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The Integrative Influence of Behavioral Genetics on Psychological Development: A Multidimensional Analysis of MPQ, PRISM, and ASSM Frameworks

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Abstract

Behavioral genetics provides a critical foundation for understanding how genetic factors interact with environmental influences to shape enduring personality traits. Within this framework, the Multidimensional Personality Questionnaire (MPQ) serves as a comprehensive psychometric instrument for evaluating key personality dimensions—Positive Emotionality (PEM), Negative Emotionality (NEM), and Constraint (CON)—which reflect the interplay of heritable predispositions and adaptive behavioral processes. Twin and family studies indicate moderate to high heritability for these core traits, underscoring the significant genetic basis for emotional reactivity, motivation, and self-regulation. To explore these relationships, Personality and Role Identity Structural Modeling (PRISM) and Advanced Statistical and Structural Modeling (ASSM) approaches were applied to examine the structural organization and interconnections among MPQ dimensions. These analytical frameworks revealed that the genetic and environmental integration of PEM and CON forms a stable foundation for emotional regulation, persistence, and adaptive control. The application of ASSM further established a hierarchical model accounting for significant variance in emotional and behavioral outcomes, confirming satisfactory model fit and internal consistency. In conclusion, integrating behavioral genetics with PRISM and ASSM modeling enhances the understanding of personality as a biologically grounded yet dynamically modulated system.

Keywords

Multidimensional Personality Questionnaire (MPQ); PRISM; ASSM; Positive Emotionality; Negative Emotionality; Constraint; Emotional regulation; Resilience; Personality traits; Behavioral analysis; Psychometric evaluation.

1. Introduction

Behavior genetics, formally established as a distinct field in 1970, focuses on the intrinsic link between genetics and behavior. Early research in this discipline utilized model organisms, such as Drosophila

melanogaster, to demonstrate that specific behaviors like mating speed have a clear, quantifiable genetic basis. Early work by Thomas Hunt Morgan established it as a cornerstone of genetics research. In relation to humans, Drosophila helps scientists understand how genetic mutations influence cell behavior, tissue function, and overall health. A significant proportion of human disease-related genes have functional counterparts in the fruit fly, making it valuable for studying conditions such as cancer, neurodegenerative disorders (like Alzheimer's disease and Parkinson's disease), and infectious diseases. Moreover, Drosophila is extensively used in drug discovery, where potential therapeutic compounds are tested for efficacy and toxicity before moving to human trials. Its ease of genetic manipulation, short life cycle, and cost-effectiveness make it an efficient system for translating basic research into insights relevant to human health and disease (Giansanti et al., 2025). Since its inception, the field has evolved to investigate the complex reasons why human individuals differ in their behaviors, cognitive abilities, and temperamental styles. Modern methodology in behavioral genetics has transitioned from traditional twin and family studies to sophisticated molecular genetics, consistently revealing that all human traits are partly heritable. This heritability is not typically the result of a single gene but rather many genetic variants, each contributing a small, cumulative effect to the phenotype. Behavioral genetics offers a robust framework for elucidating the interplay between genetic and environmental factors in shaping human behavior and development, especially in familial contexts. Fundamental methodologies and assumptions of behavioral genetics in an accessible format for family researchers with minimal expertise. Gene-environment correlation and gene-environment interaction are used for special attention because they help us understand how family environments and individual traits are related. Recent advances in molecular genetics are making it easier to study mental and psychological disorders (Samek et al., 2013). The contemporary understanding of human development has moved beyond the historical "nature versus nurture" dichotomy, favoring an integrated model of gene–environment interactions (GxE). These are essential for comprehending the etiology of psychiatric disorders, emphasizing the combined influence of genetic predispositions and environmental exposures on disease risk. Places G×E within the larger debate about nature versus nurture and describes the different methods used to study these complicated connections. It summarizes the most important findings for major psychiatric disorders, such as major depressive disorder, bipolar disorder, schizophrenia, attention-deficit hyperactivity disorder, antisocial personality disorder, and alcohol use disorder. Certain genes, including the serotonin transporter gene, COMT, DAT1, DRD4, MAOA, and ADH1B/ALDH2, have been identified in conjunction with environmental factors such as stress, cannabis use, prenatal smoking, childhood maltreatment, and cultural influences. Nonetheless, the discipline encounters difficulties associated with restricted replication and minimal effect sizes. The introduction underscores the significance of forthcoming extensive studies that integrate polygenic risk and comprehensive environmental data (the exposome) to enhance understanding (Abubucker & Potash 2024). DNA is no longer perceived as a fixed, immutable carrier of heredity; instead, it is recognized as a dynamic system influenced by environmental factors and heritable epigenetic regulation. Genes play a pivotal role in shaping an individual's behavioral characteristics, including intellectual capacity, personality traits, and susceptibility to various mental health disorders. However, the environment interacts with these genetic predispositions in highly nuanced ways. For instance, the sources suggest that supportive parenting can serve as a protective factor, potentially reducing the expression of a genetic tendency toward aggression, whereas harsh or unstable parenting may exacerbate such tendencies. Personality serves as a vital resource in human development and overall quality of life. These internal

resources are manifested through an individual's spirituality, social connections, professional achievements, and future aspirations.

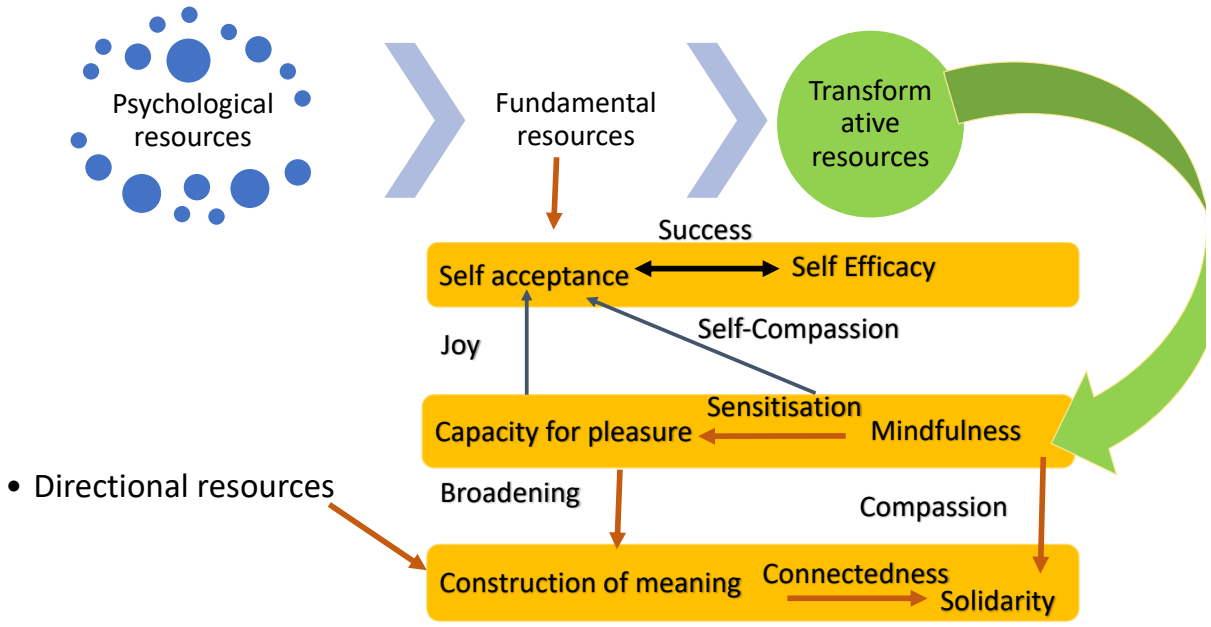

Figure 1:- psychological resources evolve into fundamental and transformative resources.

Psychological resources are constructed within the intellectual, emotional, and behavioral spheres, where personal harmony is achieved through a balanced integration of these areas. The basic psychological resources form the foundation, which are then organized into fundamental resources and further developed into transformative resources that enable long-term personal growth. A strong reciprocal relationship present between self-acceptance and self-efficacy, wherein each continuously reinforces the other, ultimately enhancing confidence, resilience, and the likelihood of achieving successful outcomes (Ewert et al., 2021). This process is supported by self-compassion, which helps regulate emotions and strengthens inner resilience. Additionally, mindfulness enhances awareness and leads to greater capacity for pleasure through sensitization, promoting emotional balance. Positive emotions such as joy broaden an individual's perspective, facilitating the construction of meaning in life. Through compassion, individuals develop connectedness, which further progresses into solidarity, reflecting strong social bonds. Directional pathways in the model indicate how these internal and interpersonal processes are interconnected, ultimately demonstrating that the cultivation of psychological resources leads to meaningful life outcomes and holistic development. This cross-sectional study examines the impact of perseverance on life satisfaction among academics, utilizing self-compassion and psychological flexibility as mediating factors. A total of 305 participants from Türkiye (34% female, 66% male) were included, with a mean age (M) of 40.22 years and a standard deviation (SD) of 8.56. Structural equation modeling demonstrated that perseverance positively predicts life satisfaction, both directly and indirectly, via self-compassion and psychological flexibility (Nas et al., 2025). Modern behavioral genetics research is governed by Four Foundational Laws that provide a roadmap for interpreting trait variation. Human behavior, emphasizing sociobiology and evolutionary psychology (EP). It explain the human mind comprises specialized cognitive modules formed by natural selection, contesting the notion of a "blank slate." John Dupré's

criticisms of EP's (evolutionary psychology) evidence, scope, and reductionist approach are used for comprehensive and balance understanding for human behaviour. It also looks at how evolutionary instincts affect legal systems, especially when it comes to things like fairness, cooperation, and punishment. It suggests that law comes from a mix of biological, social, and economic evolution over time (Chabris et al., 2015). The First Law posits that all human behavioral traits are heritable, meaning genetic differences contribute to the variation observed in every behavior, including intelligence and personality. The Second Law observes that the effect of being raised in the same family is significantly smaller than the effect of genes; siblings raised in the same home often differ due to non-shared environmental influences. The Third Law states that a substantial portion of human behavior is shaped by unique experiences and chance occurrences, frequently referred to as "developmental noise". Finally, the Fourth Law emphasizes that complex behavioral traits are polygenic, influenced by a multitude of genetic variants with individual effects that are small in isolation but significant in aggregate (Chabris et al., 2015).

So that this study examines the integrative role of behavioral genetics in psychological development using the MPQ, PRISM, and ASSM frameworks and emphasizes genetic, environmental, and psychological factors interact to shape individual traits and outcomes.

2. Material and Method

This study utilized a cross-sectional adoption design to investigate the relative contributions of genetic and environmental factors to individual differences in behavioral traits. This specific research design is highly effective at isolating hereditary influences because it allows for a direct comparison between biological parent-child data (representing genetic and shared environment) and adoptive parent-child data (representing environmental influence alone). By comparing these groups, researchers can more accurately estimate the heritability of personality dimensions. The study employed a purposive sampling strategy to select a cohort of 100 participants, ranging in age from 10 to 60 years. To ensure a comprehensive developmental analysis, the participants were categorized into three distinct life stages. The first group consisted of Adolescents (ages 10–19), with a focus on capturing data during the critical period of early emotional development. The second group comprised Young Adults (ages 20–35), whose data was used to assess the transition into identity and personality formation. The final group included Adults (ages 36–60), allowing for an examination of behavioral stability and the impact of established social roles. The primary psychometric instrument used for data collection was the Multidimensional Personality Questionnaire (MPQ). The 155-item version of the MPQ was administered to assess four higher-order factors. Positive Emotionality (PEM) was measured through sub-scales of Well-Being, Social Potency, Achievement, and Social Closeness. Negative Emotionality (NEM) encompassed Stress Reaction, Alienation, and Aggression. Constraint (CON) was evaluated via scales of Control, Harm Avoidance, and Traditionalism. Additionally, the instrument measured Absorption (ABS), which captures an individual's openness to immersive sensory and emotional states.

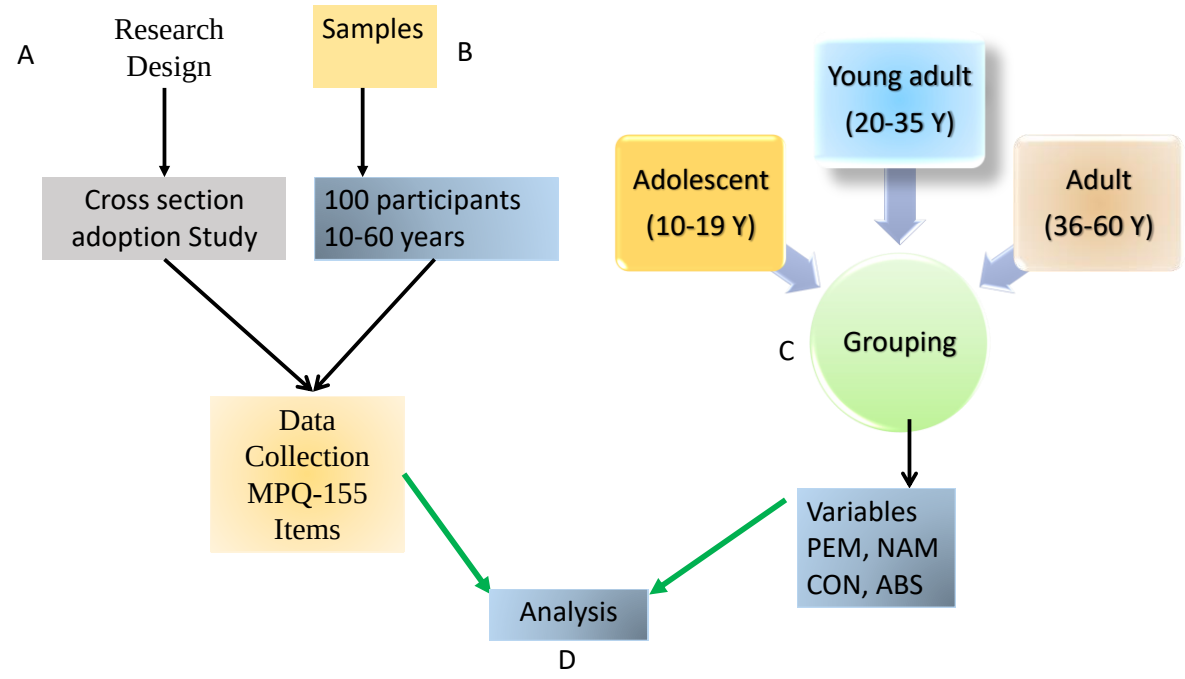

Figure 2:- The diagram represent key stages of the methodology, such as research design (A), sample (B), grouping (C), data collection, variables, and analysis (D). MPQ and measured variables (PEM, NEM, CON, ABS), and final analysis comparing genetic and environmental influences.

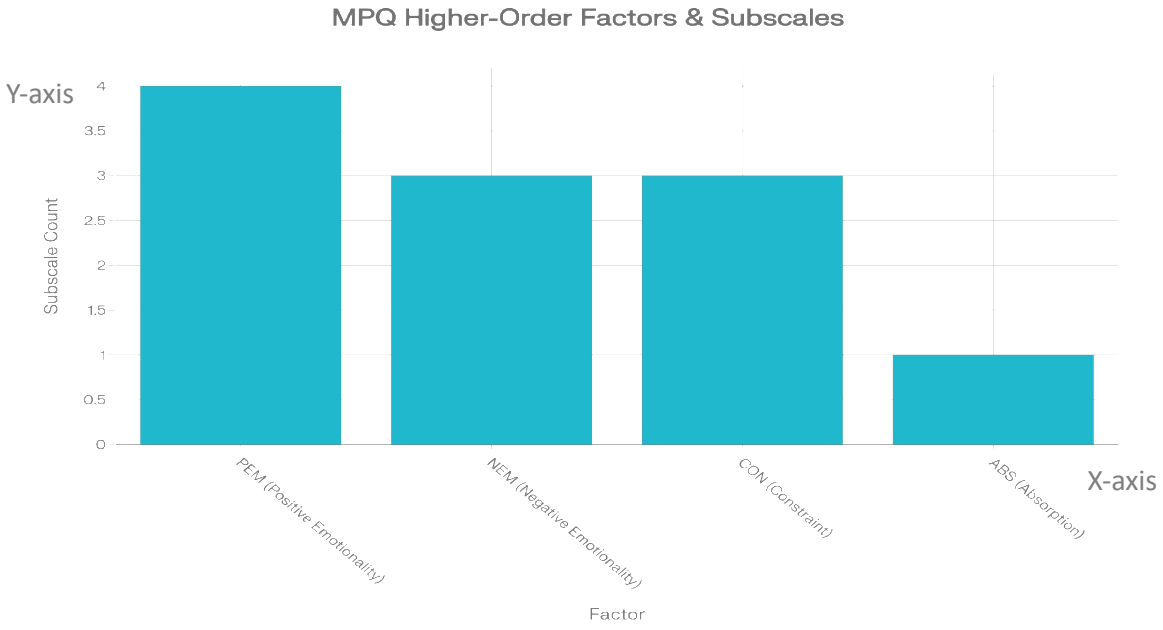

Figure 3:- The x-axis shows the personality factors (PEM, NEM, CON, ABS) and the y-axis shows the number of subscales. The vertical bars on the bar graph show the MPQ factors. The height of each bar shows how many subcomponents are included in that factor.

The graph shows the higher-order factors of the Multidimensional Personality Questionnaire (MPQ) and how many subscales each one has. Positive Emotionality (PEM) has the most subscales (4), which means

it looks at a wider range of positive affect and social engagement traits. Negative Emotionality (NEM) and Constraint (CON) each have three subscales, which means they cover a moderate range of stress-related and self-control traits. Absorption (ABS) has only one subscale, which means it is a more specific and narrowly defined personality trait. Overall, the chart shows how the MPQ factors are put together and how complex they are compared to each other.

Two primary analytical frameworks were used to process the data. The Personality and Role Identity Structural Model (PRISM) was employed to examine the organization of personality traits across different situational contexts. PRISM focuses on three hierarchical levels: Level 3 (General Traits), Level 2 (Role Identities), and Level 1 (Role-Based Behaviors). This allows researchers to see how a stable trait is modulated into specific behaviors depending on the social role being performed. The second framework, Advanced Statistical and Structural Modeling (ASSM), utilized Generalized Linear Modeling (GLM) to explore the potential relationship between professional categories and personality scores. To facilitate this analysis, dummy coding was applied, with "Students" serving as the reference group for the regression model.

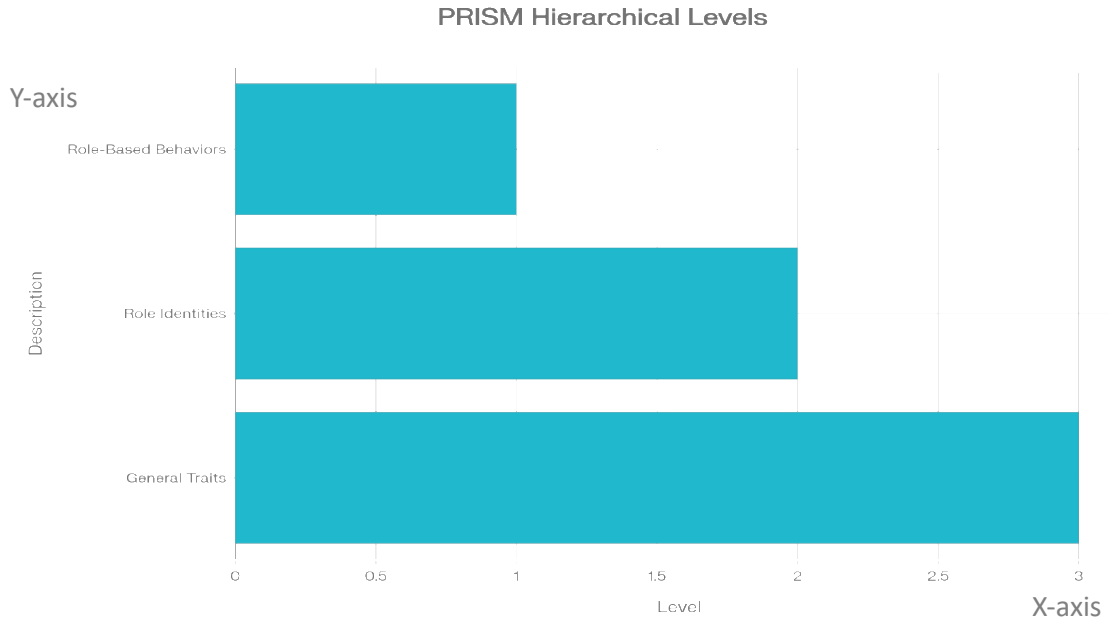

Figure 4:- The horizontal bar graph shows PRISM levels. The y-axis shows the dimensions (General Traits, Role Identities, Role-Based Behaviors), and the x-axis shows their level in the hierarchy. Each bar stands for a level in the framework, and the length of the bar shows where it fits in the personality hierarchy.

The graph shows the different levels of the PRISM framework, which shows how personality is made up of deeper and more visible parts. General Traits are at the top level (Level 3). They are stable, broad personality traits. Role Identities are at the middle level (Level 2), which shows how people see themselves in social situations. At the lowest level (Level 1), Role-Based Behaviors show specific, observable actions that are affected by the roles people play in a situation. This hierarchy shows how traits that are stable and internal lead to behaviors that are external and depend on the situation.

Table-1: PRISM Hierarchical Levels of Personality Structure

S.No.	Level	Dimension	Description
1	1	Role-Based Behaviors	Specific, observable actions in different roles
2	2	Role Identities	Self-concept based on social roles
3	3	General Traits	Stable and broad personality characteristics

3. Results & Discussion

Multidimensional Personality Questionnaire (MPQ):- The analysis of the 100 participants revealed a diverse range of MPQ scores, spanning from 62 to 130. The distribution of these scores provided insight into the general psychological health of the sample. The majority of the sample (52%) fell within the Moderate Range (90–104), suggesting that these individuals possess balanced emotional regulation and adaptive psychological traits. A significant portion (30%) scored in the High Range (105–119), a category characterized by high emotional stability, optimism, and strong interpersonal adaptability. Conversely, 18% of the participants fell into the Low or Very Low Range (below 90), indicating higher levels of emotional sensitivity and potential vulnerability to stress.

Table-2:- Distribution of MPQ Scores Among Participants

S.No.	Score Range	Category	Percentage (%)	Interpretation
1	Below 90	Low / Very Low	18%	Higher emotional sensitivity and stress vulnerability
2	90–104	Moderate Range	52%	Balanced emotional regulation and adaptive traits
3	105–119	High Range	30%	High stability, optimism, and interpersonal adaptability
4	62–130	Overall Range	—	Total observed score variation in sample

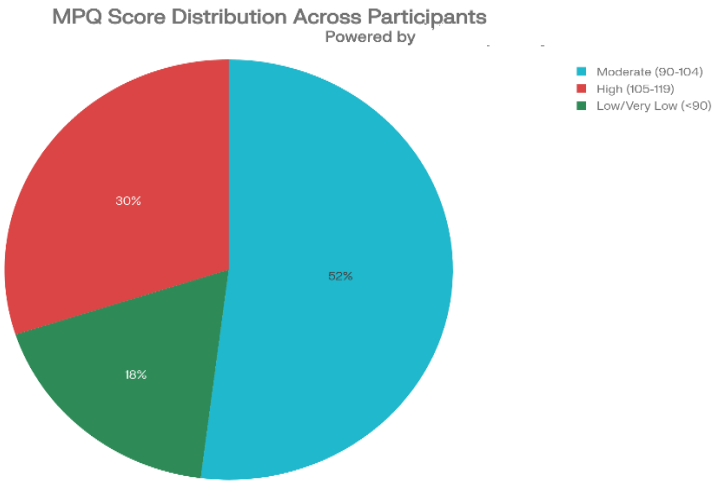

Figure 5:- The pie chart shows how the MPQ scores were spread out among the participants, which shows how well they were doing mentally overall. The biggest group in the sample, 52%, is in the Moderate range (90–104), which means they have a good balance of emotional regulation and adaptable personality traits. A significant 30% of participants fall within the High range (105–119), indicating robust emotional stability, optimism, and proficient interpersonal functioning. On the other hand, 18% are in the Low/Very Low range (below 90), which could mean that they are more emotionally sensitive and more likely to get stressed. The chart shows that most of the people who took part have moderate to high psychological well-being.

In the same way, Tasneem & Panwar 2020 study of college students found that mindfulness is positively linked to emotion regulation and psychological well-being, and that it is a strong predictor of mindfulness. Both findings support the notion that enhanced emotional regulation and psychological stability correlate with improved mental health outcomes, as evidenced by personality traits (MPQ) or mindfulness levels. Both studies consistently underscore that emotional regulation is a crucial factor influencing psychological well-being and adaptive functioning. The results of the current MPQ-based study align with the mindfulness-based intervention (MBI) study, as both underscore the significance of emotional processes in influencing psychological well-being. The MBI study indicates that mindfulness training enhances emotional differentiation and overall mental health (Guendelman et al., 2025). Conversely, the present study reveals that most participants exhibit moderate to high levels of emotional stability and adaptive traits. Both studies indicate that enhanced emotional regulation and awareness correlate with improved psychological functioning; however, the MBI study focuses on intervention effects, while the current study highlights inherent personality-based differences. Aliche & Idemudia (2025) challenges in emotion regulation are associated with adverse mental health outcomes, whereas improved emotional control promotes psychological well-being. The moderate to high MPQ scores suggest that most people have good emotional functioning, which is in line with what other studies have found about the protective role of mindfulness.

PRISM Analysis :- The PRISM analysis provided a detailed look at situational adaptability by comparing two distinct participant groups. Group 1 had a mean score of 93.22 (SD = 13.13) and was characterized by highly stable personality traits and consistent behavior across various social roles. In contrast, Group 2

exhibited a higher mean score of 100.9 (SD = 16.93) and demonstrated broader variability in their responses. This suggests that individuals in Group 2 possess greater situational flexibility, allowing them to adapt their personality expressions more effectively across different social and environmental contexts.

Table-3:- PRISM analysis of group-1 and group-2 scores

Participant	Group 1 Score	Group 2 Score
1	72	70
2	80	85
3	85	90
4	90	95
5	92	100
6	95	105
7	98	110
8	100	115
9	105	120
10	115	119
Mean	93.22	100.9
SD	13.13	16.93

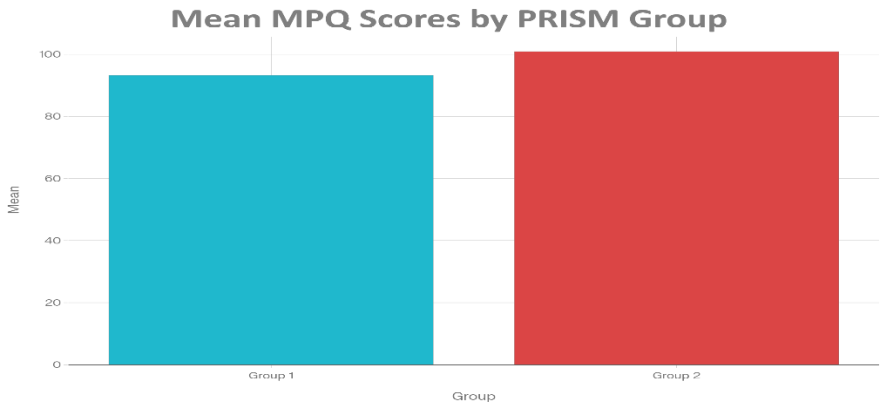

Table-4:- Descriptive Statistics of PRISM Groups Showing Mean, Standard Deviation, and Standard Error for Situational Adaptability

Group	N (Sample Size)	Mean Score	Standard Deviation (SD)	Standard Error (SE)	Interpretation of Traits
Group 1	10	93.22	13.13	4.15	Stable personality, consistent behavior
Group 2	10	100.9	16.93	5.36	Flexible personality, situational adaptability

Advanced Statistical and Structural Modeling (ASSM):- Finally, the ASSM was conducted to determine if an individual's profession could act as a predictor for their psychological scores. The 100 observations were categorized into Students (63), Educators (11), Professionals/Employees (17), and Self-Employed/Homemakers (9).

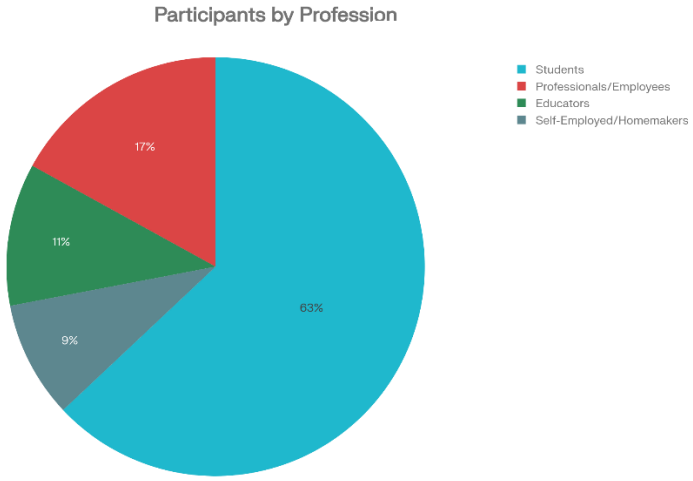

Figure 6:- The chart uses color coding to represent four categories of individuals. The light blue segment corresponds to Students, who constitute 63% of the participants and form the largest group in the distribution. The red segment represents Professionals/Employees, accounting for 17% of the sample, indicating a substantial but comparatively smaller working population. The green segment denotes Educators, comprising 11% of the participants and reflecting the presence of academic professionals. Finally, the grayish-blue segment represents Self-Employed/Homemakers, who make up 9% of the total, highlighting individuals engaged in independent occupations or household responsibilities.

Students form the majority (63%), indicating that most participants are currently engaged in academic pursuits. This is followed by Professionals/Employees (17%), representing a notable working population but significantly smaller than students. Educators account for 11%, reflecting the inclusion of academic staff such as teachers and instructors. Lastly, Self-Employed/Homemakers make up 9%, representing individuals involved in independent work or managing household responsibilities. The distribution highlights a strong dominance of students while still maintaining representation from other occupational groups.

The Model Fit (R^2) was calculated at 0.057, indicating that professional category only accounted for a mere 5.7% of the total variance in personality scores. The F-statistic was 1.94 ($p = 0.128$), which demonstrates that profession was not a statistically significant predictor of personality or resilience in this sample. Although Educators ($\beta = 1.93$) scored slightly higher than the student baseline (94.62), the difference did not reach statistical significance. These findings suggest that internal psychological resources, such as self-regulation and motivation, are more influential than external occupational categories.

Table-5 Distribution of Participants Across Professional Categories and Regression Analysis of Profession as a Predictor of Personality Scores

Category / Parameter	Description / Value	Interpretation
Students	63%	Largest group; majority of participants are engaged in academic pursuits
Professionals/Employees	17%	Second largest group; represents working individuals
Educators	11%	Includes teachers and academic professionals
Self-Employed/Homemakers	9%	Individuals managing independent work or household responsibilities
Model Fit (R^2)	0.057	Only 5.7% of variance in personality scores explained by profession
F-statistic	1.94	Indicates overall model performance
p-value	0.128	Not statistically significant ($p > 0.05$)
Highest Group Mean Comparison	Educators (β = 1.93 vs. Students baseline 94.62)	Slightly higher than students, but not significant
Overall Interpretation	Profession not a significant predictor	Personality/resilience more influenced by internal psychological factors than occupational category

Similarly, the present findings on self-efficacy are consistent with Park (2000), who found that professional women experience greater job satisfaction and a stronger sense of personal worth compared to homemakers. Working women are more likely to have access to social support, structured roles, and opportunities for achievement, which collectively contribute to enhanced self-efficacy. In contrast, homemakers may experience limited external validation and reduced opportunities for performance-based reinforcement, which can affect their perceived self-efficacy (Bharvad, 2016). One study examines how middle-class parents in Lucknow make school choice decisions, emphasizing the role of perceived quality indicators, social influence, and personal expectations from educational institutions. Findings suggest that informal social networks significantly shape decision-making, while parents' interactions with schools reflect a preference for alignment with their values and aspirations. The emergence of a "privatist community" highlights how shared middle-class norms and goals drive collective strategies aimed at maximizing educational outcomes for children. Interpreted through rational choice and Bourdieusian frameworks, the school selection is both a strategic and socially embedded process, influenced by cultural capital, social positioning, and value congruence among parents (Ullah et al., 2025).

4. Conclusion

The integration of the MPQ, PRISM, and ASSM frameworks provides a robust, multidimensional model for assessing psychological adaptability. The findings confirm that genetic predisposition forms the stable foundation of personality, while environmental exposure and unique experiences refine and enhance these

adaptive dimensions over the lifespan. Personality development is thus characterized as a dynamic interplay between innate biological potential and experiential learning. Based on these conclusions, future longitudinal and cross-cultural studies are recommended to further clarify how these traits evolve through continuous gene–environment interactions. Such research will be essential for developing targeted interventions aimed at optimizing mental well-being by aligning environmental supports with an individual's unique genetic profile.

Conflict of interest:- No

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References

1. Abubucker, S., & Potash, J. B. (2024). Gene-Environment Interactions. In Tasman's Psychiatry (pp. 559–591). Springer International Publishing. https://doi.org/10.1007/978-3-030-51366-5_54
2. Aliche, C. J., & Idemudia, E. S. (2025). Mindfulness moderates how difficulties in emotion regulation impact mental health of people living with type 2 diabetes. Discover Psychology, 5(1). https://doi.org/10.1007/s44202-025-00509-2
3. Bharvad, G.. (2016). Professionally employed women and homemakers on self-esteem and self-efficacy, International Journal of Social Impact. 1(1). DIP: 18.02.003/20160101, DOI: 10.25215/2455/0101003
4. Chabris, C. F., Lee, J. J., Cesarini, D., Benjamin, D. J., & Laibson, D. I. (2015). The Fourth Law of Behavior Genetics. Current Directions in Psychological Science, 24(4), 304–312. https://doi.org/10.1177/0963721415580430
5. Chabris, C. F., Lee, J. J., Cesarini, D., Benjamin, D. J., & Laibson, D. I. (2015). The Fourth Law of Behavior Genetics. Current Directions in Psychological Science, 24(4), 304–312. https://doi.org/10.1177/0963721415580430
6. Ewert, C., Vater, A., & Schröder-Abé, M. (2021). Self-Compassion and Coping: a Meta-Analysis. Mindfulness, 12(5), 1063–1077. https://doi.org/10.1007/s12671-020-01563-8
7. Giansanti, M. G., Frappaolo, A., & Piergentili, R. (2025). Drosophila melanogaster: How and Why It Became a Model Organism. International Journal of Molecular Sciences, 26(15), 7485. https://doi.org/10.3390/ijms26157485
8. Guendelman, S., Lutz, M., Koenig, J., Bayer, M., & Dziobek, I. (2025). Effects of a mindfulness intervention on emotion differentiation and heart rate variability. Frontiers in Human Neuroscience, 19. https://doi.org/10.3389/fnhum.2025.1515334

9. Kašparová, P., & Trávníčková, H. (2025). Emotional Intelligence as a Crucial Skill for the Next Generation: Cluster Analysis of Czech University Students. New Horizons in Adult Education and Human Resource Development, 37(3), 191–205. https://doi.org/10.1177/19394225251356894
10. Nas, E., Taytaş, M., & Vangölü, M. S. (2025). The role of self compassion and psychological flexibility in the relationship between perseverance and life satisfaction among academics. BMC Psychology, 14(1). https://doi.org/10.1186/s40359-025-03757-y
11. Samek, D., Koh, B. D., & Rueter, M. A. (2013). Overview of Behavioral Genetics Research for Family Researchers. Journal of Family Theory & Review, 5(3), 214–233. https://doi.org/10.1111/jftr.12013
12. Tasneem, S. A., & Panwar, N. (2020). Emotion Regulation and Psychological Well-being as Contributors Towards Mindfulness Among Under-Graduate Students. Human Arenas, 5(2), 279–297. https://doi.org/10.1007/s42087-020-00144-4
13. Ullah, A., Mukherjee, A., & Middendorf, G. (2025). School preferences of middle-class Indians: a sociological analysis of the decision-making process. Discover Education, 4(1). https://doi.org/10.1007/s44217-025-00617-0