of interest. Indeed, educational attainment and literacy skills are associated with greater AET participation. Further analyses showed that more women than men participated in all forms of AET, and there were some variations in AET participation by racial/ethnic minorities. More Black, Hispanic, and other racial/ethnic minority adults participated in formal AET, and more Black adults participated in all forms of AET, compared to their White counterparts. This study also provides within-race/ethnicity group variations.

Keywords
Adult education and training, education, gender, lifelong learning, literacy, PIAAC, race/ethnicity

Introduction

Adult education and training (AET), which has been used interchangeably with the term *lifelong learning* (LL), is regarded as any form of learning throughout an adult's life course (Boeren, 2017; Desjardins, 2010; Rubenson, 2011). AET is an opportunity for adults to acquire new knowledge and skills, which are linked to individual-level well-being (e.g., economic benefits, health benefits, civic engagement) as well as societal-level well-being (e.g., economic growth, increased productivity, skilled labor force) (UNESCO, 2016). However, AET is not equally accessible to all adults due to individual barriers like low socioeconomic status (SES) (e.g., education, income) and structural barriers like limited access to learning environments and social discriminations (Boeren, 2017; Lee & Desjardins, 2019). Generally, being a woman, a racial/ethnic minority, an older adult, an immigrant/non-native speaker, unemployed, or having lower economic resources are known barriers to AET participation (Boeren, 2017; Brine, 2006; Desjardins, 2010). Importantly, educational attainment and literacy proficiency are considered consistent determinants of AET participation (Desjardins, 2020b).

Yet, little is known about the potentially different roles of educational attainment and literacy proficiency across subgroups. In the last few decades, as growing numbers of women and racial/ethnic minorities have acquired greater SES, such as advanced degrees, increased labor force participation, and income (Fry, 2019; Manuel Krogstad & Radford, 2018; U.S. Bureau of Labor Statistics, 2019), it is important to re-examine the AET participation among women and racial/ethnic minorities as well as the roles of other known determinants including educational attainment and literacy skills. Additionally, there is limited literature on the examination of AET participation between specific racial/ethnic groups such as Black, Hispanic, and other minority groups. Therefore, the aim of this study is to re-examine AET participation with a specific focus on gender and race/ethnicity. The paper will (1) provide a review of the literature on the relationship between

AET, educational attainment, literacy proficiency, gender, and race/ethnicity; (2) describe the LL theoretical model developed by Boeren et al. (2010); (3) outline the research questions and hypotheses; (4) detail the data and analytic plan, (5) report the results, and then (6) conclude with the discussion including recommendations for future research, limitations, and policy implications.

AET participation: Types, benefits, and contributing factors

AET can be classified into three types—(1) formal, (2) non-formal, and (3) informal—based on the learning activities and the settings in which they take place (UNESCO, 2016). *Formal AET* (e.g., degree/certificate program) is structured, organized, and intentional learning that occurs in an educational institution, such as a college or university, and the goal is to earn recognized credentials (Commission of the European Communities, 2000). *Non-formal AET* (e.g., job-related training, public lectures, workshops) is also structured, organized, and intentional learning (Commission of the European Communities, 2000). It can occur within or alongside of an educational institution, but it does not lead to any recognized credentials. *Informal AET* (e.g., visiting a museum, reading a book, listening to the radio) includes unstructured, unorganized, and occasionally unintentional learning that occurs in daily life, and it does not lead to any recognized credentials (Commission of the European Communities, 2000).

Generally, the most known advantages of AET participation are the economic benefits, such as greater employment opportunities and income (Brine, 2006; Cedefop, 2016; Schuller et al., 2010). AET promotes these economic benefits by enhancing one's human capital, such as basic and job-related skills and knowledge (Becker, 1962; Tan, 2014). Whether an individual possesses lower or higher skills, those who participate in AET receive similar positive economic returns, including, but not limited to, higher wages, career advancements, and lower risk of unemployment (Fouarge et al., 2012). Overall, given the current knowledge-based economy in which the economic developments are driven by new information, technological advancements, and scientific innovations, AET has become more imperative for adults.

AET is also related to a range of other non-economic benefits. AET develops and reinforces crucial basic skills, such as reading, writing, and critical thinking, which promotes participation in civic life including voting, volunteering, and community building (Rüber et al., 2018; Schreiber-Barsch & Mauch, 2019; Vera-Toscano et al., 2017). Rüber et al. (2018) observed that adults who possessed higher skills and participated in AET were likely to have higher interpersonal trust, or the confidence that other people will act with good intentions, which is a key driver of civil society and democracy. Additionally, AET and basic skills were positively related to health and well-being, such as better health information seeking skills and usage (Schuller et al., 2010).

Despite the wide range of evident benefits from AET participation, certain subpopulations face unequal chances of AET participation. Importantly, Desjardins (2020b) asserted that educational attainment and literacy proficiency were the well-known determinants of AET participation, above and beyond other sociodemographic characteristics (e.g., age, gender, race/ethnicity, employment status, income). Additionally, a

series of psychological and contextual factors including the attitude and motivation to learn, the quality and access to learning environments (e.g., cost, time, location), employer support (e.g., tuition remission, family leave policies), local and national welfare programs (e.g., social security benefits), and previous AET experiences collectively contributed to the chances of AET participation (Boeren, 2017; Brine, 2006; Desjardins, 2010). Whereas inequality in AET participation has been long recognized, the rates of participation need to be constantly monitored as new data becomes available. Given the last few decades of notable social changes, such as growing educational attainment and labor force participation by women and racial/ethnic minorities, re-examining the AET participation of women and racial/ethnic minorities is important. Furthermore, exploring the within-racial/ethnic group differences is arguably an important area of inquiry for better understanding the inequality in AET.

Educational attainment and AET

Educational attainment has been consistently linked to AET participation. Individuals with a postsecondary degree or higher are likely to engage in further learning. In the 2016 National Household Education Survey on AET, Cronen et al. (2017) found that 31% of people with a bachelor's degree and 49% of people with a graduate or professional degree also had a non-degree or job-related certificate/license—an indicator of AET—compared to 17% of people with only a high school diploma. Moreover, formal education programs are likely to have certificate programs, which may explain the relationship between educational attainment and AET participation. Heisig and Solga (2017) added that higher educational attainment enabled individuals to improve their baseline knowledge and foundational skills (e.g., literacy, numeracy) and prepared them to participate in subsequent AET. Successful educational program completion was also likely to lead to positive attitudes towards AET (Illeris, 2006). Brooks and Everett (2008) added that higher education promoted goal-oriented mindsets and self-efficacy, or the confidence to achieve educational goals, for example, further degree attainment. Also, norms within one's social network, such as family's attitudes toward education, as well as the parent's or guardian's own educational attainment, were associated with further LL (Boeren et al., 2010).

Literacy and AET

Hanemann (2015, p. 299) referred to literacy as, "The (cap)ability of putting knowledge, skills, attitudes and values effectively into action when dealing with (handwritten, printed or digital) text." In other words, literacy is a basic skill that allows adults to make sense of and use information found in written materials for addressing practical matters. Literacy proficiency and the use of literacy skills, such as reading or writing an article, book, or email, reinforce each other overtime (Reder et al., 2020). For example, the more a person reads or writes, the greater their literacy proficiency and vice versa. Further, literacy proficiency is more than the "literate" versus "non-literate" dichotomy, but instead it is a continuum of basic skills and LL that can be improved over the life course (Hanemann,

2015; Rubenson, 2011). Therefore, literacy proficiency is one of the prerequisites for, as well as a by-product of, AET participation.

Individuals with lower literacy proficiency are less likely to participate in AET than those with higher literacy proficiency (Desjardins, 2020b). There are two primary explanations for this relationship. First, greater literacy proficiency is associated with higher income and lower risk of unemployment (OECD, 2016a). Grotlüschen et al. (2016) explained that individuals with lower SES had limited financial resources to participate in learning activities, including but not limited to, private classes, workshops, and seminars. Also, Desjardins (2020a) found that since most AET opportunities were employer sponsored, individuals who were unemployed had a lower chance of participating in AET. Further, individuals who were employed in lower-skilled jobs (e.g., manual labor, service work) also had a lower chance of participating in AET because more job-related AET opportunities were often allocated to individuals in higher-skilled jobs. Second, Illeris (2006) posited that lower-skilled individuals tend to have negative educational experiences in their earlier lives and, as a result, are discouraged from participating in AET later in life. On a related note, while literacy skills are closely linked to educational attainment, both of which are malleable at any life stage, improving educational attainment in adult life is more difficult than improving literacy skills.

AET participation by gender and race/ethnicity

Historically, in the U.S., women and racial/ethnic minorities have lower AET participation rates compared to men and Whites, respectively. However, women make up half the population, and racial/ethnic minorities, including immigrants, have been steadily growing segments of the population. As of 2019, racial/ethnic minorities make up nearly 40% of the U.S. population, and over 13% of the total population are foreign born (U.S. Census Bureau, 2019). Additionally, educational attainment, as well as labor force participation, by women and racial/ethnic minorities have increased in the last decades (NCES, 2019; Hipple, 2016). Women's educational attainment rate surpassed men's in the early 2010s. As of 2019, 37% of women and 35% of men had a 4-year college degree or higher (Duffin, 2021). Similarly, the ratio of men to women in the workforce was 1.7 in the 1960s and dropped to 1.2 in 2018 (U.S. Bureau of Labor Statistics, 2019). Finally, recent data showed that women invest more in skills acquisitions than men (Fry, 2019; Massing & Gauly, 2017).

Yet, women tend to face more economic disadvantages than men, which may result in missed employer sponsored AET opportunities. Boeren (2011) asserted that women were more likely to experience unemployment or temporary leave of absence due to greater caregiving responsibilities than men, which explained lower AET participation rates among women. Also, women's lower participation may be due to the complications from women's economic disadvantages, such as working part-time, receiving lower wages, and being employed in lower-skilled occupations (Boeren, 2011). Further, women were perceived as investing less in their human capital (e.g., knowledge, skills) than men (Grönland, 2012).

Grönland (2012) found that female-dominated occupations, for example, secretaries and administrative assistants, generally had less AET requirements than male-dominated occupations, and women generally received less AET opportunities than men despite being employed in similar occupations overall. Huber and Huemer (2015) claimed that married women and women with children participated less in AET compared to married men and men with children. Acker (2006) found that men who were married and had children were perceived as hardworking and deserving of additional AET, whereas women who were married and had children were perceived as less serious candidates of AET. At the same time, Massing and Gauly (2017) observed that having children was positively associated with AET participation among employed women in the U.S. compared to other developed countries.

Race/ethnicity also requires more attention in the field of adult education in relation to SES (Johnson-Bailey & Cervero, 2000). As AET participation can be partially explained by income, employment, and job skill levels, racial/ethnic minorities are more likely to be employed in lower-skilled jobs, have lower-income, and face workplace discrimination compared to Whites (Knipprath & De Rick, 2015). Additionally, AET participation among immigrants (non-Hispanic/Hispanic Latinos/as, hereafter) are likely to be lower, in part, due to English language proficiency, differences in foreign education credentials, and self-efficacy/confidence in an English-speaking setting (Batalova & Fix, 2015). At the same time, these potential explanations are not inclusive of all racial/ethnic minority groups.

Boeren et al. (2010) stated that AET is often marked by the Matthew effect, which is the notion that individuals with higher human capital and financial resources are likely to acquire additional knowledge, skills, and resources. However, Knipprath and De Rick (2015) discussed that individuals who lacked human capital and financial resources, but were aware of this, relied on social capital, such as support from friends, family, and their communities, to engage in AET. Mishra (2020) added that social capital may be particularly important to racial/ethnic minorities including Blacks, Hispanics, and Native Americans, who rely on family and peer support to achieve positive educational outcomes. Community support is necessary particularly for those whose family and peers may have negative attitudes toward education and learning. Foremost, support from family and friends were likely to motivate individuals to pursue AET (Boveda, 2019). Indeed, across all race/ethnicities, lower SES families value education overall, and arguably, for possible upward social mobility (Mishra, 2020; Rondini, 2016).

Theoretical model of LL

This study applied the theoretical model of LL/AET participation developed by Boeren et al. (2010), which is an integrated model based on core socioeconomic, cultural, and psychological dimensions from multiple theories. The chances of AET participation are unequal across subgroups based on a variety of socioeconomic factors at (1) the individual level (e.g., age, gender, race/ethnicity, education/skills, employment, income, motivation), (2) the local level (e.g., employer sponsored programs, access to learning activities, flexibility for learning styles, funding for learning) and (3) the societal level (e.g., programs and policies that support adult learners) (Boeren, 2017).

At the core of the cultural dimension, which is partially based on Bourdieu's (1973) (as cited in Boeren et al., 2010) sociological concept of cultural and social capital, individuals will pursue AET if learning is seen as valuable for themselves or among their own family and other social networks. At the same time, individuals with higher SES are likely to possess greater cultural value, resources, and social support for learning, and therefore, have more advantages in the education systems, than those with lower SES (Bourdieu, 1973). At the core of the psychological dimension, which is partially based on Keller's (1987) (as cited in Boeren et al., 2010) concept of motivation, individuals are driven by intrinsic (e.g., joy of learning, personal development) and extrinsic (e.g., higher income, career advancement) motivations to improve social and economic well-being, through AET (Courtney, 1992). Altogether, socioeconomic, cultural, and psychological dimensions make up the theoretical model of LL/AET by Boeren et al. (2010).

At the same time, some adults may not be ready to engage in AET due to the lack of foundational knowledge and skills, as well as differences in educational attainment. Likewise, individuals may face reduced learning opportunities and societal barriers, such as income inequality, gender, and racial discrimination, as well as lack of personal and professional support for AET. Resulting, in part, from the interconnections of AET participation determinants, women and racial/ethnic minorities are likely to have lower AET participation. However, given the demographic trends of women and racial/ethnic minorities, AET participation with an emphasis on gender and race/ethnicity needs to be re-examined.

Research questions and hypothesis

Based on the literature and theoretical model of LL/AET participation, the research questions are derived and summarized in the operationalized conceptual model (see Figure 1). The objective of this research study was to document the AET participation among gender and racial/ethnic minorities. This study analyzed the nationally representative data of adults in the U.S. and contributed to the adult education literature by (1) re-examining the role of key AET participation determinants, specifically, educational attainment and literacy skills, as well as (2) updating and documenting AET participation by gender and racial/ethnic minorities. To achieve these goals, this study addressed the following research questions:

RQ1: What are the characteristics of AET participants and non-AET participants among the U.S. adult population?

RQ2: Is there an association between educational attainment and AET participation among the U.S. adult population?

RQ3: Is there an association between literacy skills and AET participation among the U.S. adult population?

RQ4: Is there an association between gender and AET participation, after controlling for educational attainment and literacy skills, among the U.S. adult population?

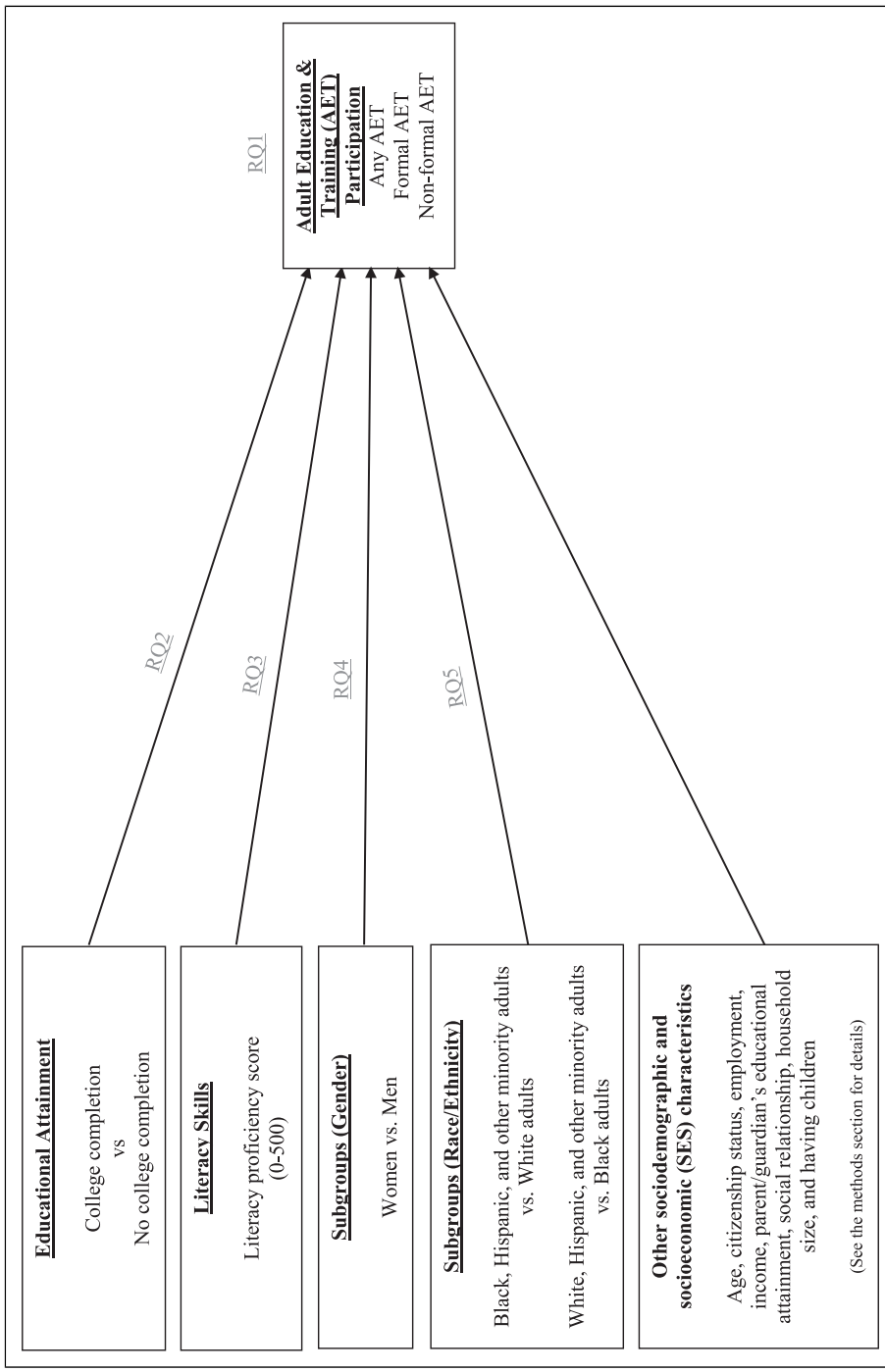

Figure 1. Operationalized conceptual model of the current study.

RQ5: Is there an association between racial/ethnic minorities and AET participation, after controlling for educational attainment and literacy skills, among the U.S. adult population?

It is hypothesized that (1) there is a positive association between educational attainment and AET. (2) There is a positive association between literacy skills and AET. (3) AET participation varies by gender across different AET types. Lastly, (4) AET participation varies by race/ethnicity across different AET types.

Methods

Data

The data were from the Program for International Assessment of Adult Competencies (PIAAC) 2012/2014 U.S. public-use file (PUF) (Holtzman et al., 2017). PIAAC is a large-scale assessment of basic skills administered to over 30 countries and conducted under the auspices of the Organization for Economic Cooperation and Development (OECD). PIAAC data provides nationally representative estimates of basic skills including literacy, numeracy, and digital problem-solving skills, along with general demographic, SES, and behavioral information among adults aged 16- to 74-years old. The detailed study design and sampling strategy has been published elsewhere (Hogan et al., 2016). The U.S. PIAAC samples with age 25- to 65-years old were selected to reflect AET participation after formal postsecondary education, which most adults complete by late twenties (Desjardins, 2010). The total sample size in the data was 8670. After excluding the cases outside of the 25- to 65-years old age group (n = 2787) and missing AET participation information (n = 131), as well as any covariates (n = 302), the final analytic sample size was 5450. We considered the missing data were not of a major concern as the rate of missing was approximately 5% given the eligible participants who met the age criteria and had AET participation information, and there were no appreciable missing data patterns.

Measures

Outcome variables: AET measures (three variables). AET participation was recorded as a dichotomous measure indicating whether a respondent has participated in AET in the last 12 months (yes or no) preceding the survey. This study considered three types of AET participation: (1) any (formal and/or non-formal), (2) formal, and (3) non-formal. In PIAAC, formal AET is defined as participation within an organized educational/training institution where the objective is to obtain formal credentials (e.g., degree/certificate program). Non-formal AET is defined as participation within an organized educational/training institution but there is no objective of obtaining formal credentials (e.g., job-related training, professional development workshops, and private tutor) (OECD, 2014; 2019).

Predictor variables: Educational attainment and literacy (two variables). Educational attainment was a dichotomous measure indicating whether respondents have a college degree

or higher (bachelor's, graduate, or professional degree) or less than a college degree. PIAAC provides literacy scores in the set of 10 plausible values ranging from 0 (least) to 500 (most proficient). Plausible values were statistically estimated literacy proficiency based on the PIAAC respondents' performance on the computer adaptive skill assessment (OECD, 2016b). In other words, the respondents were asked to complete literacy-specific tasks to demonstrate their literacy proficiency. Based on the correct answers, item difficulty, and individual characteristics (e.g., age), the statistical model returned 10 sets of the most likely literacy proficiency scores (i.e., plausible values), instead of one point estimate that is common in conventional statistical data analysis. All of 10 plausible values are used in any subsequent statistical analysis with the PIAAC data.

Subgroups (four variables). Gender was a dichotomous measure of women (reference group = men). Race/ethnicity was measured as a series of dichotomous measures indicating Black, Hispanic, and Other (reference group = White).

Covariates. Age was measured in a 10-year band from 25- to 65-years old. Citizenship/nationality was measured as a dichotomous measure of U.S. born (reference group = foreign born). Employment status was measured as a dichotomous variable (employed vs. unemployed or out of the labor force). Income was measured in the ordinal measure with six levels—the quintile (five levels) plus no income. Since the PIAAC did not collect income information from those who are unemployed or out of the labor force, they were classified as no income, instead of a missing value, to include them in the analysis. Parent/guardian's educational attainment was measured as a dichotomous variable where at least one parent (mother/female guardian or father/male guardian) had a college degree or higher (reference group = less than a college degree). Living with a spouse/partner was measured as a dichotomous variable (yes/no). The number of household members was measured as a count variable (1–7; top-coded at 7). Lastly, having a child/ren was measured as a dichotomous variable (yes/no).

Analytic plan

The International Database Analyzer (IDB Analyzer) version 4.0.14 (IEA, 2017) and SAS version 9.4 (Copyright 2013, SAS Institute, Inc.) were used for all analyses. IDB analyzer takes the PIAAC sampling weights, replicates weights, and plausible values into account, and generates the SAS macro programs to estimate the nationally representative figures of descriptive summary and statistical models. The weighted descriptive statistics and bivariate significance tests by three types of AET participation were estimated. To conduct the hypothesis testing, the survey-weighted binary logistic regression model (DeMaris, 2004) was used to examine the association between the respective AET measures and variables of interest. First, an unconditional model, which included educational attainment and literacy skills for each AET participation measures were evaluated. Second, a partially conditional model, which included literacy skills, educational attainment, gender, and race/ethnicity were evaluated. Third, all covariates were in the fully conditional model. A two-way and three-way interaction effect using binary logistic

Table 1. Descriptive summary by each adult education and training (AET) participation measures.

	Any AET		Formal AET		Non-formal AET	
	Yes *n* = 3238 (59.41%)	No *n* = 2212 (40.59%)	Yes *n* = 928 (17.03%)	No *n* = 4522 (82.97%)	Yes *n* = 2962 (54.35%)	No *n* = 2488 (45.65%)
Variables	Mean (SE) or percentage	Mean (SE) or percentage	Mean (SE) or percentage	Mean (SE) or percentage	Mean (SE) or percentage	Mean (SE) or percentage
Literacy (0–500)	[a]		[a]		[a]	
	286.06 (1.21)	253.22 (1.63)	287.09 (1.90)	270.90 (1.14)	286.76 (1.19)	255.25 (1.65)
Educational attainment	[a]		[a]		[a]	
College degree or higher	54.70%	23.53%	55.17%	40.39%	55.69%	25.02%
Less than a college degree	45.30%	76.47%	44.83%	59.61%	44.31%	74.98%
Gender	NS		[a]		NS	
Women	52.04%	51.51%	58.53%	50.71%	51.75%	51.94%
Men	47.96%	48.49%	41.47%	49.29%	48.25%	48.06%
Race/ethnicity	[a]		[a]		[a]	
White	69.46%	65.17%	57.67%	69.47%	70.74%	63.84%
Black	12.07%	10.16%	17.65%	10.26%	11.69%	10.83%
Hispanic	10.30%	18.32%	12.07%	13.66%	9.83%	18.22%
Other racial/ethnic minority	8.17%	6.35%	12.61%	6.60%	7.73%	7.11%
Age group (10-year band)	[a]		[a]		[a]	
	3.37 (.02)	3.70 (.02)	2.87 (.04)	3.61 (.01)	3.41 (.01)	3.63 (.02)
Immigration status	[a]		NS		[a]	
U.S. born	86.58%	80.16%	84.97%	83.92%	87.05%	80.11%
Foreign born	13.42%	19.84%	15.03%	16.08%	12.95%	19.89%
Employment status	[a]		NS		[a]	
Employed	87.81%	61.97%	80.25%	77.28%	89.33%	62.26%
Unemployed	12.19%	38.03%	19.75%	22.72%	10.67%	37.74%
Income group (1–6: None to highest quintile)	[a]		[a]		[a]	
	2.79 (.04)	1.48 (.04)	2.14 (.07)	2.30 (.04)	2.88 (.04)	1.48 (.05)
Parent/guardian's educational attainment	[a]		[a]		[a]	
College degree or higher	43.88%	25.54%	45.21%	35.29%	43.80%	27.30%
Less than a college degree	56.12%	74.46%	54.79%	64.71%	56.20%	72.70%
Living with a spouse or partner	NS		[a]		[a]	
Yes	70.09%	68.45%	62.85%	70.56%	71.03%	67.36%
No	29.91%	31.55%	37.15%	29.44%	28.97%	32.64%
Number of household members	NS		NS		[a]	
	3.04 (.03)	3.13 (.05)	3.13 (.07)	3.07 (.03)	3.02 (.03)	3.03 (.03)
Having children	[a]		[a]		[a]	
Yes	72.86%	80.88%	63.31%	78.12%	73.30%	79.57%
No	27.14%	19.12%	36.69%	21.88%	26.70%	20.43%

n = unweighted sample sizes; SE = Standard Error. NS indicates not statistically significant association between AET measure and variable of interest ($p > .05$). The sampling weights and replicate weights were applied.
[a] indicates statistically significant association between AET measure and variable of interest ($p < .05$).

regression was conducted to evaluate the intersection of gender, race/ethnicity, and education attainment (or literacy skills) in all models. However, none of these interaction effects yielded statistically significant results. Therefore, the interaction terms were excluded. The predictive accuracy of the models was evaluated by the area under the receiver operating characteristics (AU-ROC) curve and the Hosmer and Lemeshow (2013) criteria (>.70 = acceptable; > .80 = excellent; > .90 = outstanding predictive accuracy). A multicollinearity was assessed using the variation inflation factor < 10 for each of the models. None of the final models had evidence for multicollinearity. A series of sensitivity analyses with alternative model specifications (e.g., with and without parents' education) and measures (e.g., total years of education) showed consistent results. Lastly, we followed up the results using the Blinder–Oaxaca decomposition technique, which partitions the group differences in the explained and unexplained parts by the covariates, to explore the key group differences in AET participation by gender, race, and college-level educational attainment (Lewis & Ezoua, 2016). We used the minimum of 10% of the explained variability to identify important covariates to describe the group differences. It should be noted that the Blinder–Oaxaca decomposition was conducted with the unweighted data.

Results

Descriptive statistics

Table 1 shows the weighted descriptive statistics and bivariate significance test results for each of the three AET measures, which addresses RQ1. Generally, 59.41% of all respondents participated in either formal or non-formal AET, or both. Specifically, there were more respondents who participated in non-formal AET (54.35%) than formal AET (17.03%). Overall, AET participation varied by literacy skills, educational attainment, race/ethnicity, age, income, parent/guardian's educational attainment, and having children. Educational attainment and literacy skills were associated with all forms of AET. Of the subgroups of interest, gender was only associated with formal AET, whereas race/ethnicity was associated with all forms of AET.

Educational attainment, literacy proficiency, and AET measures

Tables 2–4 provide the estimated odds ratios (OR) of the binary logistic regression models for each of the respective AET measures, which addresses RQ2 and RQ3. Of note, the models for each of the AET measures had an AU-ROC curve of >.70, which is considered acceptable. For RQ2, there was a significantly positive association between educational attainment and each of the respective AET measures. Adults with a college degree or higher had higher odds of participating in any (OR = 2.28, SE = .22, $p < .05$), formal (OR = 1.61, SE = .24, $p < .05$), and non-formal AET (OR = 2.24, SE = .17, $p < .05$) in the last 12 months preceding the survey. Therefore, the first research hypothesis was supported. Regarding RQ3; there was a significantly positive association between literacy proficiency and the AET measures. Every additional point in the literacy proficiency was

Table 2. Estimated odds ratios from the binary logistic regression models of any adult education and training participation.

Variables	Model 1A OR (SE)	Model 2A OR (SE)	Model 2B OR (SE)	Model 3A OR (SE)	Model 3B OR (SE)
Educational factors					
Literacy score (0–500)	1.01 (.01)[a]	1.01 (.01)[a]	1.01 (.01)[a]	1.01 (.01)[a]	1.01 (.01)[a]
College degree or higher (vs. less than a college degree)	2.62 (.22)[a]	2.62 (.22)[a]	2.62 (.22)[a]	2.28 (.22)[a]	2.28 (.22)[a]
Subgroups					
Women (vs. men)	—	0.99 (.08)	0.99 (.08)	1.37 (.13)[a]	1.37 (.13)[a]
White	—	-	0.54 (.07)[a]	-	0.50 (.07)[a]
Black	—	1.84 (.23)[a]	-	2.00 (.26)[a]	-
Hispanic	—	1.19 (.14)	0.65 (.10)[a]	1.19 (.15)	0.60 (.08)[a]
Other racial/ethnic minority	—	1.33 (.18)[a]	0.72 (.12)	1.55 (.23)[a]	0.77 (.14)
Covariates					
Age group (10-year band)	—	—	—	0.84 (.03)[a]	0.84 (.03)[a]
U.S. born (vs. foreign born)	—	—	—	1.40 (.16)[a]	1.40 (.16)[a]
Employed (vs. unemployed)	—	—	—	2.03 (.25)[a]	2.03 (.25)[a]
Income group (1–6: None to highest quintile)	—	—	—	1.26 (.04)[a]	1.26 (.04)[a]
Parent/guardian's college degree or higher (vs. less than a college degree)	—	—	—	1.20 (.09)[a]	1.20 (.09)[a]
Living with a spouse (yes vs. no)	—	—	—	1.06 (.08)	1.06 (.08)
Number of household members	—	—	—	0.98 (.02)	0.98 (.02)
Having children (yes vs. no)	—	—	—	0.91 (.08)	0.91 (.08)

The models predicted the odds of participating in any AET. Note: Models 2A–3A uses Whites as the reference category for Black, Hispanics, and Others; models 2B–3B uses Black as the reference category for Whites, Hispanics, and Others. OR = Odds ratio [obtained by exp(the estimated regression coefficient)]; SE = Standard error (associated with the estimated regression coefficient).

[a] indicates statistically significant association between the AET measure and variable of interest ($p < 0.05$). The PIAAC final sampling weights and replicate weights were applied.

associated with 1.01 times odds (SE = .01, $p < .05$) of participating in each of the AET measures compared to adults with lower literacy proficiency. Thus, the second research hypothesis was supported.

Gender, racial/ethnic minorities, and AET measures

Tables 2–4 provide the results for RQ4 and RQ5. For RQ4, there was a significantly positive association between gender and participating in formal AET when controlling for all variables. Women had at least 1.31 times odds (SE = .11, $p < .05$) of participating in all three types of AET than men. Accordingly, the third research hypothesis was supported. Regarding racial/ethnic differences (RQ5), the findings were somewhat mixed. For any

Table 3. Estimated odds ratios from the binary logistic regression models of formal adult education and training participation.

Variables	Model 1A OR (SE)	Model 2A OR (SE)	Model 2B OR (SE)	Model 3A OR (SE)	Model 3B OR (SE)
Educational factors					
Literacy score (0–500)	1.01 (.01)[a]	1.01 (.01)[a]	1.01 (.01)[a]	1.01 (.01)[a]	1.01 (.01)[a]
College degree or higher (vs. less than a college degree)	1.46 (.19)[a]	1.35 (.18)[a]	1.35 (.18)[a]	1.61 (.24)[a]	1.61 (.24)[a]
Subgroups					
Women (vs. men)	—	1.37 (.12)[a]	1.37 (.12)[a]	1.32 (.11)[a]	1.32 (.11)[a]
White	—	-	0.34 (.04)[a]	-	0.41 (.06)[a]
Black	—	2.92 (.35)[a]	-	2.46 (.34)[a]	-
Hispanic	—	1.71 (.24)[a]	0.59 (.08)[a]	1.38 (.21)[a]	0.56 (.10)[a]
Other racial/ethnic minority	—	2.60 (.34)[a]	0.89 (.14)	2.42 (.41)[a]	0.98 (.19)
Covariates					
Age group (10-year band)	—	—	—	0.56 (.03)[a]	0.56 (.03)[a]
U.S. born (vs. foreign born)	—	—	—	1.32 (.17)[a]	1.32 (.17)[a]
Employed (vs. unemployed)	—	—	—	1.43 (.18)[a]	1.43 (.18)[a]
Income group (1–6: None to highest quintile)	—	—	—	0.83 (.03)[a]	0.83 (.03)[a]
Parent/guardian's college degree or higher (vs. less than a college degree)	—	—	—	0.89 (.08)[a]	0.89 (.08)[a]
Living with a spouse (yes vs. no)	—	—	—	0.93 (.09)	0.93 (.09)
Number of household members	—	—	—	1.01 (.04)	1.01 (.04)
Having children (yes vs. no)	—	—	—	0.79 (.08)[a]	0.79 (.08)[a]

The models predicted the odds of participating in formal AET. Note: Models 2A–3A uses Whites as the reference category for Black, Hispanics, and Others; models 2B–3B uses Black as the reference category for Whites, Hispanics, and Others. OR = Odds ratio [obtained by exp(the estimated regression coefficient)]; SE = Standard error (associated with the estimated regression coefficient).

[a] indicates statistically significant association between the AET measure and variable of interest ($p < 0.05$). The PIAAC final sampling weights and replicate weights were applied.

AET, Black and other racial/ethnic minority adults had higher odds of participation than White adults. At the same time, Hispanic adults had lower odds of participation in any AET than Black adults. For formal AET, Black, Hispanic, and other racial/ethnic minority adults had higher odds of participation than White adults. Meanwhile, Hispanic adults had lower odds of participation in formal AET than their Black counterparts. For non-formal AET, Black adults had higher odds of participation than White adults. Meanwhile, Hispanics and other minorities had lower odds of participating in non-formal AET than Black adults. Therefore, the fourth hypothesis was only partially supported.

Our follow-up analyses with the Blinder–Oaxaca decomposition returned the preliminary results for the covariates to explain the identified group differences. Having a college degree, higher income, and being born in the U.S. partially explained the gender

Table 4. Estimated odds ratios from the binary logistic regression models of non-formal adult education and training participation.

Variables	Model 1A OR (SE)	Model 2A OR (SE)	Model 2B OR (SE)	Model 3A OR (SE)	Model 3B OR (SE)
Educational factors					
Literacy score (0–500)	1.01 (.01)[a]	1.01 (.01)[a]	1.01 (.01)[a]	1.01 (.01)[a]	1.01 (.01)[a]
College degree or higher (vs. less than a college degree)	2.56 (.18)[a]	2.62 (.19)[a]	2.62 (.19)[a]	2.24 (.17)[a]	2.24 (.17)[a]
Subgroups					
Women (vs. men)	—	.96 (.07)	0.96 (.07)	1.36 (.12)[a]	1.36 (.12)[a]
White	—	-	0.66 (.09)[a]	-	0.58 (.08)[a]
Black	—	1.52 (.19)[a]	-	1.71 (.23)[a]	-
Hispanic	—	1.01 (.12)	0.68 (.11)[a]	1.08 (.12)	0.63 (.10)[a]
Other racial/ethnic minority	—	0.98 (.11)	0.65 (.11)[a]	1.22 (.16)	0.71 (.12)[a]
Covariates					
Age group (10-year band)	—	—	—	0.94 (.03)	0.94 (.03)
U.S. born (vs. foreign born)	—	—	—	1.39 (.15)[a]	1.39 (.15)[a]
Employed (vs. unemployed)	—	—	—	2.27 (.27)[a]	2.27 (.27)[a]
Income group (1–6: None to highest quintile)	—	—	—	1.28 (.03)[a]	1.28 (.03)[a]
Parent/guardian's college degree or higher (vs. less than a college degree)	—	—	—	1.15 (.08)	1.15 (.08)
Living with a spouse (yes vs. no)	—	—	—	1.14 (.09)	1.14 (.09)
Number of household members	—	—	—	0.99 (.03)	0.99 (.03)
Having children (yes vs. no)	—	—	—	0.93 (.08)	0.93 (.08)

The models predicted the odds of participating in non-formal AET. Note: Models 2A–3A uses Whites as the reference category for Black, Hispanics, and Others; models 2B–3B uses Black as the reference category for Whites, Hispanics, and Others. OR = Odds ratio [obtained by exp(the estimated regression coefficient)]; SE = Standard error (associated with the estimated regression coefficient).

[a] indicates statistically significant association between the AET measure and variable of interest ($p < 0.05$). The PIAAC final sampling weights and replicate weights were applied.

gap in all types of AET participation. Whereas older age and higher income partially explained the race gap (White vs. all others), having a college degree narrowed the race gap in all types of AET participation. Finally, whereas older age partially explained the education gap (college vs. less than college), employment, higher income, and having parents with college degrees narrowed the education gap in all types of AET participation in this study.

Discussion

The aim of this article was to examine the associations between AET participation, educational attainment, literacy skills, gender, and race/ethnicity among the U.S. adult population aged 25- to 65-years old. This study found that there are significant and positive associations between the AET measures, educational attainment, and literacy skills. Beyond that, there are variations between the AET measures, gender, and race/ethnicity. The finding on educational attainment is consistent with the literature and the theoretical model of LL/AET participation (Boeren et al., 2010). Under the Matthew effect, as cited in the theoretical model of LL, Boeren et al. (2010) state that individuals with higher human capital are likely to acquire and value additional knowledge and skills. In this case, higher education is likely to improve adults' knowledge and skills and prepare them for subsequent learning (Heisig & Solga, 2017). Furthermore, completion of higher education may reinforce positive attitudes toward learning, which leads to further AET participation (Illeris, 2006). Overall, it is also possible that familiarity in education and learning environments lead to greater confidence and self-efficacy in subsequent AET (Brooks & Everett, 2008).

As the results show, literacy is associated with AET participation among the U.S. adult population. In view of the theoretical model (Boeren et al., 2010), the Matthew effect can also explain the role of literacy. For example, literacy proficiency enables adults to process written information and text more effectively and efficiently, and in turn, to actively engage in more AET (Hanemann, 2015). At the same time, literacy proficiency may also be linked to other individual-level factors that altogether promote AET. Indeed, greater literacy proficiency is linked to employment and income (Grotlüschen et al., 2016; OECD, 2016a). While this study did not specifically examine the job skill levels, it is possible that adults with greater literacy skills hold higher-skilled jobs, which may provide more AET opportunities (Tan, 2014). Notably, those with higher-skilled jobs are more likely to use and improve their literacy skills overtime (Reder et al., 2020). In sum, greater educational attainment, employment, and income, which are all indicative of greater SES, are indeed associated with AET participation overall (Boeren et al., 2010). To note, these factors are not causal of AET participation as AET participation can also lead to greater educational attainment, which can then lead to the respective factors. Nonetheless, future research using longitudinal design is needed to disentangle these complex associations.

Regarding the gender differences documented in this study, women are more likely to engage in formal AET than men after accounting for educational attainment, literacy skill, and all other individual characteristics of interest. Presumably, women recognize the importance of credentials from formal AET to obtain greater SES, as well as remain competitive within a labor market in which women have historically experienced disadvantages, such as fewer job opportunities, lower chances of career advancements, lower wages, and even fewer AET opportunities compared to men (Acker, 2006; Boeren, 2011; Grönland, 2012). Such awareness may be an extrinsic motivator for women to engage in formal AET (Boeren, 2017). In conjunction with other gendered social expectations, such as caregiving and household responsibilities (Massing & Gauly, 2017), further research is

needed to better understand the reasons for the greater likelihood of formal AET participation by women, above and beyond SES.

This study found several differences among race/ethnicity in AET participation. Most notably, Black, Hispanic, and other racial/ethnic minority adults collectively had greater likelihood of formal AET participation than White adults when accounting for educational attainment, literacy skill, and other individual characteristics. One may argue that adults are generally aware of the importance of formal credentials to achieve greater SES (Boeren, 2017). In the case of racial/ethnic minorities, education overall is regarded as a means to move up the social ladder (Rondini, 2016). Given that racial/ethnic minorities have historically experienced socioeconomic disadvantages, such as poorer access to formal AET and lower financial resources (Boeren et al., 2010), it is also possible that racial/ethnic minorities rely on social support (e.g., encouragement, emotional support, and logistical assistance) to participate in AET (Knipprath & De Rick, 2015; Mishra, 2020). Further, Black and Hispanic adults who possess a college degree may also capitalize on a social support system and a cultural value for learning through their belonging to an educational institution, which presumably promotes subsequent AET (Bourdieu, 1973). Additionally, belonging to a workplace institution, which is indicative of the employment status and income variables, can also lead to a greater support system through their social network for AET (e.g., learning from peers/colleagues when new AET opportunities arise). Notably, our follow-up analysis results from the Blinder–Oaxaca decomposition supported these potential explanations. Therefore, in view of the theoretical model by Boeren et al. (2010), socioeconomic, cultural, and psychological explanations are likely to be applicable to other subgroups, for example, by gender and SES. Future research should examine the role of social and cultural capital in AET, as well as identify the reasons for the greater likelihood of formal AET participation by gender, race/ethnicity, and SES.

Another notable point is that Black adults consistently had greater likelihood of participating in all forms of AET than White adults, as well as Hispanic adults, when accounting for all other characteristics. Somewhat like the racial/ethnic majority and minority comparisons, Black adults are presumably aware of their economic disadvantages within society (Boveda, 2019). Their participation in all forms of AET is perhaps a way to cope with existing economic disadvantages and increase social mobility. At the same time, SES and other individual characteristics that are linked to race/ethnicity matter as White adults tend to participate in AET more than other race/ethnicities. In other words, when SES and other individual characteristics are not considered, White adults generally have higher AET participation rates than other race/ethnicities. Although examinations of specific explanations are beyond the scope of this study, other probable explanations for racial/ethnic differences in AET include an awareness of SES advantages/disadvantages, nativity, English language proficiency, self-efficacy, confidence in navigating education-related settings, social support, and cultural attitudes/values toward education overall (Batalova & Fix, 2015; Boveda, 2019; Mishra, 2020; Rondini, 2016). Future research should expand the scope to include a cultural understanding of racial/ethnic minorities' participation in AET.

Given that the AET participation of White adults are somewhat inconsistent with the literature (Desjardins, 2010, 2020b; Fouarge et al., 2012; Lee & Desjardins, 2019), a follow-up analysis was conducted to ensure the internal validity of these findings. First, crosstabulations of all AET measures and race/ethnicity categories were examined. In the weighted descriptive summary (see Table 1), White adults participated in any form of AET more than Black, Hispanic, and other racial/ethnic minority adults. Second, a series of unconditional binary logistic regression analyses were estimated for the AET measures, Blacks, Hispanics, and other racial/ethnic minorities. Generally, there was no evidence of racial/ethnic differences when other covariates were not considered. However, when the covariates were included in the models, the racial/ethnic differences in AET participation were observed. As mentioned earlier, the follow-up analysis also provided a clue for SES-based explanations (see Tables 2–4 for the consistent findings on education, employment, and income) on the racial/ethnic differences in AET participation.

While this study showed the racial/ethnic differences at the national level, there are several important areas of inquiries for future research to verify and contextualize the findings from this study. First, complex relationships between race/ethnicity and SES, including education, employment, and income need to be unpacked to clarify the pathways between race/ethnicity and AET participation. Examinations of additional SES measures (e.g., more detailed childhood SES than the parent's education, subjective experience in formal education programs) would be particularly interesting as each measure may capture different aspects of SES across racial/ethnic groups. Second, this study also documented understudied differences between racial/ethnic minorities, such as Black versus Hispanic adults. Most of the previous research focused on White adults versus racial/ethnic minorities. Findings of Black adults being more likely to participate in both formal and non-formal AET than Hispanic adults warrant additional studies. Some of the known explanations including language barrier, self-efficacy, and SES advantages/disadvantages require more rigorous examinations focusing on specific comparisons of racial/ethnic groups. By the same token, probable explanations of other minorities are inconclusive due to limited data, sample sizes, and information (e.g., Asians, Asian Americans, Pacific Islanders, Native Americans, mixed race). Third, given the use of employment and income in the analysis, future research should further explore on-the-job and non-job related AET participation, as well as job skill levels, by gender and race/ethnicity to better understand access to AET opportunities beyond the types of AET (i.e., formal vs. non-formal) measured in this study. Finally, building on the baseline findings from this study, future research should further explore the intersection of gender and race/ethnicity in the context of AET participation. As the theory of intersectionality proposed by Crenshaw (1989) suggests, the lived experiences of White men and women versus men and women of color are systematically different, in part, due to the unequal distributions of resources in society.

Limitations

Several limitations should be noted. First, although the more recent 2017 PIAAC PUF data were available at the time of this study, the 2012/14 PIAAC PUF data were used because of the limited sample sizes across racial/ethnic minorities in the 2017 data. Despite the slightly older data by 3–5 years, detailed inquiry of subgroups was only possible with the 2012/2014 data. The restricted use file (RUF) data, which combined all 2012/2014 and 2017 data were available. However, the strict data security guidelines (e.g., secured data office, dedicated non-networked computers) did not allow this study to use the RUF data. Second, as common in conventional statistical model-based inquiry, the relationships between the predictor variables (e.g., education, literacy, gender, race/ethnicity, SES) were not simultaneously examined with the outcome of interest—AET participation—in this study. Third, although AET participation was restricted to adults aged 25–65 years old to indicate AET participation post college degree attainment, it is possible that AET participation preceded college degree attainment for older adults in higher education. Therefore, this study reveals a correlation between educational attainment, literacy, and AET participation. Causal relationships should be explored further. Fourth, there is limited information on the subpopulations that consist of the other racial/ethnic minority group. Findings on the racial/ethnic differences did not take detailed background within any of the groups. Namely, White, Black, Hispanic, and other adults may have diverse national and cultural backgrounds within their own groups. Future data collection in the PIAAC may consider additional background items. Fifth, conventional social relationship measures, such as marital status, were unavailable in the PIAAC data. Although this study used alternative measures including living with a spouse/partner and having child/ren, results may not be entirely comparable with other research in the social network or relationship context. Sixth, possible omitted variable bias cannot be ruled out as potentially important individual-level measures, such as skill levels of jobs, psychological factors (e.g., confidence, self-efficacy), and contextual measures (e.g., local AET opportunity, policy, economic condition), were not included in the analysis (Boeren et al., 2010; Boeren, 2017). Last, this study relied on the theoretical model, cross-sectional data, as well as relevant literature for the research design and interpretation of the results. Further research, preferably with longitudinal data, is needed to clarify detailed associations and underlying explanations of the AET participation determinants by gender and race/ethnicity, as well as the intersection of gender and race/ethnicity.

Contributions and implications

This study is one of the few recent studies to focus on AET participation, educational attainment, and literacy proficiency by gender and race/ethnicity in the U.S. The detailed national profile by different types of AET participation are useful for future research and policy discussions. Additionally, this study added empirical evidence of the gender and racial/ethnic differences in AET participation to the literature. In particular, the findings

about greater likelihood of AET participation by women and Black adults may have practical implications for addressing existing social inequality and discriminations among adult learners. That is, women and racial/ethnic minorities tend to systematically face poorer access to AET opportunities due to socioeconomic disadvantages. To address social inequality by gender and race/ethnicity, providing policy-level support and public resources for individuals' AET participation, especially outside of higher education and workplace institutions (e.g., AET support for unemployed persons, AET support for individuals with children, promoting AET through formal education regardless of a college degree) is a wise investment. Also, any intervention and policy should pay closer attention to the differences across subgroups of gender (e.g., lower vs. higher income women) and racial/ethnic minorities (e.g., lower vs. higher income Black vs. Hispanic adults). Finally, in future discussions, the evidence of gender and racial/ethnic differences above and beyond demographic and socioeconomic characteristics warrants more attention to sexism and racism, as well as unique experiences in AET at the intersection of gender and race/ethnicity differences.

Conclusion

This study examined the associations between AET participation, educational attainment, literacy skills, gender, and race/ethnicity among the U.S. adult population aged 25- to 65-years old. Educational attainment and literacy proficiency continue to be consistently linked to AET. Also, important variations in AET participation across gender and race/ethnicity are documented. Specifically, historically disadvantaged subpopulations, including women and racial/ethnic minorities, had greater likelihood of participating in AET than men and White adults, respectively. Also, between racial/ethnic minorities, such as Black and Hispanic adults, differences in AET participation were identified. In hopes to promote AET participation and equitable learning among gender and race/ethnicity, this study provided the recent baseline information for the profiles of AET participants and non-participants by the detailed demographic and SES characteristics, as well as updated the empirical evidence of AET participation by gender and race/ethnicity in the U.S.

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