The Investigation Related to the Impact of Cognitive Ability on Self-Esteem

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Abstract. Cognitive ability's underexplored relationship with self-esteem—defined as the self-evaluative component reflecting perceived competence and worth—was investigated using National Longitudinal Survey of Youth (NLSY) cross-sectional data. The theoretical foundation of this study draws on William James's view that self-esteem stems from the experience of achieving important life goals, a view that continues to influence modern psychology. Through the multiple linear regression analysis of 4,488 observations, Armed Forces Qualification Test (AFQT) scores were modeled as predictors of self-esteem scores, with age dichotomization (⩾25 years vs. <25 years) tested as a potential moderator via interaction terms. The experimental results indicated a statistically significant positive association between higher AFQT scores and increased self-esteem. Neither the age dummy variable nor its interaction with the AFQT demonstrated statistical significance. These findings contribute to the ongoing debate about the antecedents of self-esteem, highlighting the importance of cognitive abilities as a foundational psychological resource.

Keywords: AFQT, self-esteem, regression analysis.

1. Introduction

The concept of self-esteem was initially formulated by William James as arising when important life objectives are consistently achieved or surpassed, generating positive self-regard. James' century-old definition retains contemporary relevance: self-esteem is widely regarded as the evaluative component of self-knowledge, indicating both personal self-liking and perceived competence. A highly favorable self-perception characterizes high self-esteem; conversely, low self-esteem manifests through either ambivalent or explicitly negative self-assessments [1]. Self-esteem is the psychological foundation of human life, which can keep a person's life healthy and complete. The concept of self-esteem is pervasive in contemporary life. It is widely believed that high self-esteem is crucial to success in all areas of society. Promoting self-esteem and preventing inferiority is widely regarded as an important social goal that deserves extensive intervention to increase the self-esteem level of the population [2].

Self-esteem is undoubtedly one of the most popular research topics in modern times. There are a large number of relevant academic achievements now. Many researchers have explored the underlying causes, influences, and factors of self-esteem through extensive and diverse literature. For instance, a study considers the age effect as one of the important factors [1]. The results show that self-esteem increases in early and middle childhood, remains almost unchanged in adolescence, continues to increase in adulthood, and then drops significantly in old age [2]. There are also studies that view health as another important factor, showing that the link between health and self-esteem is very close [3]. Traditional theories assert that human needs follow a strict hierarchy, with physical survival superseding psychological needs like self-esteem and respect. This hierarchical model is challenged by Doyal and Gough, who propose health and autonomy as co-equal fundamental needs. Crucially, autonomy—intimately connected to self-worth and social recognition—only becomes a priority after health security is assured. Individuals first secure health provisions before addressing autonomy-related concerns. Health and autonomy are both fundamental human needs, and they are intrinsically interconnected. Experiencing limited autonomy and diminished self-esteem correlates with adverse health outcomes, an established relationship overlooking cognitive aptitude as its essential foundational component.

In view of this, this study aims to use Armed Forces Qualification Test (AFQT) scores to determine an individual's cognitive ability and focus on the impact of cognitive ability on self-esteem. In addition, the regulating effect of age on the relationship between AFQT and self-esteem is also studied. This study uses statistical models to analyze the correlation between the two. To draw accurate conclusions, this study reviewed the relevant literature and used Stata to conduct regression analysis on a large amount of data. After the analysis of the regression results. This study found that individuals with higher cognitive ability (AFQT) tend to have higher self-esteem, and compared with other factors, cognitive ability (AFQT) demonstrates a slightly stronger standardized effect and far greater statistical significance. Thus, AFQT is likely the more influential factor in shaping self-esteem in this model.

2. Method

2.1. Dataset Preparation

The data used in this study comes from cross-sectional data extracted from the National Longitudinal Survey of Youth. The National Longitudinal Survey of Youth (NLSY) is a longitudinal survey targeting the youth population. This longitudinal study, initiated in 1979 and led by the Center for Human Resource Research at The Ohio State University, targets youth cohorts while encompassing multidimensional domains including education, employment, and health [4]. Data collection was executed through a multi-stage stratified sampling methodology, utilizing a representative sample of 12,000 individuals. It specifically examines social structural influences and educational outcome mechanisms during adolescent development. Findings are routinely applied in educational policy evaluation and social mobility research [5]. This study contains 4,488 observations and uses self-esteem_score as the dependent variable and AFQT_score as the independent variable. The following is a specific explanation of each variable: 1) Self-esteem_score: Individual standardized self-esteem score (dependent variable), 2) AFQT_score: Cognitive ability scores, 3) Age: As of 1989, survey respondents were aged 24 to 32 years. 4) age_dummy: age_dummy=1, age>=25. age_dummy=0, age<25. 5) AFQT×age_dummy: Expressing the product of AFQT and age_dummy (Interaction term). Table 1 provides some sample data from the dataset.

Table 1. The sample data from the dataset.

year	Self-esteem_score	age	AFQT_score
1989	16	30	12
1989	20	27	51
1989	23	31	43
1989	21	25	88
1989	25	30	63

2.2. Linear Regression

Predictive modeling through linear regression analyzes associations between dependent targets and independent predictors [6-8]. Commonly applied in causal inference, time series forecasting, and predictive analytics, this methodology is extended in the current study via multiple linear regression [9]. Dummy variables and interaction terms are incorporated to assess predictor effects on the target variable while investigating potential moderating relationships. The exploratory regression equation is consequently formulated as:

$$self - esteem = \beta 0 + \beta 1 AFQT + \beta 2 age\_dummy + \beta 3 (AFQT \times age\_dummy) + \epsilon \quad (1)$$

Where β0 represents the intercept term (constant term), while β1 、 β2, 、 β3 are regression coefficients (indicating the degree of influence of their respective variables on Y). In addition, ϵ represents a random error term (obeying the normal distribution with a mean of 0)

This model has the following advantages: 1) This model can control for confounding factors, improving estimation accuracy. Multiple regression allows simultaneous inclusion of multiple predictors, reducing omitted variable bias and yielding more reliable estimates of core independent variables. Dummy variables effectively handle categorical variables (e.g., age). 2) It has enhanced the interpretability of the model. Compared to single-variable models, multiple regression explains more variance in the dependent variable (higher adjusted R^2) and provides a clearer ranking of variable importance (via standardized coefficients).3) This model has strong transparency and scalability. Regression coefficients can be directly interpreted as "the change in Y per unit change in X, holding other variables constant," making results intuitive. The model can be flexibly extended by adding interaction terms.

In addition, the model also has the following disadvantages: 1) This model may face the risk of multiple Collinearity. High correlation between independent variables (e.g., years of education and working) may lead to unstable coefficient estimates (Variance Inflation Factor, VIF > 10 warrants caution). Interaction terms exacerbate multiple collinearity. 2) It will be more troublesome and complicated to explain the interaction effect. Significant interactions require simple slope analysis or marginal effect plots for accurate interpretation, as misinterpretations (e.g., "paradoxical interactions") are common.3) The model requires a large sample size for complex calculations. Models with interaction terms or polynomials require larger sample sizes to avoid over-fitting (e.g., 50–100 additional samples per new interaction term). High-dimensional data may reduce computational efficiency (especially with stepwise regression).

3. Results and Discussion

The regression model examines the relationship between self-esteem scores (self-esteem_score1) and AFQT scores (afqt_1), age (dichotomized as age ≥25), and their interaction. The analysis shown in Table 2 is based on a sample of 4,488 observations, with the model explaining approximately 13.6% of the variance in self-esteem (R-squared = 0.1365). The overall model is statistically significant ($F(3, 4484) = 236.32$, $p < 0.001$). Adjusted R-squared is a modified version of the standard R^2 (R-squared) that quantifies the proportion of variance in the dependent variable explained by the independent variables, while penalizing the addition of irrelevant predictors. It addresses a key flaw in R^2: R^2 always increases when new variables are added to a model (even if they are statistically meaningless), which can artificially inflate the model's perceived explanatory power. True explanatory power is 13.59% after penalizing the 3 predictors. But 86.41% of self-esteem variance remains unaccounted for. AFQT Score (afqt_1): There is a significant positive effect ($\beta = 0.0599$, $p < 0.001$), indicating that higher cognitive ability (as measured by AFQT) is associated with higher self-esteem. The 95% confidence interval [0.0363, 0.0835] confirms the robustness of this relationship. Age Group (age_dummy): The dummy variable for age (1 => 25 years, 0 = <25 years) does not have a statistically significant effect on self-esteem ($\beta = 0.6315$, $p = 0.236$). Interaction Term (afqt_1 × age_dummy): The interaction between AFQT score and age group is not significant ($\beta = -0.0061$, $p = 0.618$), suggesting that cognitive ability's influence on self-esteem does not differ meaningfully between younger and older individuals. However, the relatively low R-squared value suggests that additional factors not included in this model may influence self-esteem.

Table 2. Linear Regression Results Chart.

Source	SS	df	MS	Number of obs = 4,488 F(3, 4484) =236.32 Prob >F=0.0000 R-squared=0.1365 Adj R-squared=0.1359 ROOt MSE=3.8464		
Model	18489.1001	3	3496.3667			
Residual	66339.7974	4484	14.7947809			
Total	76828.8975	4487	17.1225535			
sesteem_sco~l	Coefficient	std, err.	t	P>|t|	[95% conf.	Interval]
afqt_1	.0598749	.0120444	4.97	0.00	.0362619	.6834878
age_dummy	.6314523	.5322237	1.19	0.236	-.4119687	1.674873
afqt_age_in~n	.0262252	.0122231	-0.50	0.618	-.03006	.0178664
_cons	18.98656	.5182833	36.63	0.00	17.97047	20.00265

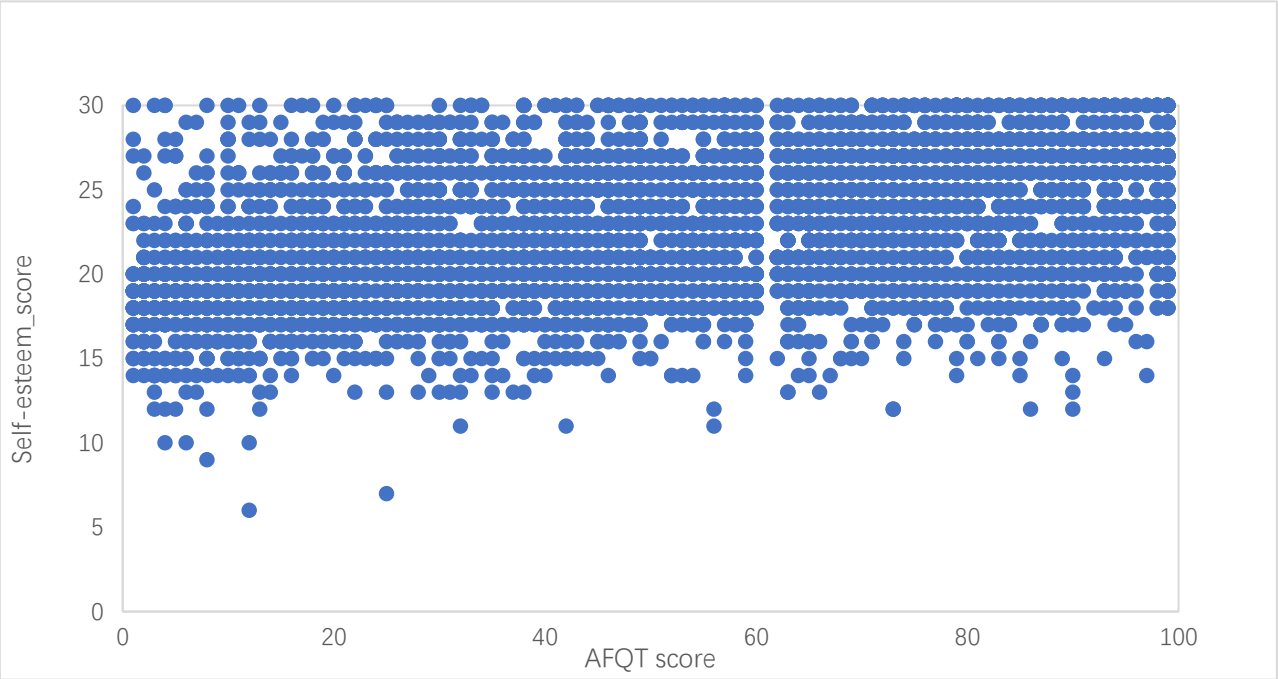

Fig. 1 The relationship between AFQT score and self-esteem score (Picture credit: Original).

Fig. 1 shows a weak positive correlation between AFQT and self-esteem scores. Higher AFQT scores (right side) tend to be associated with moderately higher self-esteem (upper half), but with substantial scatter. While AFQT reached statistical significance, its trivial effect size supports "threshold models": In fact, evidence suggests that a significant portion of the impact of school education on self-esteem coefficient is mediated by differences in AFQT scores. In this case, the AFQT coefficient equals 0.059. Empirical patterns indicate that family background explains a small fraction of the decrease in self-esteem caused by regression. The influence of family background on the self-esteem coefficient appears to be well explained by the effects of AFQT scores. Another explanation for why the self-esteem coefficient declines when incorporating AFQT scores and other covariates lies in measurement errors in self-esteem assessments (for example, if AFQT scores are affected by measurement errors and these errors correlate with AFQT) [10].

4. Conclusion

This work uses the AFQT score to show the level of personal cognitive ability and analyse the potential relationship between cognitive ability and self-esteem, and the regulating effect of age. This paper used Stata software and multivariate linear regression models to conduct regression analysis of data. Experimental results showed that cognitive ability (AFQT) is a significant predictor of self-esteem, whereas age (as dichotomized in this model) does not play a significant role. The lack of a significant interaction effect implies that the relationship between AFQT and self-esteem is consistent across age groups. Future research could explore other potential predictors to improve explanatory power.

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