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## The Five-Factor Model: An Exploratory Study of the Personality Profile of Science, Technology, Engineering & Mathematics (STEM) Students in a Nigerian University

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### **Abstract:**

*Background: This study examined the personality profile of STEM students in a Nigerian University, with the aim to identify dominant traits, gender differences as well as create a platform for therapeutic intervention where necessary.*

*Methods: The study involved three STEM based faculties. Participation was voluntary and consent was given by willing participants before the administration of the BFI questionnaire. Data was analysed both descriptively and analytically.*

*Results: The total number of respondents was three hundred and seventeen (M=189; 59.62%; F=128; 40.38%, 42%), with an age range of 16 years to 29 years. Our results show conscientiousness as the most dominant trait, followed by Neuroticism, no significant difference was found in gender on conscientiousness, extraversion and neuroticism, Agreeableness, Openness to experience and Extraversion in descending order. Males had a significantly higher likelihood to be open to experience. ( $X^2=.000$ ;  $P < 0.05$ ). A significant difference was also found between males and females on agreeableness trait ( $X^2=.000$ ;  $P < 0.05$ ). Males had a higher likelihood to be agreeable.*

*Conclusion: The lower index of openness to experience among female STEM students compared to their male counterparts may have far reaching effect on career development. The results also reflect a need to step up the agreeableness trait among female STEM students as this is fundamental to sustaining relationships and networking for career development. The high proportion of females who had positive neuroticism traits is an indication that female scientists are vulnerable to psychological health challenges. The need for psychological appraisal, intervention and mentoring of STEM students can thus not be overemphasized.*

**Keywords:** Personality, big five, STEM students, Nigeria

### **1. Introduction**

Personality is defined as "the coherent pattern of affect, cognition, and desires (goals) as they lead to behaviour"<sup>[1]</sup> According to the American Psychological Association (APA), personality is: "individual differences in characteristic patterns of thinking, feeling, and behaving"<sup>[2]</sup> Personality bears a huge impact on life, it correlates strongly with life satisfaction<sup>[3]</sup>. Studies have reported the influence of personality on success in school<sup>[4]</sup> and work<sup>[5]</sup>. Although personality studies are age long and span diverse theoretical views, the current view is that human personality can be condensed into the Five Factor Model (FFM) which explains personality from five dimensions namely, Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness. These traits have been found to be related to a wide range of life outcomes including academic performance and success. By way of expression the traits can be described as thus; Openness (Appreciation for art, emotion, adventure, unusual idea, imagination and curiosity), Conscientiousness (A tendency to show self-discipline, act dutifully and aim for achievement), Extraversion (Energy, urgency and the tendency to seek stimulation and the company of others), Agreeableness (A tendency to be compassionate and cooperative rather than suspicious and antagonistic towards others) and Neuroticism (A tendency to easily experience unpleasant emotions such as anger, anxiety, depression, vulnerability, hostility and impulsiveness<sup>[6&7]</sup>

In the light of the importance of science, technology, engineering and mathematics (STEM) in human development and advancement, it is imperative to examine the personality profile of STEM students. Personality profiling affords the opportunity to predict the likely course of an academic life by virtue of prevailing traits and their correlates. It also affords the opportunity to examine the pattern of presentation of the traits. This provides a veritable tool for intervention where and when needed. Additionally, it will be beneficial to see if there are gender differences in the personality profile of STEM

students as this may have far reaching implications on career development. This study therefore sought to examine the personality profile of STEM students in a Nigerian University.

## 2. Materials and Methods

The study involved students from three STEM based faculties (Engineering, Life and Physical Sciences) of the University of Benin, Nigeria. The University of Benin is one of the first-generation Federal universities in Nigeria, founded in 1970 and presently has over 10 faculties. Ethical clearance to conduct the study was obtained from the Administrative heads of the various STEM-based faculties involved in the study.

Participation in the study was voluntary and informed consent was given by willing participants before the administration of the questionnaire. Respondents were consecutively recruited; only full-time degree STEM students were eligible to participate in the study. The questionnaire was self-administered, it comprised three sections; Section A was designed to elicit socio demographic information. Section B sought information on knowledge and attitude towards academic mentoring and attendant challenges, Section C comprise the Big Five Personality Inventory specifically developed to assess personality.

The Big Five Inventory <sup>[8]</sup> is a standardized psychological assessment tool. It contains 44 items designed to measure personality from a five-factor model (FFM) perspective. It has five dimensions namely Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness to Experience, (The synonym CANOE OR OCEAN is frequently used). The items are scored on a Likert format of 1-5. Values of the numbers shaded are added to obtain the clients score in each of the subscales. The scale has been used in Nigeria and has high psychometric attributes. <sup>[8]</sup>Reported coefficients of reliability are Cronbach alpha of 0.80 and 3 months test-retest of 0.85.<sup>[8]</sup> The norm reported by Umeh, <sup>[9]</sup>was used to ascertain the presence of the Big Five traits in the study population. Data was analysed both descriptively and analytically using SPSS.20.

## 3. Results

As shown in Table 1, the total number of respondents was three hundred and seventeen (M=189; 59.6%; F=128; 40.4%) with an age range of 16 years to 29 years. A hundred and thirty-nine (43.9%) were from the Faculty of Engineering, sixty-six (20.8%) from Life sciences a hundred and twelve (35.3%) from Physical Sciences. The ratio of males to females in the faculty of engineering was wide (M =92, 66.2%, F=47, 33.81%) compared to the disparity in the other faculties, Life Sciences (M=29, 43.9%, F=37, 56.1%), Physical Sciences (M=68 (60.7%, F=44=39.3%). A majority of the respondents were aged between 18 -21years.

Variable	Faculty							
	Engineering		Life Science		Phy. Science		Total	
Gender	n	%	n	%	n	%	n	%
Male	92	(66.2)	29	(43.9)	68	(60.7)	189	(59.6)
Female	47	(33.8)	37	(56.1)	44	(39.3)	128	(40.4)
Age in Years								
<18	20	(14.3)	5	(7.6)	11	(9.8)	36	(11.4)
18-21	67	(48.2)	49	(74.24)	53	(47.3)	169	(53.3)
22-25	47	(33.8)	11	(16.67)	42	(37.5)	100	(31.5)
26-29	5	(3.6)	1	(1.52)	6	(5.3)	12	(3.8)
Year of Study								
100 level	26	(18.7)	23	(34.85)	29	(25.8)	78	(24.6)
200 level	35	(25.2)	20	(30.30)	24	(21.4)	79	(24.9)
300 level	26	(18.7)	19	(28.79)	15	(13.4)	60	(18.9)
400 level	22	(15.8)	4	(6.06)	44	(39.3)	70	(21.8)
500 level	30	(21.6)					30	(9.8)

Table 1: Socio Demographic Factors of Respondents

Big Five Traits	n	%
Openness to experience	100	(31.7)
Contentiousness	245	(77.7)
Extraversion	57	(18.1)
Agreeableness	142	(45.0)
Neuroticism	153	(48.5)

Table 2: Distribution of Respondents' Big Five traits

As shown in Table 11, the personality profile of the respondents on the Big Five traits in descending order are; Conscientiousness (77.7%) Neuroticism (48.5%) Agreeableness (45.0%) Openness to Experience (31.7%) Extraversion (18.1%).

Variable	Male				Female				X <sup>2</sup>	P value
	Yes		No		Yes		No			
Big Five Traits	n	%	n	%	n	%	n	%		
Openness to experience	67	(35.5)	122	(64.6)	33	(25.8)	95	(74.2)	.000	P<0.05
Conscientiousness	134	(70.9)	55	(29.1)	111	(86.7)	17	(13.3)	.504	P>0.05
Extraversion	36	(19.1)	153	(80.1)	21	(16.4)	107	(83.6)	.379	P.0.05
Agreeableness	115	(60.9)	74	(39.2)	27	(21.1)	101	(78.9)	.000	P<0.05
Neuroticism	63	(33.3)	126	(66.6)	90	(70.3)	38	(29.7)	.094	P>0.05

Table 3: Big Five Traits of Respondents by Gender

Our results show no significant difference in gender on conscientiousness, extraversion and neuroticism as shown in Table 111. However, a significant difference was found between males and females on the openness to experience trait ( $X^2 = .000$ ;  $P < 0.05$ ). Males had a higher likelihood to be open to experience. A significant difference was also found between males and females on agreeableness trait ( $X^2 = .000$ ;  $P < 0.05$ ) Males had a higher likelihood to be agreeable.

#### 4. Discussion

The ratio of males to females in the Faculty of Engineering reflects a culture where engineering is still regarded as a male domain. Indeed, it has been noted that women are generally underrepresented in almost all areas of scientific endeavour and their participation in science and technology has remained low around the world. [10] This calls for demystification through mass enlightenment and advocacy. Consented effort must be explored at all levels to mitigate psycho-social and cultural barriers to the study of science particularly engineering. The need for parents, caregivers, and young secondary school girls to be enlightened accordingly cannot be over emphasized. Importantly, the role of female role models must be emphasized as a means of encouraging young female scientists.

The low index of openness to experience among female STEM students compared to their male counterparts is worrisome in view of the attributes of the trait which include adventure, unusual ideas, imagination and curiosity. These attributes form the bed rock for the intellectual prowess required in STEM. It is however possible that the disparity found in this study may be attributed to psycho-social expectations of the girl child. Typically, it is said that "boys will be boys" conversely the girl child is chided from explorative tendencies. This no doubt can have far reaching implications on career development particularly as it concerns STEM.

The result also shows a significant disparity between male and female STEM students on the agreeableness trait. This however contradicts assertions and by Feingold and Costa et al [11&16] that women consistently score higher than men on Agreeableness and related measures, such as tender-mindedness. The attributes of the trait which include a tendency to cooperate rather than suspicion and antagonism towards others is fundamental to sustaining relationships and networking for career development. Female students may require mentoring and the development of psycho social skills to enhance their agreeableness potential.

A high neuroticism score indicates a susceptibility to psychological distress, maladaptive and unrealistic ideas, however it is not indicative of the presence of any clinical disorder or a risk of receiving a psychiatric diagnosis. On the other hand, a low score is associated with emotional stability, an ability to face stressful situations without becoming upset or rattled. [12]. Of immense concern is the high proportion of females who had positive neuroticism traits compared to their male counterparts. This could be an indication that female scientists are vulnerable to psychological health challenges, this calls for constant psychological appraisal, counselling and necessary intervention for sound mental wellbeing as a prerequisite for productivity and career development. The challenges of a discipline in STEM requires a healthy mental state devoid of the attributes of neuroticism. This is of particular importance because mental health is fundamental to sustainable achievement on all facets of life.

The personality profile of STEM students reveals conscientiousness, which is associated with a tendency to show self-discipline, act dutifully and aim for achievement as the most dominant Big Five personality trait among Nigerian STEM students. This is remarkable as conscientiousness is reported to be positively related to both college and high school GPA, implying an association of conscientiousness and academic achievement [13] The correlates of the prevailing trait of conscientiousness has been variously seen as willingness to follow authority and conform to group norms [14] and a high likelihood to excel in leadership positions [15] Within the conscientiousness factor are traits which depict; persistence, ambition, self-discipline, reliability, resourcefulness, hard work and behaviours that facilitate goal-directed behaviour [8]. This is highly commendable and implies the presence of an inherent potential consistent with the demands of STEM. Consistent with earlier findings [16] the result showed no significant gender difference on the conscientiousness trait of STEM students. This is of importance in a culture where females may be dissuaded from pursuing science on the premise that they do not possess the necessary wherewithal such as attributes included in the conscientiousness trait. Generally, it is needful that conscientiousness be nurtured and reinforced in STEM students by the provision of an enabling environment for the enhancement and sustenance of the existent potential.

#### 5. Limitations of the Study

The Big Five traits are broad in expression [17] and thus not so powerful in predicting actual behaviours, future studies should seek to investigate primary level traits. Additionally, the scope of the study is presently limited to just one research field, future studies in this area should consider cross institutional research for a more robust result.

## 6. Conclusion

The ratio of males to females in the faculty of Engineering calls for demystifying Engineering as a male profession. The low index of openness to experience and agreeableness traits among female STEM calls for further exploration, as this may hold the key to the understanding of women's status in STEM careers. The vulnerability of female STEM students to mental health challenges calls for mentoring as well as psychological intervention.

## 7. Recommendation

There is the need to encourage young female students to take up the challenge to study science particularly engineering that is erroneously seen as a man's profession. The institution of scholarships for science inclined female students will go a long way to bridge the disparity reported in this study. It is also recommended that psychology clinics be established in institutions of higher learning to provide needed platforms for therapeutic intervention where counselling and guidance is required for academic and personal or social challenges.

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